Students' Academic Board
IIT Guwahati

IIT Guwahati

Research Conclave'18

An amalgamation of Academia, Industry & Startups

March 8-11, 2018

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भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

Prof. Gautam Biswas
FNA, FASc, FNAE, FNASc, F-ASME, FIE
Director and J. C. Bose National Fellow

गुवाहाटी–781 039, भारत
Guwahati–781 039, India

MESSAGE FROM THE DIRECTOR

It gives me a great pleasure to know that the Fourth Research Conclave of the Institute will take place between March 8 and March 11, 2018. This event is celebrated by the Master's and PhD students across the Institute. This event was originally planned by Prof. Anupam Saikia with the ambition that the event would help you to know your colleagues and encourage you to exchange the ideas in a free and efficient manner. The idea has now fructified as a regular event in the calendar of the Institute. This year also, a large number of enthusiastic faculty members are participating in the event with a great passion. We do hope that the event will provide opportunity to come closer to each other as the fellow scientists.

As part of the programme, the students showcase their research work through posters and presentations to the peers, invited guests and fellow attendees from other Institutes.

The responsibility for completing a PhD within a reasonable period of time is a very important issue for maintaining the flow of steady stream of students to the Institute. At the same time the quality of PhD is echoed through the number of cutting edge publications at the top-tier journals in the field. Meeting up the challenge of the above two seemingly bivalent requirements is a great responsibility. The responsibility has to be shouldered by the students and their advisors jointly. The Institutes have to develop an eco-system to support such an endeavor. I hope and believe the event will bring about a significant change in the aspiration of the PhD students.

Gautam Biswas
(Gautam Biswas)

भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

Students' Academic Board
IIT Guwahati

MESSAGE FROM
DEAN OF ACADEMIC AFFAIRS

Undertaking research in any discipline is important because it aims to find out the truth which is unknown as yet and it helps to discover answers to questions and solutions to problems in a scientific way. New knowledge is being discovered and existing knowledge is developed through research, and the gained knowledge helps to prevent or solve or control current and future practical problems.

On behalf of Indian Institute of Technology Guwahati, it is my pleasure to welcome all distinguished guests, experts and researchers to the Research Conclave 2018. Research Conclave is organized by the students of IIT Guwahati under the banner of Students' Academic Board. It is a multi disciplinary event for displaying and sharing research ideas & outputs emerging from various disciplines of Science, Engineering and Humanities. The advantage of such a variety of presentations is that researchers may witness ongoing research in other areas and other disciplines. It may kindle cross fertilization of ideas that can often lead to creative ideas and innovations.

Research conclave 2018 includes Lectures by Eminent Persons from Academia & Industry, Poster and Model Presentations by Young Researchers, Visits to Research Laboratories & Facilities of IITG, Technical Workshops and Interactions with Industry Delegates. I invite all participants of Research conclave 2018 and the outside community to take a round to look at resources & facilities available and witness ongoing researches at our institute. One can not only learn about accomplishments of our researchers and but can explore collaboration with them.

I would like to congratulate entire team of Research Conclave 2018 and extend best wishes to all concerned for a most successful and fruitful event. Finally, I express my sincere thanks to all delegates and participants of Research Conclave 2018.

Prof. M. Guru Prem Prasad
Dean of Academic Affairs
Professor, Department of Mathematics
IIT Guwahati, Assam 781039

भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

Students' Academic Board
IIT Guwahati

MESSAGE FROM
FORMER ASSOCIATE DEAN OF ACADEMIC AFFAIRS & SAB CHAIRMAN

It is heartening to note that the students of the institute, cutting across all the disciplines, have put in a lot effort to organize the fourth edition of Research Conclave. Research Conclave is an event that aspires to promote and celebrate research, innovation and entrepreneurship. The organizing team of Research Conclave 2018 has gone ahead with meticulous planning, tireless effort, energy and vision. Such dedicated effort work will surely take this year's edition to even greater heights. The event will certainly motivate the students towards higher academic pursuit, facilitate interaction amongst researchers across various disciplines and contribute to the growth of an ambiance of interdisciplinary research. It is highly commendable that a lot of initiative has also been taken by the organizers to enhance academic interaction with the students and researchers from other institutes in the region through this event. I am full of appreciation for everyone who has contributed in his or her own way to make this event a huge success. I conclude with the hope that the Research Conclave 2018 will be a memorable event for everyone.

Anupam Saikia

Prof. Anupam Saikia
Professor, Department of Mathematics
IIT Guwahati, Assam 781039

भारतीय प्रौद्योगिकी संस्थान गुवाहाटी
Indian Institute of Technology Guwahati

Students' Academic Board
IIT Guwahati

MESSAGE FROM ORGANIZING COMMITTEE

With great pleasure, we welcome you all to Research Conclave 2018, organized by Student's Academic Board (SAB), Indian Institute of Technology Guwahati (IITG), Assam, India.

Research Conclave is a platform to nurture the young minds towards research, innovation and entrepreneurship, which intends to bring the integrity of the students towards both industries and academia to redress the academic research challenges, concerns of the entire student community and upcoming entrepreneurs around the globe. It is a forum to harness innovative mind to level-up the economic strata of current society from research to industries. Research Conclave works as a catalyst for building leaders through holistic, transformable and innovative ideas.

Research conclave has been growing year by year since its inception in 2015. Research Conclave 2018, the fourth edition of the event, includes a wide spectrum of programs that aims to provide a platform to students to understand current research scenario in science, engineering and humanities. The oral and poster presentation and model exhibition will motivate the students to understand and practice high quality research. The event will also host inspiring talks from distinguished chemist Prof. Gautam R. Desiraju (IISc Bangalore), renowned physicist Prof. H. C. Verma, Padma Shri A. S. Kiran Kumar (Former ISRO Chairman), Prof. Yuji Iwahori (Chubu University, Japan), Prof. Arun Chattopadhyay (IIT Guwahati) and Dr. Raksh VirJasra (Reliance Technology Group, Reliance Industries). We believe these lectures will reinvent the students' interest in their field of research and motivate them to pursue a career in research and development in their particular area of interest. In addition, several workshops have been arranged in the thrust areas of modern science and technology. We do hope that all the participants would be highly benefitted by these events. The Institute Open Day of IIT Guwahati, which is observed during this event, will host around 500 school students this year apart from other participants from various colleges and universities. These school students will get a chance to visit various laboratories of IIT Guwahati and listen to lectures delivered by eminent scientists.

We would like to acknowledge the relentless efforts of IIT Guwahati community and other participating institutes, who made this event possible. We thank and congratulate all the participants for their contribution. We also thank the sponsors for their enormous support to this event.
We wish you a memorable, enjoyable and eventful stay here at IITG.

Dr. Prasenjit Khanikar
Faculty Convener
Research Conclave 2018
IIT Guwahati, Assam 781039

Dr. Akshai Kumar A.S.
Faculty Co-Convener
Research Conclave 2018
IIT Guwahati, Assam 781039

Prince Kumar Baranwal
Student Convener
Research Conclave 2018
IIT Guwahati, Assam 781039

SCHEDULE FOR THE EVENT

Research Conclave'18

An amalgamation of Academia, Industry & Startups

March 8-11, 2018

Students' Academic Board IITG

MARCH 8- DAY 0

2:00pm - 5:00pm
Registration - Internal (IIT Guwahati) Participants and Display of Poster in Lecture Hall Premises
Registration Venue: Main Auditorium Foyer

5:00pm - 6:00pm
Visit to Poster Presentation Arena by the Chief Guest, Prof. Gautam R. Desiraju (IISc Bangalore)

6:00pm - 6:30pm
High Tea

6:30pm - 6:35pm
Welcome Note by Mr. Prince Kumar Baranwal, Student Convener – Research Conclave'18

6:35pm - 6:37pm
Inauguration by Lighting the Lamp (by Chief Guest, Director, Deputy Director, and others)

6:37pm - 6:42pm
Brief Address by Deputy Director, Prof. P. S. Robi

6:42pm - 6:55pm
Address by Director, Prof. Gautam Biswas

6:55pm - 7:00pm
Release of Souvenir by the Chief Guest, Director and Deputy Director

7:00pm - 7:05pm
Brief Introduction about the Chief Guest by Faculty Co-Convener, Dr. Akshai Kumar A. S.

7:05pm - 7:50pm
Inaugural Lecture by the Chief Guest –
Prof. Gautam R. Desiraju, IISc Bangalore
Topic: Academics, Industry and Startups – An Inflection Point in India

7:50pm - 7:55pm
Felicitation of Chief Guest by Director

7:55pm - 8:00pm
Vote of Thanks by Faculty Convener, Dr. Prasenjit Khanikar

MARCH 9- DAY 1

Session-I (8:00am - 1:00pm)

Registration – External Participants (8am – 10 am)

Poster/ Model display
(8:00am - 10:00am)
Venue: **Lecture hall premises**

Lab Visits
(9:00am - 1:00pm)

Startup competition
Redstart - The Startup Challenge
(10:00am - 1:00pm)
Venue: **Conference Hall 3**

Startup Talk by:
Mr. Rohit Radhakrishnan, Co-Founder, Openfuel (CIIE, IIM Ahmedabad)
Topic: Out of Syllabus - Student Entrepreneurship
(10:05am – 10:30am)

Ms. Ajita Patki, Advocate, Legal Associate
Topic: IPR & their Use in Startups
(11:30am – 11:45am)

Workshop-I
Advanced Excel
(10:00am – 1:00pm)
Venue: Conference Hall 2

Session-II (2:00pm - 4.45pm)

Lab Visits
(2:00pm - 3:00pm)

WOW Maths and Science Show
Mr. Dinesh Lahoti
Founder Edugenie and Alumnus, IIT Guwahati
(1:45pm – 2:45pm)
Venue: **Mini Auditorium**

Prof. HC Verma
Title: Spirit of Questioning
(3:15pm - 4:30pm)
Venue: **Main Auditorium**

Session-III (5:00pm - 8:00pm)

Startup competition (contd.)
Redstart - The Startup Challenge
(5:00pm - 7:00pm)
Venue: Conference Hall 3

Talk by:
Mr. Ashutosh Muglikar, Director, Propelis Pvt. Ltd.
Topic: Startup Laws & Rules
(5:00pm – 5:15pm)
Venue: Conference Hall 3

Workshop-II
Image J
(5:00pm-7:00pm)
Venue: Conference Hall 2

SCHEDULE FOR THE EVENT

MARCH 10- DAY 2

Session-I (8:00am - 1:00pm)

Oral presentation (BSBE, NT, EN, ENV, DoD, CL, HSS, RT, ME) (8:30am – 11:00am)
Venue: ***

Poster presentation (PHY, CIVIL, EEE, CSE, MATH)
(8:30am – 11:00am)
Venue: Lecture Hall Premises

Padma Shri AS Kiran Kumar, Former ISRO Chairman
(11:30am – 12:30pm)
Venue: Main Auditorium

Workshop-III
Internet of Things
(8:00am- 11:30am)
Venue: Conference Hall 3

Workshop-IV
Multi-Touch and Augmented Reality
(8:00am – 11:30am)
Venue: Conference Hall 4

Session-II (2:00pm - 4.45pm)

Oral presentation (PHY, CIVIL, EEE, CSE, MATH, CH)
(2:00pm – 4:00pm)
Venue: ***

Poster presentation (BSBE, NT, EN, ENV, DoD)
(2:00pm – 4:00pm)
Venue: Lecture Hall Premises

Prof. Arun Chattopadhyay, IIT Guwahati
Title: Scientific India: Quo Vadis?
(2:30pm – 3:00pm)
Venue: Lecture Hall 4

Prof. Yuji Iwahori, Chubu University, Japan
(4:15pm – 5:15pm)
Venue: Lecture Hall 3

Workshop-III
Internet of Things
(2:00pm- 6:30pm)
Venue: Conference Hall 3

Workshop-IV
Multi-Touch and Augmented Reality
(2:00pm – 6:30pm)
Venue: Conference Hall 4

Session-III (5:00pm - 8:00pm)

Workshop-V
Advanced Origin
(5:30pm - 7:30pm)
Venue: Conference Hall 2

MARCH 11- DAY 3

Session-I (8:00am - 1:00pm)

Three Minute Thesis presentation
(8:30am – 10:30am)
Venue: Lecture Hall 1

Poster presentation (CH, CL, HSS, ME, RT)
(8:30am – 10:30 am)
Venue: Lecture Hall Premises

Model presentation
(9:00am – 1:00pm)
Venue: Lecture Hall Premises

Dr. Raksh Vir Jasra
Reliance Tech. Group, Reliance Industries
Title: Opportunities in Chemical Sciences for the Sustenance of Present Civilization
(10:00am - 11:00am)
Venue: Lecture Hall 1

General Quiz
Quiz Master: Mr. Abhra Das
(10:00am – 1:00pm)
Venue: Lecture Hall 2

Workshop-III (continued)
Internet of Things
(8:00am - 1:00pm)
Venue: Conference Hall 3

Workshop-IV (continued)
Multi-Touch and Augmented Reality
(8:00am – 1:00pm)
Venue: Conference Hall 4

Session-II (2:00pm - 4.45pm)

Dr. Prabuddha Ganguly
CEO – Vision IPR & Visiting Prof. IIT Kharagpur
Title: Patent writing and Copyright
(1:30pm – 4:30pm)
Venue: Conference Hall 2

Workshop-III (continued)
Internet of Things
(2:00pm - 5:00pm)
Venue: Conference Hall 3

Workshop-IV (continued)
Multi-Touch and Augmented Reality
(2:00pm – 5:00pm)
Venue: Conference Hall 4

Session-III (5:00pm - 8:00pm)

High Tea (4:45pm - 5:15pm)

Valedictory Session (5:15pm – 8:00pm)
Venue: Main Auditorium

Venues for Oral Presentation: (8:30am – 11:00am): *** **BSBE (Bioscience and Bioengineering)** – Lecture Hall 1; **NT (NanoTechnology)** – Core1-1004; **EN (Energy)** – Core1-1003; **ENV (Environment)** – Lecture Hall 2; **DoD (Design)** – Core1-1005; **CL (Chemical Engineering)** - Lecture Hall 3; **HSS (Humanities & Social Science & Management)** – Core1-1006; **RT (Rural Technology)** – Lecture Hall 4; **ME (Mechanical Engineering)** – Conference Hall 2

Venues for Oral Presentation: (2:00pm – 4:00pm): *** **PHY (Physics)** – Lecture Hall 1; **CIVIL (Civil Engineering)** – Lecture Hall 2; **EEE (Electronics and Electrical Engineering)** – Lecture Hall 3; **CH (Chemistry)** – Lecture Hall 4; **CSE (Computer Science and Engineering)** – Core1-1005; **MATH (Mathematics)** – Core1-1006

INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI

Indian Institute of Technology Guwahati, the sixth member of the IIT fraternity, was established in 1994. The academic programme of IIT Guwahati commenced in 1995. At present the Institute has eleven departments and three inter-disciplinary academic centres covering all the major engineering, science and humanities disciplines, offering BTech, BDes, MA, MDes, MTech, MSc and PhD programmes. Within a short period of time, IIT Guwahati has been able to build up world class infrastructure for carrying out advanced research and has been equipped with state-of-the-art scientific and engineering instruments. Indian Institute of Technology Guwahati's campus is on a sprawling 285 hectares plot of land on the north bank of the river Brahmaputra around 20 kms. from the heart of the city. With the majestic Brahmaputra on one side, and with hills and vast open spaces on others, the campus provides an ideal setting for learning.

Indian Institute of Technology Guwahati, the sixth member of the IIT fraternity, was established in 1994. IIT Guwahati was established in 1994 by an act of parliament and its academic programme commenced in 1995. Indian Institute of Technology Guwahati's campus is on a sprawling 285 hectares plot of land on the north bank of the river Brahmaputra. With the majestic Brahmaputra on one side, and with hills and vast open spaces on others, the campus provides an ideal setting for learning.
IIT Guwahati has been symbolised as one of most effervescent Institutes across the world by several major ranking associations. The hardship of students, devotion of quality research, contributions of renowned alumni, dedication and untold effort of the teachers and staff (teaching and non-teaching), and the vision of the administration was influential in these achievements. Worldwide, the ranking of IIT Guwahati was 451–460 in the QS World University Ranking of 2015 and 89 in the QS Asian University Rankings of 2012. In India, among engineering academies, it was ranked 10 by India Today in 2012, 8 by Outlook India in 2012 and 7 by Dataquest in 2011. In the Mint Government Colleges survey of 2009 it was ranked 6. In 2014, IIT Guwahati has been ranked 87 in 100 Top Global Universities under 50 Years by the Times Higher Education World University Rankings, bringing India into the list for the very first time. In 2015, IIT Guwahati has been ranked 50 by BRICS ranking. In 2016, IIT-Guwahati ranked 14th among 20 institutions classed as the World's Best Small Universities in the latest Times Higher Education (THE) rankings of 2016.

According to recent statistics, IIT Guwahati has around 6000 students, 425 staff and 375 faculty. IIT Guwahati is now 17 Convocations old, has over 7000 alumni, and has graduated over 475 Ph.D. students. Over the years, more than 250 companies/organisations have participated in the student placements.

ABOUT STUDENTS' ACADEMIC BOARD

Students' Academic Board (SAB)
IIT Guwahati

The SAB is intended as a student forum which strives to redress the academic problems and concerns of the entire student community of IIT Guwahati. It is a bridge between the students and the academic administration and is responsible to redirect the academic issues of the students to the appropriate administrative authority.

Together we strive to achieve the following:
To make you cognizant of the Academic protocols and procedures. For any system to function efficaciously there is a set of rules and ordinances which needs to be followed to achieve maximum organization. Often the students are unaware regarding these and end up wasting a lot of their time.

SAB, through its workings, organizes various Departmental and Inter-Departmental Activities through-out the semester. Such a synergistic system is often necessary to inculcate the spirit of Academic Excellence and innovation. Last but not the least, the SAB conducts periodic sessions to interact with the Student Community and undertake timely dissemination of important information.

Issues such as Internships, Exchange Programs, Fellowship/ Scholarship Schemes etc. remains the underlying topics on which we try to bolster the student community so as to achieve positive results in a methodical way and thus succeed in bringing laurels to our Alma mater.
SAB Ph.D. Council includes the Ph.D. student members of the DPPC of all the department in IIT Guwahati along with the elected Ph.D. representatives of different centres (Centre for Energy, Nanotechnology, and Environment) within the Institute. Apart from such activities the Ph.D. council conducts Research Conclave

ABOUT RESEARCH CONCLAVE

Research Conclave'18

An amalgamation of Academia, Industry & Startups

Research Conclave is an event organised by the Students' Academic Board (SAB) of Indian Institute of Technology Guwahati (IITG). It started in 2015 with great rhythm and passion; and this year with the same enthusiasm, we are conducting this event in a broader spectrum.

Research Conclave is a staunch platform to nurture the young minds towards research, innovation and entrepreneurship which intends to bring the integrity of the students towards both industries and academia to redress the academic research challenges, concerns of the entire student community and upcoming entrepreneurs around the globe. It is a forum to harness innovative minds of current society by taking innovations made in research to their real/actual implementation in the industries. Research Conclave works as a catalyst for building leaders through holistic, transformable and innovative ideas.

OBJECTIVES

- Showcase the ongoing research activities of different institutes / universities / colleges across the country.
- Model exhibition by research groups from premier institutes and universities across the country.
- Industry-academia interaction with industrial delegates highlighting their technological requirement, expectations from research institutes.
- Interactive sessions with entrepreneurs across the globe to identify the avenues through local firms, businesses and other intermediaries through innovation and research.
- Providing a prestigious platform for start-ups to exhibit their products and ideas to industries and academia.
- Providing a platform for industries to identify highly intellectual, motivated and enthusiastic students for their firms and furnishing technological implementation towards sustainable development and encouragement to student community for pursuing higher studies.

RESEARCH CONCLAVE FEATURES

'CONNAISSANCE'
(Lecture series: Academicians & Industrialists)

'SCIENTIFIQUE'
(Oral, Poster, Model presentation and Laboratories visit)

'ACAD-INDUSTRIE SYNERGY'
(Interaction with Industry delegates, Startups & Aacademicians)

'DISCUTIR'
(Panel discussion & Quiz)

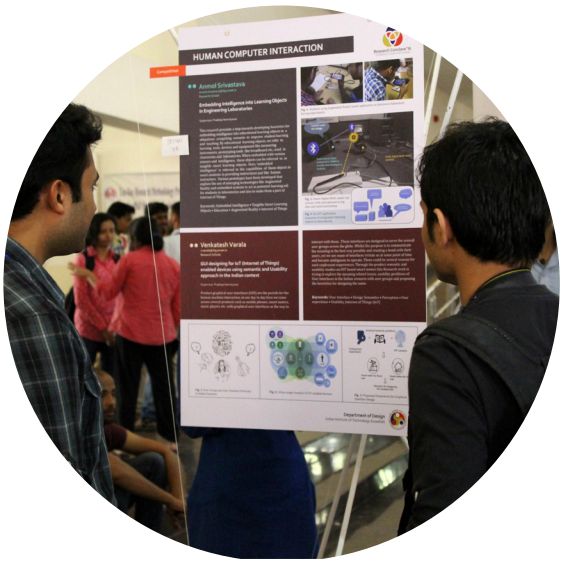
'INNOVATEUR PLATE-FORME'
(Startup)

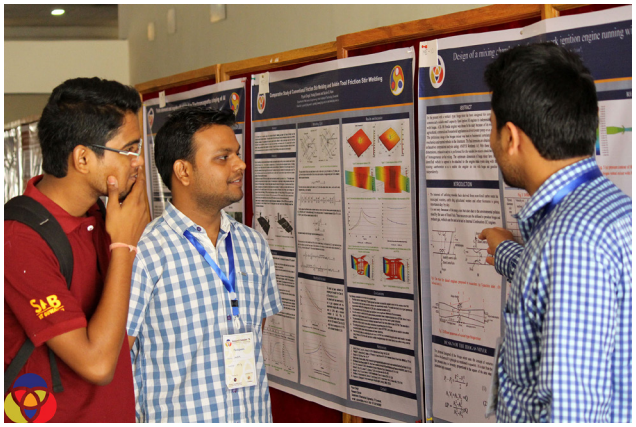
'ATELIER'
(Workshops & Photography)

REMINISCENCE: A GLIMPSE

A Glimpse

- Showcased various research activities undergoing in different departments within IIT Guwahati through posters, lectures, presentations and lab visits.
- Active participation from institutes all across North-East India.
- Overwhelming response and positive feedback from academic community and industries.





EMINENT SPEAKERS FOR RESEARCH CONCLAVE '18

Day 0 | 8th March, 2018

Prof. Gautam R. Desiraju,
IISc Bangalore
Time- 7:05pm
Venue: Main Auditorium

Day 1 | 9th March, 2018

Mr. Rohit Radhakrishnan
Co-Founder, Openfuel
(CIIE, IIM Ahmedabad)
Time- 10:05am
Venue: Conference Hall 3

Day 1 | 9th March, 2018

Ms. Ajita Patki
Advocate, Legal Associate
Time- 11:30am
Venue: Conference Hall 3

Day 1 | 9th March, 2018

Mr. Dinesh Lahoti
Founder Edugenie and Alumnus,
IIT Guwahati
Time- 1:45pm
Venue: Mini Auditorium

Day 1 | 9th March, 2018

Prof. H.C. Verma
Author of *"Concept of Physics"*
and Retd. prof. from IIT Kanpur
Time- 3:15pm
Venue: Main Auditorium

Day 1 | 9th March, 2018

Mr. Ashutosh Muglikar
Director, Propelis Pvt. Ltd.
Time- 5:00pm
Venue: Conference Hall 3

Day 2 | 10th March, 2018

Padma Shri Jadav Payeng
The Forest Man of India
Time- 5:30am
Venue: New SAC, IITG

Day 2 | 10th March, 2018

Padma Shri AS Kiran Kumar
Former ISRO Chairman
Time- 11:30am
Venue: Main Auditorium

Day 2 | 10th March, 2018

Prof. Arun Chattopadhyay
Department of Chemistry, IIT Guwahati
Time- 2:30pm
Venue: Lecture Hall 4

Day 2 | 10th March, 2018

Prof. Yuji Iwahori
Chubu University, Japan
Time- 4:15pm
Venue: Lecture Hall 3

Day 3 | 11th March, 2018

Dr. Raksh Vir Jasra
Reliance Tech. Group,
Reliance Industries
Time- 11:30am
Venue: Lecture Hall 1

Day 3 | 11th March, 2018

Dr. Prabuddha Ganguly
CEO – Vision IPR
& Visiting Prof. IIT Kharagpur
Time- 1:30pm
Venue: Conference Hall 2

EVENT LECTURES & TALKS SUMMARY

Day 1 | 9th
March, 2018

Prof. H.C. Verma
Author of *"Concept of Physics"*
and Retd. prof. from IIT Kanpur

Time- 3:15pm
Venue: Main Auditorium

Title: Spirit of questioning

Questioning is a necessary element of innovation and enhancement of knowledge. Unfortunately, our education system does not encourage questioning and trains us to accept things because they are told by elderly wise persons. Over the period of time, the so the facts too become distorted during their propagation through ages and people still tend to accept them. In this talk cum demonstration, several popular experiments will be shown and their explanation will be examined.

EVENT LECTURES & TALKS SUMMARY

Day 3 | 11th March, 2018

Dr. Prabuddha Ganguly
CEO – Vision IPR
& Visiting Prof. IIT Kharagpur

Time- 1:30pm
Venue: Conference Hall 2

Title: Patents, Copyright, Trademarks and Design Registrations Value Adding to Research and Innovation

Professor Prabuddha Ganguli
CEO, Vision-IPR and Visiting Professor,
Rajiv Gandhi School of Intellectual Property Law,
IIT Kharagpur

The quest for knowledge is driven through a process of enquiry by defining a problem, posing a variety of questions in the context of the problem, looking for previous efforts by others to address the same or similar problems, draw lessons from prior studies and then work towards possible solutions to the defined problem. Such pursuits lead to discoveries, theories & explanations to observed phenomena, and inventions involving new products and processes.

Intellectual Property Rights (IPR) provides a legal platform on which the inventors are given exclusive rights to their inventions so that others legitimately use these inventions with the permission of the right holder. It is to be appreciated that the legal rights are given only if the inventor discloses the invention in a patent specification such that a person skilled in that field is able to reproduce the invention. In addition to such a disclosure, the invention has to satisfy certain criteria set by the patent law in a country. Further, it is to be appreciated there is no concept as a world patent as patent system sets only territorial rights.

Similarly, creative expressions, creative aesthetic shapes and ornamentations, logos, etc can be protected by legal tools such as copyright, design registration and trademark. These rights like patent rights are also territorial.

Such rights can also be transacted, thereby opening up diverse options in the market place, and therefore the entire innovation value chain from ideas to the market place needs to be effectively managed.

The workshop is designed to expose the participants to the entire innovation value chain, how convert the outcome of their research into their IPR and how to manage these acquired rights. The workshop will also demonstrate how to conduct information searches for the purposes of research proposal writing, designing of experiments, also ensuring that the research trajectory is not infringing any existing intellectual property rights so that the technology transfer processes are streamlined to derive higher value from the innovations.

The workshop will illustrate all these aspects with case studies from diverse sectors including biotechnology, nanotechnology, artificial intelligence, ICT, materials science, etc.

Day 3 | 11th March, 2018

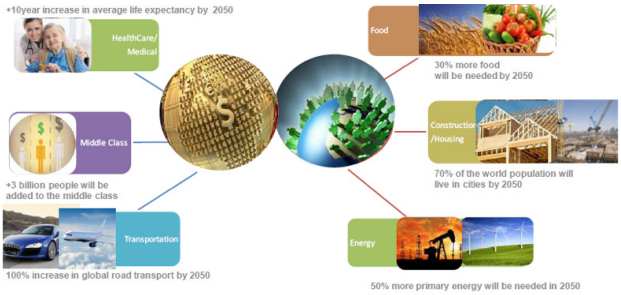
Dr. Raksh Vir Jasra
Reliance Tech. Group,
Reliance Industries

Time- 11:30am
Venue: Lecture Hall 1

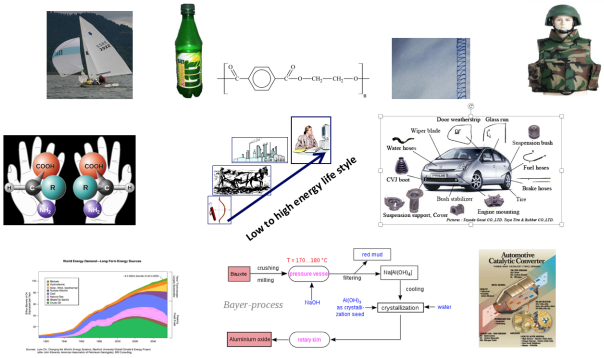
Title: Opportunities in Chemical Sciences for the Sustenance of Present Civilization

Dr. Raksh Vir Jasra
Head, Reliance Technology Group, Vadodara
Reliance Industries Ltd.
rakshvir.jasra@ril.com

With more than 7 billion persons living on planet earth, there are serious challenges on Energy, Materials, Health, Food, and Water and Environmental front for the sustenance of modern civilization. It is further estimated that by 2050, there will be 100% growth in global road transport; 70% of the World's population will live in cities; 50% more primary energy and 30% more food will be needed in the World.



Lecture will to describe how chemistry has responded to similar challenges in the last century and is on the forefront to meet the challenges of 21st century also. Specific developments where chemistry has played defining role such as food security, mobility, energy and materials requirement in the past will be discussed. Lecture will largely focus on future challenges and the potential opportunities in chemical sciences to overcome those challenges.



RESEARCH CONCLAVE'18 SUB- EVENT

Birds of IIT Guwahati

The bird count inside campus was held from February 16 - 19, 2018 during the Campus Bird Count. 'Campus Bird Count' a sub-event of Great Backyard Bird Count, an initiation by Cornell Lab of Ornithology, is organized every year to count the number of Bird species inside a campus. Since, IIT Guwahati holds the potential to host such a wide variety of birds, team Research Conclave'18 thought that it would be great to map the species inside our beautiful campus as well.

This was the first time that we had an extensive bird count for four days inside campus and we thank all the students and faculty members of IIT Guwahati for joining us early in the morning and co-operating with us throughout the session. We were overwhelmed by the presence of the famous Astrophysicist and an expert Bird watcher Prof. Dhruba Jyoti Saikia (Ex-VC, Cotton College State University, Assam). It was indeed a great experience to learn from him. We were also accompanied by Prof. Joyashree Roy (Jadavpur University) and Prof. Pranab Mukhopadhyay (Goa University) who admired the beauty of our campus as it hosts several endangered and vulnerable species like Oriental Darter, Ferruginous Pochard etc. A total of 75 species was documented in this Bird walk and it was not only the birds but also the trees on which the birds are dependent were noted down for future plantation.

Faculty members of IIT Guwahati and other residents of our campus also joined us in documenting the birds, to name a few, Dr. Gayatri Natu, Dr. Amit Awekar, Dr. Uma (Cotton College State University, Assam) etc. We thank you all for your love and support.
With so many nature enthusiasts in our campus we believe that the biodiversity of our campus shall prevail.

The organizers for the bird walk included the following student members from IIT Guwahati: Umang Rathod, Smruti Ranjan Dash, Jayakrishnan U, Srikanth Katla, Prince Kumar Baranwal and Rupam Bhaduri.

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Research Conclave'18

An amalgamation of Academia, Industry & Startups

Abstracts (Model)

BioScience

Grocycle

Mushroom cultivation

We realize that mushroom cultivation is currently the only viable, socially-acceptable, and widespread biotechnology to convert waste into high-quality food, which places a special responsibility on our industry to take the lead in a more resource-efficient circular economy. Our research and solutions have focused on:

- use of various organic waste streams to prepare substrate for edible and medicinal cellulolytic mushrooms (oyster mushroom,),
- use of natural plant-based agents for protection during mushroom cultivation,
- optimization of product quality for mushroom's role as a functional food (e.g. less pesticides and heavy metals, more micronutrients),
- productive uses of spent mushroom substrate.

The waste from our own growing cycle is turned into fertile compost for local use.

Chemical

Magnetic door security alarm

Privacy and security are the aspects that every person wants to have in their life. But since the device to secure our homes are too costly and can't be afforded by people with average annual income, so with this aim we have tried to make a affordable magnetic door security alarm with materials easily accessible and affordable to people. Also, once this is successfully made, we can also connect a device to the security system to send a SOS message to the register owner to let him know that burglars have entered his house and so he can take further precaution.

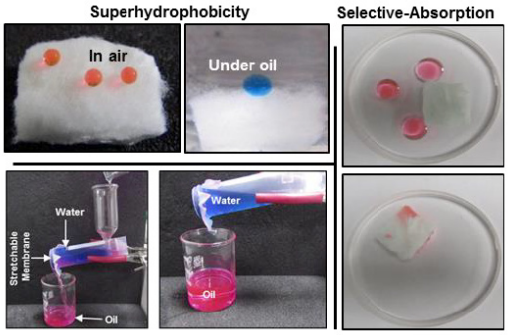
Chemistry

Superhydrophobic and porous fibrous substrate for oil spills cleanup

Adil Majeed Rather, Dibayangana Parbat, Arpita Shome and Uttam Manna*.
Department of chemistry, IIT Guwahati

Oil, one of the most important and non-renewable energy sources, is usually reported for spillage during exploration, transport and storage. This spillage usually damages the coastal environment and marine ecosystems, as well as leads to creation of severe waste.1 Thus, it is essential to solve this problem by cleaning and recovering the spilled oil that floats on the sea. Currently, the most common cleaning techniques include physical absorption by porous materials, oil skimmers, burning, physical diffusion, and biodegradation.2–5, which are energy consuming and will also cause secondary pollutions. Here, we have exploited a fibrous substrate6 (i.e.; cotton ball and polyurethane fabric) in energy-efficient and environmental-friendly cleaning of different forms of oil-contaminations including floating light-oil, sediment heavy-oil and emulsions, after the appropriate optimization of both the topography and essential chemistry in the fibrous substrate through catalyst-free, simple and scalable 1, 4 conjugate addition reaction between amine and acrylate groups in ambient condition. The synthesized superhydrophobic fibrous substrate is capable of extremely repelling water both in air and under oil, has provided a common avenue for highly selective 1) absorption (with efficiency of above 2000 wt.%) of oil (both heavy and light oils) and 2) gravity driven active-filtration of oil. The synthesized material is highly efficient in separation of oil from aqueous phases that are chemically harsh, including the extremes of pH (1 & 12), artificial seawater, UV exposures etc. Further, the current approach provided a simple basis to separate oil from complex three-phase oil/water mixture that composed of heavy-oil phase (bottom layer), aqueous phase (middle layer) and light-oil phase (top layer), where the strategic use of SHC allowed successful cleanup of oil from complex oil/water mixture through complementary—absorption and filtration processes.

(1) Xue, Z.; Sun, Z.; Cao, Y.; Chen, Y.; Tao, L.; Li, K.; Feng, L.; Fu, Q. Wei, Y.; RSC Adv., 2013, 3, 23432.
(2) Calcagnile, P.; Fragouli, D.; Bayer, I. S.; Anyfantis, G. C.; Martiradonna, L.;
Cozzoli, P. D.; Cingolani, R. Athanassiou, A.; ACS Nano, 2012, 6, 5413
(3) Broje, V.; Keller, A. A.; J. Hazard. Mater. 2007, 148, 136.
(4) Aurell, J.; Gullett, B. K.; Environ. Sci. Technol., 2010, 44, 9431.
(5) Zhao, J.; Xiao, C. F.; Xu, N. K. J. Dispersion Sci. Technol., 2012, 33, 1197.
(6) (a) Rather, A. M.; Jana, N.; Hazarika, P.; Manna U. J. Mater. Chem. A, 2017, 5, 23339.
(b) Rather, A. M.; Manna U. J. Mater. Chem. A, 2017, DOI: 10.1039/c7ta04073c.



Acute energy cool chamber

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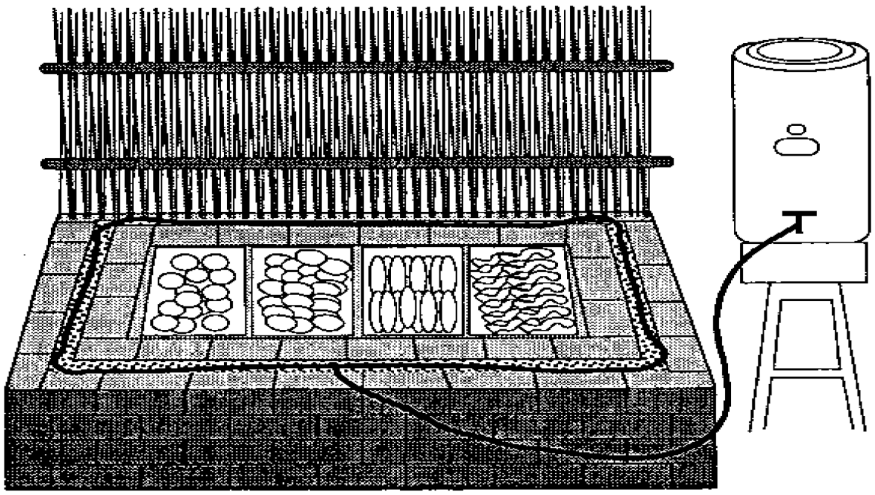
Low temperature maintenance is a great problem in a tropical country like India. In India horticultural products like fruits, vegetables damage immediately after harvest due to lack of cool storage space. Refrigeration is neither east to install in remote areas nor always environment friendly. Considering acute energy crisis and lack of cool storage facility efforts made to develop low cost and low energy cool chambers. Acute energy cool chamber works on the principle of "Evaporative Cooling", as water evaporates it has considerable cooling effect and faster the rate of evaporation greater the cooling. Water evaporates into air raising the humidity and same time cooling the bed. Efficiency of evaporative cooler depends on humidity of the surrounding air. The advantages of acute energy cool chamber are it uses no mechanical or electrical energy, it can be used for mushroom cultivation, raising silk worm, storage of bio fertilizers, small and marginal farmers store a few days harvest to avoid middle man, it allows small farmers to store products for a few days and thus avoid costly rush selling. Ideal for household and can be constructed by an unskilled person. It reduces losses and thus pays for itself in a short time. This can be easily installed in farmer's field, packing stations, railway stations, super market, whole sale markets, hotels, processing factories etc. Low cost environment friendly commercial size cool chamber can be developed utilizing the principle of evaporative cooling.



Models of household Arsiron Nilogon and Fluoride Nilogon: Simple, efficient, safe and low-cost methods of Arsenic and Fluoride removal

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Water with high level of arsenic can cause several health problems including cancer. Similarly, long-term drinking of water containing high F- content also lead to various manifestations of skeletal, dental and soft tissue fluorosis. Vast areas in India are affected by contamination of groundwater with arsenic and excess fluoride. We propose to demonstrate models of two successful simple, efficient, safe and low-cost methods of arsenic and fluoride removal, namely, Arsiron Nilogon and Fluoride Nilogon, developed in Tezpur University.1,2 Arsiron Nilogon is based on oxidation-coagulation-adsorption at optimized pH (OCOP) operating in batch mode needing two containers, one for treatment and the other as a sandgravel filter. The method uses three common chemicals, viz., cooking soda (baking soda, NaHCO3), potassium permanganate (KMnO4) and ferric chloride (FeCl3). On the other hand, phosphoric acid-crushed limestone treatment (PACLT) method unit consists of a plug-flow reactor and a sand-gravel filter. The reactor is filled with crushed limestone where water is put along with a small dose of 0.68 mM phosphoric acid (PA). Both methods have been gaining popularity in Assam as well as in other states of India.

KEYWORDS: Arsenic, Fluoride, Ferric chloride, Limestone, Phosphoric acid, Potassium permanganate.
References:
1. R.K. Dutta, S. Bordoloi, S.K. Nath, Indian Patent No. 280737, Arsenic removal from groundwater by oxidation-coagulation at controlled pH for domestic and community applications.
2. R.K. Dutta, S.K. Nath, Indian Patent No. 289204, A highly efficient defluoridation method by in-situ generation of an efficient precipitant and strong adsorbents of fluoride in crushed limestone fixed-bed column and plug flow reactors.

Industrial Scale Fabrication of Self-Cleanable Robust Superhydrophobic Coating

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Often, the properties of materials are controlled through appropriate optimization of physical and chemical parameters. In past, the post-chemical manipulation on the thin and featureless 'reactive' polymeric interfaces is exploited in synthesis of several functional materials.1 However, the approach of controlled tailoring of various chemical functionally —three dimensionally (including top surface and interiors) in the hierarchically featured and thick polymeric coating, is rare in the literature, and would be useful in synthesis of various other smart and durable material for diverse applications in practically relevant scenarios . In this context, synthesis of artificial biomimicked interfaces are highly relevant, where the biomimicked interfaces are developed by the appropriate integration of essential chemistry and hierarchical surface topography. For example, several top-down and bottom-up approaches are adopted[2] to synthesising a classical and prospective bio-inspired wettability—commonly referred as superhydrophobicity—which is well recognized for its wide range of prospective applications. Such interfaces are mostly achieved by optimizing the required surface chemistry (e.g.; inert coating) at the top of the essential hierarchical topography. In common practice, these chemical optimizations were mainly maintained over few manometer across the thickness of the coating, and that even achieved by associating some delicate chemistries (e.g. hydrogen bonding, electrostatic interaction, metal-thiol bond and modifications with various analogues of silane etc.) which are susceptible at severe chemical/physical insults, and the embedded special wettability in the thin organic/inorganic coatings faced significant damage in practically relevant harsh conditions. [3] Eventually, the artificial biomimicked wettability becomes inappropriate for various outdoor prospective applications. To combat this poor durability aspect of the artificial bio-mimicked wettability, some interesting and sophisticated designs are recently

introduced, including self -healing, post-repairing and mechanically durable coatings. [4] Such designs are certainly capable of providing more stable wettability, compared to the conventionally synthesized superhydrophobic materials. However, mostly, the essential chemical optimization at the top of the appropriately decorated hierarchical topographs still remains restricted over few nanometre across the thickness of the such special biomimicked desings. Thus, the severe physical damages (e.g. scratching)—which are involved in erosion of the top surface and exposed the interior of the thin coating, are likely to cause permanent damage to the embedded wettability. As a consequence, most of these synthesized materials would be inappropriate for outdoor applications in practically relevant complex scenarios. In the current demonstration, a catalyst-free, rapid and mutual reactivity between amine and acrylate groups are strategically associated in synthesizing three-dimensionally 'chemically-reactive' spray-based polymeric coating for covalent and bulk manipulation of desired chemistry. The synthesized porous and covalently cross-linked polymeric coating was possessed with 'chemically -reactive' residual acrylate functionality—three dimensionally including the surface and interior of the coating, and eventually allowed to optimize the desired chemistry in the entire polymeric coating through simple 1,4-conjugate addition reaction at ambient condition. After, the appropriate and covalent chemical modification, the porous and covalently cross -linked polymeric coating was embedded with bulksuperhydrophobicity— and inherently sustained various severe physical and chemical insults. Moreover, simple and covalent optimization of desired chemistry in the porous polymeric coating conferred various interesting special wettability including controlled adhesive and non-adhesive superhydrophobicity through optimum and controlled tailoring of the fraction of contact area between the beaded water droplet and metastable trapped air in the polymeric bulk coating. Diverse of substrates (concert, wood, plastic, metal, glass, cellulose etc.), irrespective of their shape, size and texture, were coated with such highly robust bulk-superhydrophobicity for practically relevant applications[5].

Reference:

(1) Lahann, J.; Balcells, M.; Rodon, T.; Lee, J.; Choi, I. S.; Jensen, K. F.; Langer, R. Langmuir **2002**, 18, 3632-3638.
(2) Li, X. M.; Reinhoudt, D.; Crego-Calama, M.; Chem. Soc. Rev. **2007**, 36, 1350-1368.
(3) Verho, T.; Bower, C.; Andrew, P.; Franssila, S.; Ikkala, O.; Ras, R. H. A. Adv. Mater. **2011**, 23, 673-678.
(4) Deng, X.; Mammen, L.; Zhao, Y.; Lellig, P.; Müllen, K.; Li, C.; Butt, H. -J.; Vollmer, D. Adv. Mater. **2011**, 23, 2962-2965.
(5) Maji, K; Manna, U. Submitted Manuscript, 2018

Smart Noise Pollution Reducer

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Noise pollution is one of the major environment concerns in India and all over the world nowadays but has hardly attracted any debate and discussions.It has led to serious health threats like hearing impairment, insomnia, hypertension, heart ailments, stress,etc.Thus it needs to be addressed at earliest so that the menace of noise pollution is deduced. We have designed a prototype namely"Smart Noise Pollution Reducer"with the help of mobile phone, raspberry pi, mic, sound card, et al ,which helps in controlling the noise pollution as it cuts down the usage of loudspeakers.Instead of loudspeakers to listen various sounds, we have combined our device with mobile phones and listen the conversations or speeches through these mobile phones.The science behind this model is simple and the technology used is a lot more simpler. The mechanism of our device is such that it converts the sound waves to the FM (Frequency Modulator) waves and the range of the device is quite well.

Keywords:- Noise pollution,Health threats,Raspberry pi,loudspeakers.

Portable Bamboo Shelter: Ephemeral Architecture in Humanitarian Aid

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The ephemeral concept in contemporary architecture implies a fleeting temporality, with a timeline so short that the creation itself admits destruction. There are two aspects of design, first which reflects artistic thinking, seeking innovation and exuberance that communicates with the user's emotional perception, and second, is an investigation for functional adaptability, referring to a language of material reuse, methodical and rational structural system, subsequent to a sustainable future. There are three types of portable architecture, the third approach in which elements of modular parts are easily transported, and dry assembled on site has been considered to design and develop a Portable Bamboo Shelter. This is a suitable type of shelter for use in humanitarian emergencies in North- East India where bamboo as a construction material is available in abundance. The transportable modular parts consist of Bamboo Poles that are connected with connectors to form a light frame which supports the foldable woven bamboo wall panels. The lightness of the modular components makes the structure highly efficient for fast delivery and the designed metal connectors help in rapid assembly by users during humanitarian emergencies. According to the GRID 2017 , Global Report on Internal Displacement 284.8 billion people were displaced and were in need of shelter in 2016 due to emergencies of flood, landslide, earth quake, riots and war. This design exercise is an endeavour to establish the need for a form of architecture that is flexible, lightweight in construction and has the minimal environmental impact, accepted by cultural context and is responsive to adaptive architectural design. The prototype shows that portable bamboo shelters is feasible, and can fulfill many different roles and are economically viable to build and operate in post-disaster situations.

Key Words: Architecture; Bamboo; Ephemeral; Disaster ; Shelter

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Smart power harvesting module for gym

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Introduction: The conventional sources of electricity generation are gradually diminishing and hence we are continuously moving towards renewable sources of energy. The model we are presenting has a huge potential in renewable energy sector. We have prepared a model which is based on energy harvesting in Gym equipments. By this method we would be able to convert the mechanical energy we are putting in the equipments to electrical energy.
Materials required: A frame to represent a gym equipment, a spring turbine (found in small toy cars), generator, inertial disk, battery.
Process: At first we remove the dead weights from the equipment frame and fitted with the spring turbine (fig-1) followed by generator and battery. When someone do workout, the energy wasted through this process stored in battery. Afterwards the energy can be utilized in the gym. This concept has weight varying capacity also.

Fig 1

Contactless power transfer system for sealed lead acid battery charging

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A model is developed for charging the sealed lead acid battery bank using a series-parallel (SP) compensated contactless power transfer (CPT) system. Constant current (CC) and constant voltage (CV) modes are used for charging the battery bank. An expression of optimum operating frequency is derived to maintain the maximum compensated coil efficiency throughout the load variation in charging process. An experimental setup of SP compensated CPT system is built for charging the battery bank. The variation of compensated coil efficiency and the load phase angle with respect to different operating frequencies in CC and CV modes is verified with the measurement. Based on the analysis, the control parameters are identified. An android based UI is developed to monitor and control the complete system.

Fingerprint Based Vehicle Ignition and Security System

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To reduce the shortcomings of the conventional key-based vehicle ignition system, we decided to come up with a biometric vehicle ignition system which would make the ignition process more accurate and almost next to impossible for anyone to gain access other than the user himself, since no two persons in this world have the same set of fingerprints. There are several advantages of this system over the conventional key based system. Firstly, in the conventional key based system, though the keys are provided with RFID now-a-days, if they fall into the wrong hands, the security system fails to prohibit as the system cannot verify the user, it can only verify the keys. Such problems never occur in a fingerprint based system. Secondly, the fingerprint access devices are highly efficient and convenient to gain control. While pins and passwords can easily be forgotten, hacked or stolen and even the keys can be misplaced, forgotten or stolen; the biometric system that includes biological characteristics, cannot be obtained or replicated by an unauthorized person. Lastly, being an automated system, it instantly tracks unauthorized access, verifies with the stored database and informs immediately to the user whereas, this is not possible in a conventional key based system. At first, all the required fingerprints are saved using the fingerprint sensor. These fingerprints are stored in the memory unit of the fingerprint sensor. When a user wants to start the car, he/she has to turn on the module .It displays to verify his/her fingerprint. The scanned fingerprint would be verified and if it is matched, microcontroller (Arduino UNO) sends the signal to the car ignition unit, where a motor would be driven to start the car. If the fingerprint does not match with any of the registered fingerprints, then a phone call alert would be sent to the registered owner mobile through GSM module. Only the owner of the car has the authority to add/ remove the fingerprints. The use of new electronic theories has been put down by expertise to increase the facilities given by the existing appliances.

Portable Wind Power Generation

Abstract: Wind turbines are becoming popular in the renewable energy world. Nowadays, it is wellunderstood that the burning of fossil fuels in electric power station has a significant influence on the global climate due to greenhouse gases. In manycountries, the use of cost-effective and reliable lowcarbon electricity energy sources is becoming an important energy policy. Among different kinds of clean energy resources-such as solar power, hydro-power, ocean wave power and so on, wind power is the fastest-growing form of renewable energy at the present time.
In our model presentation we are designing a micro wind turbine using a 12V dc geared motor for generating electricity.

Low Cost, Flexible Electronics for Health Care Applications

Brijesh Meena[1], Prashant Thapliyal[2], Vithya Saahar[4], Charu Monga[3] and Harsh Chaturvedi[2*]

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A Low cost and Flexible Heater was fabricated on PET (Polyethylene Terephthalate) substrate using Screen Printing Technique (Image 1). Carbon-polymer based inks with different carbon concentration were developed. Viscosity measurements were performed on these inks and both were found to be compatible with screen printing. Characterization such as Raman spectroscopy and SEM Imaging were performed on these ink samples. Patches of different Area were Screen Printed and change of Resistance with change in Area was measured. Output Temperature at constant Voltage was found to be different for different Area patches. Ink and patch size with highest Temperature deliverance at low power consumption was selected for further development of Heater. Consisting of two-layer printing, first Interdigitated electrodes were screen printed on PET film using Conductive ink. Later, a Thermally-active layer was printed on the electrodes. This layer consists of Carbon-polymer ink patch printed in an array between the Interdigitated Electrodes. Temperature profiling was done by measuring Temperature of Heater with respect to Time at different Voltages (Graph 1). Increase in Steadystate Temperature of Heater with increase in applied Voltage was observed. Bend test was performed by measuring Temperature at various bend angles. Change in Temperature with various angles were found to be in range of 5-10% and decreased with time. This Heater was able to provide 37oC (Human body Temperature) at DC voltage below 5V. Therefore, an ideal component for Health Care Applications, operating at low Voltage, which can be used in Thermal Jackets and in portable, controlled-environment, Baby-Incubators.

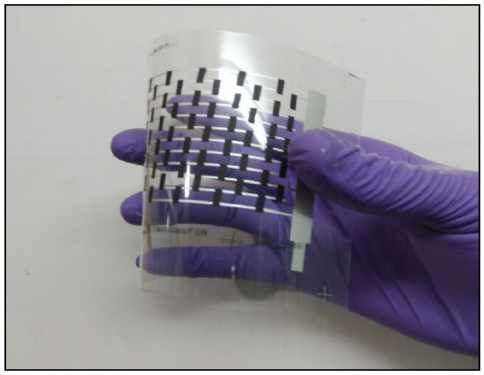
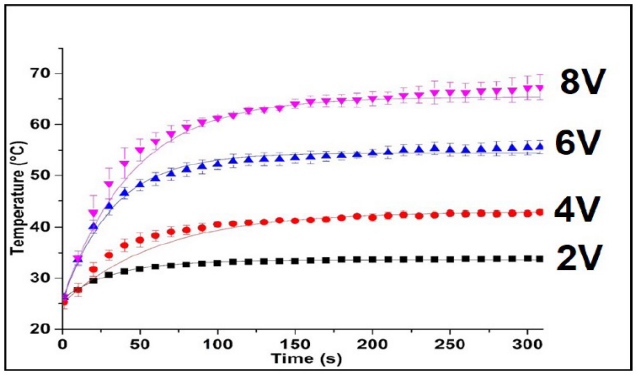


Image 1: Printed Flexible Heater on PET film.



Graph 1: Temperature Profile of Heater at Different Voltages.

Assam's looming power crisis: A model presentation to resolve the crisis of electricity supply

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Power crisis is a huge issue of our country India and Assam is facing a severe power crisis after a fall in the generation of power by Hydel and thermal power stations. The power generating stations in the state have also been affected due to the shortage of gas supply for thermal power stations and less availability of water for the Hydel power stations, sources said. Students who are preparing for exams are highly affected during study hours. In summer season, the peoples faced high load shedding and due to increasing in temperature it's impossible to live without electricity because all electric equipments i.e. Ac, Fan, computer, etc are run by power supply. This is a model presentation based on my idea upon how to resolve the crisis of power supply also known as load shedding. This model is based on renewable power resource operate by motor vehicles. By the help of motor vehicles which generate continuous power supply and reduce the power crisis of the state. So, Asssam is my mother land and I was also faced power cut problem due to load shedding during my exams and I never want that the students to Re-face the problem. Joi aai assam.

Keywords- Power crisis, Hydel Power, load shedding, Temperature, Renewable Resource,.

Flood water harvesting: A model presentation to utilize flood water of Brahmaputra river

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Floods are one of the most common hazard in the world and cause loss of lives, livelihood and property destruction. Every year Assam experiences a huge amount of losses due to devastating flood caused by the river Brahmaputra. Losses are caused in two valleys of Assam, Brahmaputra valley and Barak valley. In same time, the water shortage is also caused in many places of the state or in the country and results economic loss and other draught issues. So to reduce flood problem and utilize the flood water, here I prepare a model on FLOOD WATER HARVESTING. The objective of the model is to reduce the flood problem by utilizing process of the flood water. Every year during monsoon, flood occurs and first cause huge destruction and then drains out as runoff and the resulted totally waste of water and other resources. Therefore, flood is a natural occurring force of water and it is very difficult to command on flood by man. But by this model we can utilize the flood water and help to improve our nation's economy.

Keywords: Flood, Harvesting, Utilize, Hazard, Valley, Runoff, Command, Economy.

Islamic Banking: Inclusion of Ijara in India

The following study is a cumulative research emphasis laid out on the virtues, legality, applicability and other parameters of Ijara, and other Islamic financial services committed in the Qu'ran as an alternative to conventional banking systems prevailing in the modern world. This study analyses it's satisfaction within the set of respondents from all over India & their consumer relation with other modern banking techniques. Ernst & Young World Islamic Banking Competitiveness Report present- ed at the 18th Annual World Islamic Banking Conference predicted that Islamic assets in the conventional banks globally would reach US$1.1 trillion in 2012, a compounded jump from US$826 billion, with rise of 33% in merely 2 years. At the concluding end, we witness the possibility of an inclusion of IBS in Indian banking systems, with proposals of 'Islamic Window', in order to tap on vast majority of Sharia-compliant customers. The importance of Islamic Financing is transcendental, after having seen a penetrative rate of above 15% in regions where it has outperformed conventional banking and financial methods.

In this paper we discuss how Islamic Financing if closely synthesized and modified, can create a wholesome amalgamation of forming close equivalents with present day equity, mortgages and other derivatives. Starting from the basics of the financial concepts of this type of banking, we then review how the various projects have the potential to control liquidity and boost credit/capital value along with tackling macroeconomic issues. An IMF working paper argues that "holding constant the level of financial development and other growth determinants, countries where Islamic banking is present and hence its impact on growth is measurable, experience faster economic growth than others." With this in lieu, we also aim to obliterate the myth of Islamic Financing as a outdated and rudimentary method for helping the minorities of a particular religion.

Year	Number	Base Index	No. Times
2009	3	200	2
2010	5	250	3
2011	9	299	9
2012	14	400	10
2013	19	499	19
2014	29	591	30
2015	44	703	49

The Growth Table of Islamic Banking in India along with a few parameters is drawn, to be discussed along with the relationally factors. This rise in number of banks extending support (Marginal) is seen as a factor of growth for IB system.

Keywords: Islamic banking, profit sharing, Shariah complaint, Interest Free Loan, Islamic financial institution, conventional bank and joint venture

Abbreviations: Gulf Cooperation Council (GCC); Middle East and North Africa (MENA)

References:

1. https://www.microfinancegateway.org/sites/default/files/mfg-en-paper-a-comparative-literature-survey-ofislamic-finance-and-banking-nov-2001.pdf
2. https://www.labnol.org/india/sharia-compliant-islamic-banking-in-india-a-wealthy-proposition/160/
3. S. Natrajan & R. Parameswaran (2001), "Indian Banking", S. Chand & Company LTD, Rajender Ravindra Printer (Pvt.) Ltd, New Delhi.
4. Modeling Interest-free Economy (A Study of Macro Economic and Development) The International Institute of Islamic thought) USA.

A mobile, statically balanced and bamboo-made linkage for warehouse robot

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Introduction to the device:
The linkage that would be designed and fabricated would have a differential drive mobile base. On the top of the base there is a scissor linkage. The purpose of the scissor linkage is to move a platform vertically up and down. In order to have proper motion of the scissor linkage, one bottom most point of the scissor linkage is fixed to the base and other bottom most point of the scissor linkage is guided on a straight horizontal line by making use of Chebyshev linkage. The top platform is milarly attached to the scissor linkage through straight line generating Roberts mechanism. Furthermore, we will design a linkage on the top platform to facilitate loading and unloading of objects on the top platform. Most of the links in the linkage have been made from bamboo pieces. When motors along with controllers and sensors are added to actuate the differential drive wheels, up and down motion of the scissor linkage and loading and unloading mechanism on the top platform, the linkage would become a warehouse robot. The up-down motion of the scissor linkage which acts under the potential field of gravity is balanced by addition of springs. The balancing would ensure that most of the energy lost by the device while going down is stored in the springs and springs would supply back the stored energy during upward motion.

Novelty of the device:
Since the links of the linkage are made of bamboo pieces, one can find significant lateral sway on the linkages. The first novelty of the device is incorporation of triangular-prism shaped scissor linkage instead of the popular parallel-plane type scissor linkage. The triangular-prism-shaped scissor linkage significantly reduced the lateral sway. The second novelty is to connect the scissor linkage to the base through straight line generating Chebyshev linkage instead of popular slider joint. The replacement of slider joint was necessary since slider joints fabricated on bamboo pieces were found to be highly unsatisfactory.

Design details or methodology:
While the outline of the linkage designed has been presented earlier, the details on triangular-prism-shaped scissor linkage and the Chebyshev linkage base would be presented next. The methodology for static balancing would also be explained. The triangular-prism shaped scissor mechanism consists of three single-plane scissor linkages placed in the form of equilateral triangle based prism. The scissor linkages in the three planes are connected by connectors as shown in figure (1). In order to accommodate the triangular-prism shaped scissor linkage, two Chebyshev linkages at an angle of 60°are placed on the base. Further braces are added to Chebyshev linkages to prevent lateral sway. Similarly two Roberts mechanism at an angle of 60° can be found on the top platform. To balance the linkage springs were used. The springs are obtained by cutting a certain length from a long strip of spring. The springs were added along horizontal and vertical lines formed by the crosses as shown in figure (1).

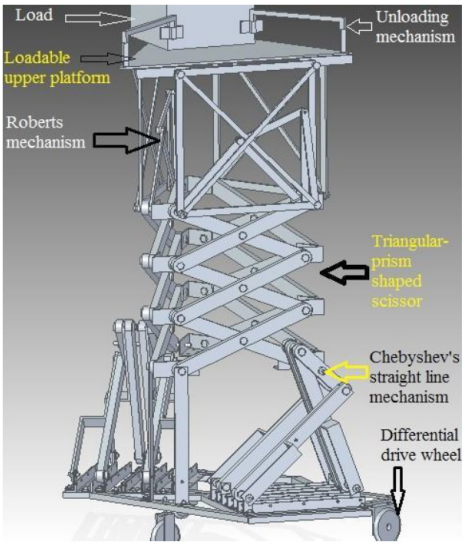

Figure 1: 3D CAD model of triangular-prism shaped scissor mechanism with loadable platform, unloading mechanism and differential drive wheel.

Highlights:
1. The device consists of linkage that moves a loadable platform up and down.
2. The linkage is partially statically balanced against the load to save the loss of energy.
3. The links of the linkage is primarily made of bamboo pieces.
4. The linkage is fabricated out of low cost locally available materials.
5. The static balancing of the linkage is accomplished by the use of normal springs instead of theoretically well understood zerofree-length springs.

Economically Designed Tong for Kitchen Purpose

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Tong is a mechanical device used to hold or lift heavy utensil. Tongs are generally used to hoId and lift objects. With this concept a tong for holding hot vessel is designed. It is specifically used to lift both light and heavy utensils having flat edges. Generally people often use cloth to lift such hot utensils, especially the women in India mostly use their saree-ends or use some normal cloth. This can be very dangerous and life threatening as there are chances and slippage of the hot vessel and causing burns to the person. So to eradicate this problem, economically designed tongs can be used for kitchen and laboratory purpose. This tong is designed specifically to hold and lift kitchen vessels having flat edges. Handles are provided to lift and vary the size of the pair of tongs to hold vessels of various diameter (15cm-40cm) and thus vessels of various capacities. Due to incorporation of spring, the handle's tightly press against the vessel and allows the person to safely hold and lift the hot vessel and thus removes the chances of slippage. This tong is designed to hold utensils of various diameters. Insulated material is provided in the handle to ensure that hot heat does not burn the users palm and fingers which ultimately allows in easy lifting of hot vessels without much effort. Apart from kitchen use this tong can be used in workshops, laboratories to lift hot vessels. The tong being simple and easy to use will be of great use in lifting hot utensils and prevent unnecessary accidents.

KEYWORDS: Tong, Hot utensil, Unnecessary accidents

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Cancer is one of the leading cause of death worldwide, which if detected earlier can be treated better. The limitation in diagnosis such as delayed treatment, overdose, lack of target specificity and limitation of resources in the remote areas have propelled scientists to bring forth novelty in the field of cancer theranostics. Photodynamic therapy is proposed to be an emerging tool in the field of oncology where photosensitizers are used which when activated by a light energy of suitable wavelength generates activated form of oxygen that is detrimental to cells, pathogen and unwanted tissues. The effectiveness of the therapy is usually confirmed via detection using colorimetric biochemical assays that gives the information about the viability of treated target. Photodynamic therapy being a photochemical reaction requires a suitable light source such as lasers and LEDs for irradiation. Low powered LEDs are preferred to avoid necessity of high power and minimize amount of heat release. Herein, we have developed a multipurpose wirelessly operated portable LED device for conducting photodynamic therapy and at the same time monitor the therapeutic efficiency by transmittance based colorimetric assays. The notable characteristics of the device include the ability to irradiate multiple samples over a range wavelength (as many as 96 samples). After the samples are exposed to photodynamic therapy, the success of the treatment can be evaluated using the biochemical colorimetric assay whose results can be monitored by the device itself. By switching over to respective wavelengths, the device is able to give the measurements indicating the cell viability and toxicity which was observed to be similar to the results obtained by the conventional microplate reader. Thus, the device was tested in the laboratory conditions for photodynamic therapy followed by the confirmation of the treatment using biochemical assays thereby revealing its potency. The device can be remotely controlled using a smartphone application in a controlled environment. The obtained results can also be analysed using the smartphone itself and thus confirm the therapeutic efficiency without the requirements of any server based system. Keywords: photodynamic, LED, microplate reader, theranostics, smartphone

Reference:

1. Wirelessly Operated Led Device For Photodynamic Therapy And Subsequent Monitoring Of Therapeutic Success. Indian Patent Application No.: 201731031603

Wave Analyser

Our project, Wave Analyser is a simple device that is used to analyse signals in the form a 2D image. It used the principle of Chladni's surface vibration and a lasing system to project the 2D image. We have taken a rubber membrane as the vibrating surface and a simple pointing laser and a piece of mirror as the lasing system. The application of this project will be mainly in Space Research projects, to study wave patterns from outer space and of different celestial bodies. It basically studies the radio frequency part of the electromagnetic wave. The lasing system then creates the image of the vibration on a screen. We can see different pattern of different frequencies of the wave. By studying the patterns we can determine the origin of the wave, its source nature and many more. Its a new application of the Chladni's surface vibration theory. Its is very simple way of analysing waves at a low cost . So it is basically a cost efficient project.

Rejuvenation Rural Industry through Need Based Intervention of Technology

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The authors have developed a Potter's wheel for the rural artisans associated with Pottery business in Assam. The newly developed tool has been tested at different parts of Assam and found more productive with user friendly features. Field testing results of the newly developed tool are encouraging as women workers are very much interested to use such a safe and cost effective tool. The model of the tool cab seen the fig. 1.

Fig. 1. Artisan working in Modified Potter's wheel developed at IIT Guwahati

Ecological River Corridor (ERC): ways for sustainable river management

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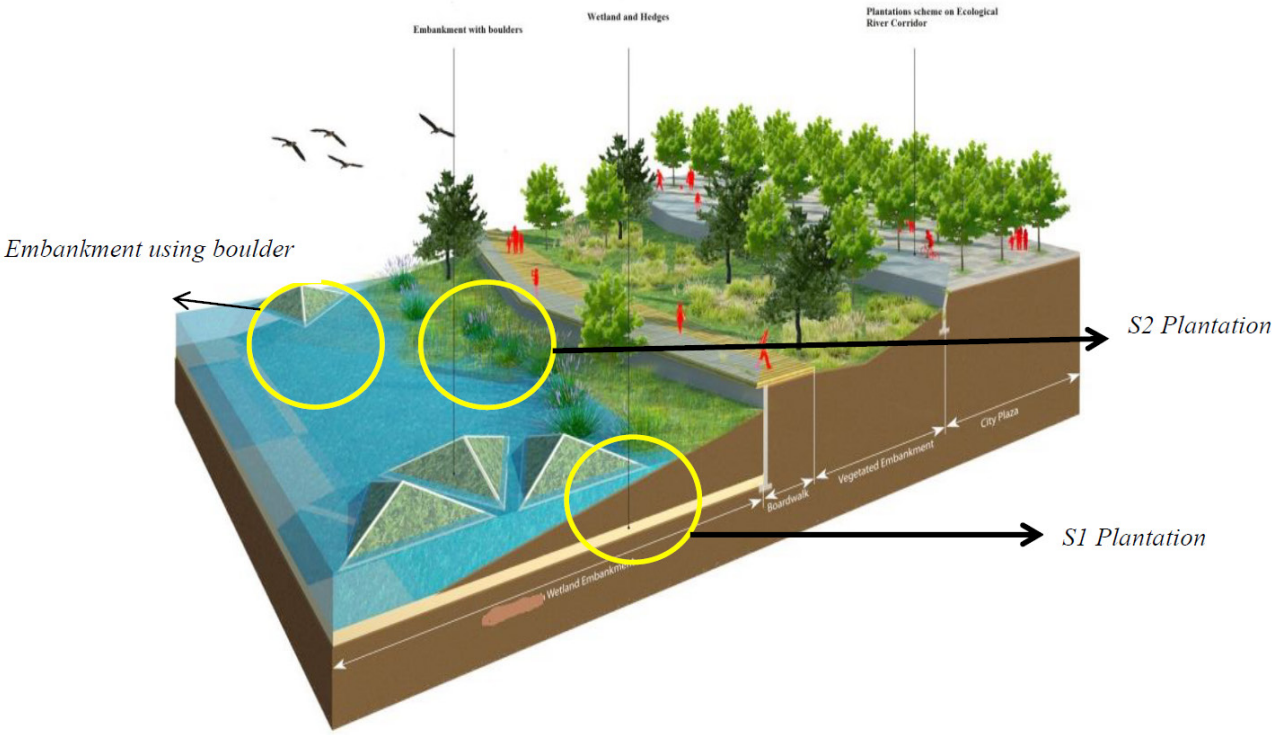
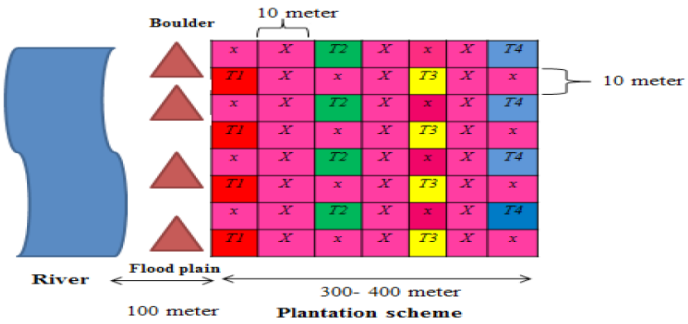
Ecological River Corridor (ERC)

ERCs will play a crucial role in introducing environmental sustainability for rural areas (villages), cities, towns situated on the bank of rivers, tributaries in North East encountering the erosion. The concept lies behind the using properties of plants like Soil Holding Capacity, Air Pollution Tolerance Index (APTI), Slope stabilization, Rhizo-filtration and dense canopy structure for avifauna. Rivers water qualities are strongly interlinked and get influenced by land use pattern along the riverside. The, vegetation present on the banks of the water body is known as riparian forest or gallery forests or streamside forests. 'Riparian' word has originated from the Latin word has 'Ripa', which means on the bank of water bodies. Looking into account of importance a scientific plantation must be carried out to make an ecological corridor.



Plantation scheme layout:
ERCs are mostly green boundaries having native grasses, flowers, shrubs and trees that line the stream banks. They are also called vegetated buffer zones. The following are the scheme:



Sr. No.	Type of Tree (T1…T4) & (S1)	Color coding	Tree / Scrubs names (Trees were chosen on the basis of APTI, Soil holding capacity, Aesthetics, high canopy, Native vegetation)
1.	**T1**	T1	*Ficus benghalensis, F. religiosa, F. racemosa , Dillenia indica, Aegle mermelos.*
2.	***T2***	T2	*Cocos nucifera, Areca catechu, Bombax ceiba, , Ailanthus excelsa*
3.	***T3***	T3	*Delonix regia, Dalbergia sissoo, Mangifera indica, Mikania micrantha* Kunth
4.	***T4***	T4	*Bauhinia species, Azardirachta indica, Alstonia scholaris.*
5.	***S1***	S1	*Chrysopogon zizanioides, Cascabala thevetia, Largerstroemia indica, Plumeria alba.*
6.	***S1***	S2	*Yucca gloriosa, Murraya paniculala, Thuja orienlalis*

- *The above scheme is indicative and change under specific requirements*

Sanitary napkin or sanitary pad is manufactured with different absorbent materials e.g. cotton, wood pulp and also high absorbent chemicals. Most of the wood pulp used for the purpose is imported, and therefore expensive, increasing the overall cost. The high cost of cotton is also the reason why unable to replace wood pulp; which results in increased cost of a napkin. In addition, uses of polyethylene and plastics causes' problem in degradability and soil pollution in landfill area. To solve this problem it is necessary to find a material locally available as well as it is biodegradable and abundant in quantity. Our aim is to look for bioresources from North –East India, particularly from Assam to develop a bio-friendly sanitary napkin at an affordable price.
Firstly, based on the material availability in this region, segregation of material has been carried out and after that depending on different chemical properties final segregation is done. Firstly four materials available in this region is taken into account, these are sisal plant leaf fibre, pineapple leaf fibre, areca nut husk fibre, banana plant cover fibre. These materials are tested to find out different chemical properties like cellulose, hemicellulose, lignin content. Also, FTIR analysis is being done to find out the different functional groups present. Based on the above experiment areca nut husk fibre is segregated to carry out designing and fabrication of sanitary napkin.

Keywords : Sanitary napkin sanitary pad, Absorbent materials ,plant fibre, areca nut husk fibre, biodegradable.

RoBo car x

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Working System: This car can run in land, air, stones, hills and rope-bridge. This car can reach the areas which are very difficult to reach by human beings. This car has wi-fi connection along with 4 cameras attached to it. That's why this car can be operated by sitting at home. This is a very useful device for Indian army to utilize in their regular activities. This car facilitates the provision of installing fire alarm, bomb detector etc.

The blacky teenovation

Musabbir Islam & Hitesh Agarwalla
Std. 10, Sophy Mercy Memorial School, sivasagar

We generally use air conditioners during the summer hot days. Air conditioners help us to maintain our body temperature. But as we know for everything we have both advantages and disadvantages. We cannot eradicate disadvantages of anything completely but we can reduce it to some extent. Similarly Air conditioners also have some disadvantages.

air conditioning is actually not so cool.
1>Unexpected change in humidity and temperature affects individual respiratory system
2>Regular use of air conditioners dries skin and mucous membrane
3>Air conditioning does not come for free, high bills loses our pocket strength.
4>A more comfortable environment may Make us lazy.
Therefore I teenovate the "FACE AIR CONDITIONING SYSTEM". It is a simple Black box with two motors which runs on both AC and DC current. This system help to cool our face and consequently the body gets cooler. Also it creates a congenial temperature inside the room which do not affect our health.

working principle.
It's a simple black box with two motors. One on the upper part while the other on the side part. What we need to do is to fill the box with ice. The upper fan will draw the hot air from the surrounding environment. The ice inside the box will cool down the air temperature. And finally the fan on the side part draws the cool air from inside and brings it to our face. The water produced due to the melting of ice falls drop by drop through the outlet pipe at the bottom of the box

Advantages of the system.
It reduces our electric bill as it runs only on two 4.5 volt motors. Its electric bill is equal to the amount we pay for charging our mobile phones in one month.
The cool air from it contains humidity as a result it does not dry up the skin of our face
Air conditioners make us lazy. But the face air conditioning system does not make us feel lazy as it works only on our face. Moreover it relaxes our brain when our face gets cooler which is a good way to reduce our stress level.

looking at these disadvantages a teenovation was required which may not eradicate it but lower it to some extent

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India, one of the fastest growing nations in the world. As such we require a lot of energy for development. Energy can be of many forms. One of them is electricity. In now days, electricity is like the oxygen to the human body. Oxygen is available and renewable but this characteristic lacks in the case of electricity. From the earlier days scientist are trying hard to find new ways to generate electricity. In the beginning and now also electricity is produced through thermal power plants. But here we need a lot of coal to produce steam by boiling water. Coal, as we know is non renewable and causes pollution. Looking at these disadvantages scientists launched a new method to generate electricity i.e. hydropower generation. Here, big dams are constructed on rivers, to store water and then to rotate the turbines by the force of water. However when dams are constructed, one side of the river completely dries up and create hurdles. Also a small crack in the dam, may lead to huge floods in the nearly areas, taking thousand of lines. Consequently in the coming days, many new ways were invented such as wind energy, tidal energy, solar energy etc.In all the above cases we need to depend on nature to generate electricity, as said by someone, energy cannot be created nor destroyed but can only converted from one form to another. Our concern is about how to generate electricity without depending on nature or may be negligible depending on nature. On further thinking, there came up only one solution "Electromagnetic Induction" According to this law,
(i) whenever the number of magnetic lines of induction flux through a circuit changes an induced e.m.f is produced in the circuit
(ii) The induced e.m.f last as long as the change in number of lines of force continues.
(iii) The magnitude of induced e.m.f is proportion to the rate of change of magnetic flux.
From this law we can take a solenoid of insulated copper wires and allow electricity to pass through it and keep as many as similar solenoids near it, there will be an induced e.m.f in all the..... solenoids. The amount of current in the solenoids will be equal or negligibly unequal to the primary coil. This is how we can multiply energy from a primary amount. The concept will become clearer once it is shown practically. The above mentioned way is just the definition the actual working process can be seen only practically. Through this way we can multiply a given amount of current as much as we want. This is how we may be able to solve the problem of energy crisis. This may be a beneficial concept towards development of Humanity .If we continues using this types of concepts surely in the upcoming years smart countries like Japan and china will be forced to say that India is the smartest of all nations. The above concept will surely work, as by Faraday's law there will be in an induced E.M.F in the nearby coil if electricity is allowed to pass through a solenoid near it.

Hydroelectricity

Abhijit Deka, Samir Basak, Sumanta Biswas

Have you ever noticed how many things we tend to take for granted? When we wake up in the morning and head to the bathroom to get ready for school, we do not give much thought to how we'll see in the dark. We just take it for granted but have you ever thought about how many things have to happen for those lights to come on when you flip that switch? For starts you have to have electricity flowing to the outlets and switches in your house. Where these the electricity you used come from? There are many different ways to produce electricity. Some people have electricity generated by power plants that burn coal. Others might get their electricity from wind turbines. Still others who live near rivers may get their electricity from an entirely different source. What are we talking about? Hydroelectricity, of course! Hydroelectric power is generated by flowing water. If you live near a river that has dams, you might very well benefit from Hydroelectricity. So just how does a dam convert flowing water into electricity? It's actually fairly simple and straightforward. Hydroelectricity and coal power plants produce electricity in a similar way. Both use a power source to turn the propellers of a machine called a turbine. As the turbine spins, It turns a metal shaft connected an electric generated, which is basically a motor that produces electricity. In the case of a hydroelectric dam, it's flowing water that's used as the power source to turn the turbine. Hydroelectric dams are constructed with a special passageway-called the penstock-for water. These passages are sloped downward to create a flow of falling water. As the water falls down the passageway, it's directed past the propellers of the turbine. The force of the flowing water turns the turbine, which in turn spins the metal shaft in the electric generator the produce electricity! But why are dams necessary? Could you just construct a hydroelectric plant on any river? Not exactly hydroelectric dams need to be constructed on large rivers that's have a large drop in elevation. The dam stores water that can then be controlled by engineers to regulate the water flow to produce electricity on demand at a specific rate. Unlike coal, which is burned to produce system to turn the turbines in a coal power plant, the water used in hydroelectric dams keeps flowing. Thanks to the natural water cycle, hydroelectric power plants take advantage of a easily renewable energy source!

Research Conclave'18

An amalgamation of Academia, Industry & Startups

Abstracts (Oral)

Investigating the unique features of Self-assembled Hen Egg White Lysozyme Nano-aggregates using Biophysical approaches

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We report a novel strategy for synthesis of Hen-egg-white Lysozyme nanoparticles by alkaline pH induced aggregation at room temperature (298 K). Aggregation at alkaline pH is characterized by an absence of lag phase or nucleation phase. Thus, aggregation proceeds without any requirement of critical concentration of the nucleus. These nanostructures offer the advantage of synthesis in a size controlled manner. Intermolecular association by disulfide linkage (s-s) renders the protein conformation to be further stable against any electrostatic repulsion faced by the oligomeric units when transferred from pH 12.2 to pH 7.0.

Detailed characterization of a complex self-assembling system presents an enormous challenge due to the heterogeneous nature of oligomeric species involved in the aggregation of HEWL. Biophysical methods like steady state fluorescence anisotropy, AFM, TEM, SAXS and DLS were employed to characterize the nanoparticles. In order to address the issue of size heterogeneity, chromatographic methods such as ion exchange and size exclusion have been used. Accessible hydrophobic regions in HEWL nanoparticles were assessed by ANS and Tryptophan fluorescence. Sensitivity of Pyrene monomer fluorescence has been used to estimate the probe microenvironment as a result of conformational changes during aggregation of HEWL. DLS was used as characterization technique to analyze the size distribution of polydisperse HEWL oligomers. Small angle X-ray scattering has been used to extract structural parameters and track conformational transition of HEWL aggregates.

Significant drop in steady state anisotropy of Fluorescein conjugated fractions shows that aggregates labeled with multiple fluorophores exhibit HOMO-FRET. Chemical incorporation of –CF3 group into Hen egg white lysozyme protein was used as the strategy to develop fluorinated conjugates. Here, we report the development of fluorinated HEWL polydisperse nanoparticles and fluorinated HEWL monomer. It was achieved by covalent linking of SETFA (S-ethyl trifluorothioacetate) to solvent accessible lysine residues of the protein.

Reference

Ravi, V. K., T. Swain, N. Chandra and R. Swaminathan (2014) On the characterization of intermediates in the isodesmic aggregation pathway of Hen lysozyme at alkaline pH.
PLoS ONE 9(1): e87256 doi 10.1371/journal.pone.0087256

Structural and functional characterization of a presumed homologue of the regulatory subunits of eIF2B

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Owing to the fact that the process of translation initiation in archaea and eukaryote are considerably homologous, the presence of a homologue of eukaryotic translation initiation factor 2B (eIF2B) in archaea has been anticipated. eIF2B is a multi-subunit protein critical for the successful completion of the process of protein biosynthesis in eukaryotes. Made up of two copies each of five subunits, α, β, δ, γ and ε, eIF2B acts as a guanine nucleotide exchange factor (GEF) for its GTP-binding protein partner, eIF2. Archaeal genome includes the homologues of only the regulatory subunits (α, β and δ) of eIF2B and lacks the counterparts of the catalytic subunits (γ and ε). However, only the regulatory subcomplex alone would not confer full functionality to eIF2B, as the catalytic subcomplex accomplishes the crucial function of GTP exchange. These regulatory subunits has also been found to be significantly similar to a functionally non-related protein, ribose-1,5-bisphosphate isomerase (R15Pi) known to be involved in the NMP degradation pathway wherein it catalyzes the conversion of ribose-1,5-bisphosphate (R15P) to ribulose-1,5-bisphosphate (RuBP).

The three dimensional crystal structure was elucidated to obtain an insight into the availability of a homologue of eIF2B

regulatory subunit in archaea. Results indicate that the presumed homologues of eIF2B regulatory subunits share more structural resemblance to R15Pi and also has the ability to interact with R15P (substrate) and RuBP (product). Thus, this compels to reconsider the earlier assumption of the presence of the homologues of eIF2B regulatory subunits in archaea.

Reference

1. Kakuta, Y. et al., (2004) Biochem. Biophys. Res. Commun. 319, 725–732.
2. Nakamura, A. et al., (2012) J. Biol. Chem. 287, 20784–20796.
3. Kashiwagi, K. et al., (2016) Crystal structure of eukaryotic translation initiation factor 2B. Nature 531, 122-126.

Tailoring Mechanical Properties of Silk Based Engineered Disc to Modulate Matrix Deposition of Annulus Fibrosus cells

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For successful tissue engineering application towards load bearing application recapitulating the biomechanical functions which are directly related to the structural intricacy, becomes crucial. Mimicking such anatomical complex structure of the annulus fibrosus (AF) remains challenging due to their biochemical and biomechanical heterogeneity. Tissue engineers have yet to capture the multi-lamellar hierarchy structure and region-specific mechanical properties of AF tissue [1-3]. Reconstruction of the native tissue's anatomical and biophysical milieu dictates the success of tissue engineered graft's cellular fate. Herein, we report a fabrication procedure to replicate the anatomical and biomechanical features of annulus fibrosus (AF) tissue. A seamless, full thickness disc-like angle-ply construct was fabricated using silk fibroin (SF) protein. To mimic the gradual transition of mechanical gradient from inner to outer region of native AF tissue, SF proteins from two different sources (namely Bombyx mori, BM SF as mulberry, and Antheraea assamensis, AA SF and Philosamia ricini, PR SF as non-mulberry) were blended in various ratios that provided differential mechanical and cell binding properties. Fabricated constructs were physicochemically and biologically characterized. The substantial alterations in physical properties e.g., pore size/porosity, inter-lamellar distance, swelling, degradation, and mechanical properties of the construct were attained in blends, when compared to control BM SF. The seeded porcine AF cells were found to align along the lamellar pores as visualized through staining. Enhanced AF cell proliferation was observed within constructs created of non-mulberry silk. Gene expression study concluded increased expression of collagen-I with enhancement of mechanical properties (particularly in the blends of BM SF and AA SF), whereas an opposite trend was observed for both collagen-II and aggrecan. Overall, the angle-ply construct with tailored mechanical properties supported cellular alignment and proliferation, and modulated the extracellular matrix (ECM) deposition forming a functional AF tissue like construct, thus providing a robust foundation as an alternative tissue engineered strategy in intervertebral disc (IVD) regeneration for future replacement therapy.

Key words: Silk; Annulus fibrosus; Mechanosensing; Biomaterial; Tissue engineering.

References:

1. S. Hariharan, J. A. Scarlett & S. E. Abram, Techniques in Regional Anesthesia & Pain Management 13, 67-75 (2009).
2. N. Nandan L, S. Sen, A.H. Huang, D. M. Elliott & R. L. Mauck, Spine 35, 867-873 (2010).
3. P. S. Hyug, E. S Gil, B. B. Mandal, H. Cho, J. A. Kluge, B. H Min & D. L. Kaplan, Journal of tissue engineering and regenerative medicine 6, s24–s33 (2012).

The NcZrg-17 gene of Neurospora crassa encodes a cation diffusion facilitator transporter required for vegetative development, tolerance to endoplasmic reticulum stress and cellulose degradation under low zinc conditions

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The Neurospora crassa gene NcZrg-17 encodes a membrane protein with homology to the cation diffusion facilitator (CDF) family of transporters. We analyzed the phenotypic and functional characteristics of ΔNcZrg-17 and the implications of these characteristics in vivo. The ΔNcZrg-17 mutant showed several phenotypes that are zinc suppressible such as reduced growth rate, short aerial hyphae, increased hyphal branching, early and enhanced conidiation and delayed conidial germination. Furthermore, the NcZrg-17 gene was found to be crucial for survival in the presence of endoplasmic reticulum (ER) stress inducing chemical agents. In addition, we found that ΔNcZrg-17 mutant is defective in protein secretion on cellulose media under low zinc conditions, pointing towards a physiological role for NcZrg-17 in N. crassa. A gradual and delayed transcriptional upregulation (~3-fold) of NcZrg-17 on exposure to low zinc suggests its role in adaptation to low zinc rather than zinc homeostasis. Together our findings support a function of NcZrg-17 in normal vegetative growth, tolerance to ER stress and degradation of cellulose under low zinc conditions in N. crassa.

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Intelligent Drowsiness Detection for Vehicles

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Drowsy driving is the cause of around 100,000 auto crashes each year in US itself. According to the surveys conducted by World Health Organization on road safety, over 1.3 million people die in road accidents in a year while almost 20 to 30 million road accidents resulted in serious injuries to traveller. Drowsy driving refers to driving along with the condition of sleepiness or fatigue. Drowsiness usually happens when a driver has not slept enough, sleep disorders, medications, drinking alcohol etc. The proposed system is a non-intrusive system used to determine the drowsiness of the driver and to alarm the driver if drowsiness is detected. The system incorporates two different methods of drowsiness detection and a processing unit. Having two methods for detection reduces the risk of a false drowsiness assessment. The first subsystem consists of Physiological sensors placed in the steering wheel measures the ECG of the driver to determine the drowsiness level of the driver. The second subsystem will monitor the driver's eyes using camera and by pattern recognition it will detect symptoms of driver fatigue. The processing unit is equipped with Artificial Intelligence and will be used to analyze and monitor the data from the camera and the physiological sensor to determine the driver's drowsiness state and therefore avoiding corresponding risk of falling asleep while driving.

Method Involved

Step1: The physiological sensor placed at the steering wheel will continuously monitor the heart rate of the driver and based on the machine learning algorithms; the processor will identify the drowsiness of the driver.

Step2: A small camera will be positioned in front of the driver behind the steering wheel, which will capture the images of driver's eye at regular intervals of time and will also monitor the driver's head movement. Then the image will be processed in the processor where it will perform pattern recognition of the acquired data and determine if the driver is drowsy or not.

Step3: Based on the output of Step1 and Step 2 ,the processing unit by using logistic regression algorithms which in turn will determine if the driver is drowsy or not .

Intelligent Drowsiness Detection for Vehicles

References:

[1]Mortazavi, Ali, AzimEskandarian, and R. A. Sayed. "Effect of drowsiness on driving performance variables of commer-

cial vehicle drivers." *International journal of automotive technology* 10.3 (2009): 391-404.
[2]Wei-Chih, H. U., et al. "Drowsiness detection system." U.S. Patent Application No. 12/122,798.
[3] Ueno, Hiroshi, Masayuki Kaneda, and MasatakaTsukino. "Development of drowsiness detection system." *Vehicle Navigation and Information Systems Conference*, 1994.Proceedings., 1994. IEEE, 1994.
[4] Lal SKL, 2001, 'The Psychophysiology of Driver Fatigue/Drowsiness: Electroencephalogram, Electro-oculogram, Electrocardiogram andPsychological Effects', PhD thesis, University of Technology, Sydney.
[5] Ji, Qiang, and Xiaojie Yang. "Real-time eye, gaze, and face pose tracking for monitoring driver vigilance." Real-Time Imaging 8.5 (2002): 357-377.
[6] Sahayadhas, Arun, Kenneth Sundaraj, and MurugappanMurugappan. "Detecting driver drowsiness based on sensors: a review." Sensors 12.12 (2012): 16937-16953.
[7] Saini, Vandna, and RekhaSaini. "Driver drowsiness detection system and techniques: a review." *International Journal of Computer Science and Information Technologies* 5.3 (2014): 4245-4249.

Habitat ecology and fish composition in the downstream of Ranganadi River Dam, N.E, India.

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Extensive survey on habitat ecology and fish composition was conducted in the downstream of Ranganadi River Dam (a tributary of Subansiri River)from March'2016 to February'2017. Habitat ecology reveals that the minimum (21 ± 0.57°C) water temperature was recorded in winter and the maximum (27.27 ± 0.71°C) in post-monsoon; lowest(19.5±0.66°C) air temperature in winter and highest(28.67±0.71°C) in post- monsoon; the lowest(7.13±0.26)pH in post-monsoon and highest(7.46±0.26) in post- monsoon; minimum (18.66 ± 1.42cm) transparency in monsoon and its maximum (40.67±2.25cm) in winter; minimum depth (39.3 ± 2.10 cm) in post-monsoon and maximum (103.3 ± 3.19cm) in pre-monsoon; minimum (0.35±0.18m/s) current flow in post-monsoon and the maximum (0.52±0.34m/s)in pre-monsoon; the lowest (6.73 ± 0.37mg/l)DO in post-monsoon and its highest(9.76±0.53mg/l) in winter; minimum (9.13 ± 0.77mg/l) F CO_2 in post-monsoon and its maximum (16.43±1.68mg/l)in winter; the highest (96.66±1.53mg/l) hardness in winter while its lowest (50.66±1.91mg/l)in monsoon; minimum (19.6±1.03mg/l)Ca hardness in monsoon and maximum (44.1±0.83mg/l)in winter; minimum (253.3±7.10mg/l)TDS in pre-monsoon and maximum (480 ± 5.16mg/l) in post-monsoon;the minimum (166.66 ± 4.09mg/l) and maximum (320 ± 3.65mg/l)TSS was found in winter and post-monsoon season respectively. The same fluctuation was noticed in case of Total Solids also. Some of the parameters showed slight monthly fluctuation. During the survey, a total of 51fish species belonging to 8orders,19 families and 36 genera have been recorded from this river and it was found to bed ominated with Cyprinidae family followed by Channidae and Bagridae. Conservation status of the recorded species was assessed.

Keywords: *Habitat Ecology, Fish Composition, Ranganadi River Dam.*

Distinct role of Akt isoforms in Oral Cancer

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Despite the therapeutic and diagnostic advances for oral cancer, it remains the prime global health concern. To overcome this situation novel and effective therapies need to be established. Akt, a serine-threonine kinase is known to be overexpressed in many cancers including oral cancer. However, Akt kinase exists in three isoforms (Akt1, Akt2 and Akt3) and strikingly they perform non-redundant function even opposing functions in promotion and progression of different cancer. Although, the mechanisms by which isoform-specificity are bestowed are yet to be deciphered fully. The present study was aimed to elucidate the isoform-specific role of Akt isoforms in oral cancer progression. The immunohistochemistry analysis of tissue microarray slides for oral cancer tissues has shown the overexpression of Akt1 and Akt2 isoforms but not Akt3. Also, the data retrieved from the dataset of The Cancer Genome Atlas (TCGA) for head and neck cancer has revealed the presence of maximum genetic alterations in Akt1 followed by Akt2 and Akt3. Furthermore, the genetic alterations associated with Akt1 were found to be correlated with a worse clinical outcome. On analyzing the effect of crude tobacco extract along with their components such as benzo(a)pyrene and nicotine showed that the expression of both Akt1 and Akt2 gets increased while at the same time it also increased the aggressive of oral cancer cells in terms of proliferation, clonogenic and migration potential. The knockdowns of Akt1 and Akt2 isoforms have shown that it decreased the cell survival of oral cancer cells and also it led to cell cycle arrest in G2 phase. The knockdown of Akt1 and Akt2 caused the decrease in the expression of molecular mediators involved in different processes of cancer progression such as MMP9, COX-2, Bcl-2, and cyclin D1. Also, their knockdown significantly reduced the tobacco-induced aggressiveness by decreasing the clonogenic and migration potential. The promoter sequence analyzed through MatInspector program of Genomatix showed unique transcription factors binding sites was observed among the isoforms which have earlier been implicated in different cancers. In addition, an attempt has been to categorize the general Akt inhibitors and other natural inhibitors using computational docking method utilizing the Glide (Grid-based Ligand Docking with Energetics) program (version 10.3) of Schrodinger software. Based on the affinity (GScore) towards the Akt isoforms selectively, the inhibitors were further classified and ranked.

Engineering the fracture characterization of Graphene Oxide: An atomistic approach

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In this article, functionalized graphene's exceptional compatibility and interfacial interaction with host polymer matrix were the motivating factors for their fracture depiction. The authors have considered hydroxyl, epoxide and carboxyl functional groups for this investigation; as our main goal was to comprehend the molecular physics behind their adsorption in graphene lattice. These variants of graphene form the backbone of intrinsic atomic structure of graphene oxide (GO). Molecular dynamics (MD) simulations in conjunction with reactive force field (ReaxFF) have been executed to capture the failure morphologies of GO framework. To the best of our knowledge, GO fracture toughness value is still unnoticed; since the literature does not offer a widely accepted model for their structure. The authors have tried to rectify this gap and predicted a range of fracture toughness value of 1.6 ± 0.25 MPa m-1/2 by examining their various configurations. In this article, we have used Large-scale Atomic/Molecular Massively Parallel Simulator (LAMMPS) package [Plimpton, 1995] for the simulations with ReaxFF parameters [Chenoweth et al., 2008]. Mathematically, the total energy of atomistic system (Esystem) specified by ReaxFF is in accordance with equation 1:
Esystem = Ebond + Eover + Eangle + Etors + EvdWaals + Ecoulomb + Especific (1)

A monolayer graphene nanosheet of length and width of 200 Å was considered with a strain rate of 10-3 ps-1. The atomic

virial stresses [Zhou, 2003] in all the simulations were predicted using the formulation depicted with the help of equation 2:

$$\sigma_{ij}^{\alpha} = \frac{1}{\varphi^{\alpha}}\left(\frac{1}{2}m^{\alpha}v_i^{\alpha}v_j^{\alpha} + \sum_{\beta=1,n} r_{\alpha\beta}^{j} f_{\alpha\beta}^{i}\right) \quad (2)$$

Post processing of dump files generated by LAMMPS was performed with the aid of open visualisation tool OVITO [Stukowski, 2009].

Figure 1 showcases the stress distribution on GO when loading was applied in the horizontal direction with a central crack embedded in its domain

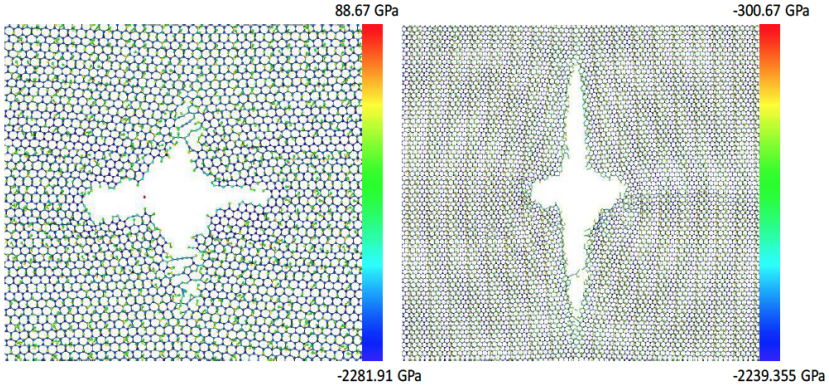

Figure 1. Stress distribution in GO

References:

1. Rajasekaran, G., Narayanan, P. and Parashar, A., 2016. Effect of point and line defects on mechanical and thermal properties of graphene: a review. Critical Reviews in Solid State and Materials Sciences, 41(1), pp.47-71.
2. Chenoweth, K., Van Duin, A.C. and Goddard, W.A., 2008. ReaxFF reactive force field for molecular dynamics simulations of hydrocarbon oxidation. The Journal of Physical Chemistry A, 112(5), pp.1040-1053.
3. Zhou, M., 2003. A new look at the atomic level virial stress: on continuum-molecular system equivalence. In Proceedings of the Royal Society of London A: Mathematical, Physical and Engineering Sciences (Vol. 459, No. 2037, pp. 2347-2392). The Royal Society.
4. Stukowski, A., 2009. Visualization and analysis of atomistic simulation data with OVITO–the Open Visualization Tool. Modelling and Simulation in Materials Science and Engineering, 18(1), p.015012.

Integration host factor mediated restructuring of CRISPR leader and site specific positioning of Cas integration complex ensues the directional expansion of CRISPR array

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Clustered regularly interspaced short palindromic repeats (CRISPR) in concert with CRISPR associated (Cas) proteins confer an RNA mediated immune response against invading mobile genetic elements in bacteria. CRISPR adaptation, a pivotal step in this defense retort, enriches the host with DNA fragments (termed 'protospacers') derived from invaders. Cas1-2 integrase catalyze the protospacer invasion into CRISPR array. Amidst the presence of several repeats, incoming protospacers are specifically integrated at the leader proximal repeat. Using CRISPR/dCas9 mediated immunoprecipitation and genetic assays in Escherichia coli, we identified the indispensable involvement of integration host factor (IHF) in expansion of CRISPR memory. Further, we demonstrated that IHF localization and bending of CRISPR leader regenerate the cognate binding site for Cas1-2 integrase in proximity to the first repeat. This mechanism appears to guide the directional incorporation of protospacers into the CRISPR array.

Investigation of Image processing techniques for Diagnostic Support

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Recent advances in Optical Imaging procedures and modalities have facilitated early diagnosis and treatment evaluation of critical diseases. Optical imaging and processing techniques such as optical coherence tomography, confocal microscopy multispectral endoscopy, multiphoton microscopy and diffuse reflectance are used to capture anatomical, physiological, metabolic and functional information of human body [1]. In most of the developing countries lacking resources and skilled physicians optical imaging techniques using a simple low cost digital camera for image acquisition and reliable image processing techniques can provide non-invasive, simpler, faster and cost effective solution to masses in healthcare and management sector. Digital Image processing techniques can be used to explore primitive diagnostics methods for diseases detection at early stages with limited resources and skilled labor. These techniques can also assist doctors during clinical examination without any need for invasive pathological test, this will help to facilitate pati ent comfort and avoid infection during blood test like HIV, Hepatitis viruses. Various blood components such as haemoglobin and billirubin whose approximate measure can directly be identified by just viewing the color of patient skin, nails, eye or any other target area can be measured and classified in terms of the color content of the image of the targeted area. Further, some diseases like anaemia and yellow fever and prenatal jaundice can also be detected and monitored time to time by processing the color information[2][3 [4]]. Life threatening chronic diseases such as skin cancer, which shows visual deformation on a patient skin, can be detected and its intensity can be evaluated [5]. Many physiological disorders which is associated with a subjects facial features can also be diagnosed and monitored [6]. Analysis of image processing techniques in conjunction with specialized supervision can provide significant exploration in the field of biomedicine and clinical applications. This research work proposes an image processing based non-invasive method of measuring haemoglobin(Hb) concentration present in patient's blood by analyzing the color and texture of digital photographs of patient's palpebral conjunctiva.
The images of patient's palpebral conjunctiva were processed and 8 relevant features were extracted .ANN classifier was used to correlate the output quantity to be measured with the values of the quantity measured by the standard method as per the guidelines given by WHO. Further, based on the testing results obtained by the classifier the patients whose Hb concentration was less than 11g/dL were screened as anaemic patients. A confusion matrix was then plotted to evaluate and compare the predicted classification results with the actual value of Hb obtained from invasive test. It was found that the proposed algorithm was able to diagnose anaemia with 71.42% sensitivity and 89.47% Specificity .The proposed work is targeted to be useful for giving assistance to medical practitioners for reliable diagnosis of anaemia in the clinic itself and in low resource settings.

Reference

[1] Atam P. Dhawan et. al "Optical Imaging Modalities for Biomedical Applications," IEEE Reviews In Biomedical Engineering, VOL. 3, 2010
[2] C.C.Fan, "Application of artificial classification techniques to asscess the anemia conditions via palpebral conjunctiva color component(Master thesis)",National Ilan University,Taiwan,2013
[3] Yi-Ming Chen et.al "Examining palpebral conjunctiva for anemia assessment with image processing methods," Journal of Computer Methods And Programs In Biomedicine -125–135, Elsevier,2016
[4] Mustafa Aydın et.al "Neonatal Jaundice Detection System," springer sciences ,Journal of Medical System, July 2016
[5] Roberta B. Oliveira et.al "A computational approach for detecting pigmented skin lesions in macroscopic images" Journal of
Expert Systems With Applications 61 (2016) 53–63, Elsevier , 11 May 2016
[6] Yunhua Chen et.al "Hybrid facial image feature extraction and recognition for non-invasive chronic fatigue syndrome diagnosis,"
Journal of Computers in Biology and Medicine Elsevier, 5 June 2015

Multi channel tarnish resistant surface plasmon resonance (SPR) biosensor for biosensing applications

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Over the years surface plasmon resonance based biosensors have been widely used because of real time and label free detection of biomolecular interaction. This work presents a tarnish resistant surface plasmon resonance biosensor enabling multiple detection of biological analytes. Silver, which is usually the most preferred choice for the metal surface in SPR based biosensors faces the problem of tarnishing when it comes in contact with air, degrading its sensing properties. Therefore the goal of the paper is to design a tarnish resistant biosensor surface such that the lifetime of the biosensor is improved. Further the work aims to immobilize an array of antibodies on the biosensor surface in order to achieve multiple detection of analytes. Proteins for example avidin, calmodulin, lysozyme and BSA can be detected separately by making microfluidics channel using PDMS. The biosensor will be optimized by immobilizing different concentration of various antibodies on the biosensor surface for different incubation time and the SPR response will be analysed.

Reference

1. Homola J; Surface Plasmon resonance sensors for detection of chemical and biological species. Chemical reviews 2008 Feb 13;108(2):462-93
2. Jordan Louis, Grenell L.H., Herschman H.K; Tarnish Resisting Silver Alloys; United States Government Printing Office, Washington; 1927
3. Abdulhalim I, Zourob M, Lakhtakia A. Overview of Optical Biosensing Techniques. In Marks RS, Lowe CR, Cullen DC, Weetall HH, Karube I (ed): Handbook of Biosensors and Biochips. Wiley, Weinheim 2007.
4. Federica Rusmini, Zhiyuan Zhong,*,† and Jan Feijen*Protein Immobilization Strategies for Protein BiochipsDepartment of Polymer Chemistry and Biomaterials (PBM), Institute for Biomedical Technology (BMTI), Faculty of Science and Technology, University of Twente, Enschede, 7500 AE, The Netherlands
Received December 19, 2006; Revised Manuscript Received February 21, 2007
5. Nicholas G. WelchJudith A. Scoble and Benjamin W. MuirPaul J. Pigram , Orientation and characterization of immobilized antibodies for improved immunoassays (Review),Published by the American Vacuum Society
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Understanding chemoresistance in AML

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AML is one of the aggressive forms of hematological malignancy wherein the fast-dividing myeloid progenitor cells present in bone marrow stop dying at the normal rate. “Acute” nature of the disease and rapid progression causes death within months if not treated. Even with current treatments, as many as 70% of patients aged 65 years or older succumb to the disease within 1 year of diagnosis. There has not been any drastic improvement in treatment options available for AML since the 1960s wherein DNA nucleotide analog, cytosine arabinoside (ara-C), is administered alongside DNA damaging anthracycline compound, Daunorubicin (DNR), to induce complete remission (CR). [De Kouchkovsky et al. 2016 Blood Cancer J.] Drug resistance is a major impediment in the treatment as up to 40% patients do not respond to the initial therapy and as high as 70% of those in CR relapse back with a more aggressive chemotherapy-resistant cancer within 5 years. [Verma, D. et al. 2010 Leuk. Lymphoma] Currently, two different models namely cancer stem cells (CSCs) model and micro-environmental mediated drug resistance model are under investigation for explaining the primary as well as acquired drug resistance in leukemia. [Zahreddine et al. 2013 Front. Pharmacol.] This study aims at tackling the question of whether drug treatment selects an already existing chemoresistant population of cells or induces a de-novo resistance and elucidating the pathways involved in the acquisition of chemo-resistance by leukemic cells.

THP-1 cells (a human monocytic cell line derived from an acute monocytic leukemia patient) were treated with different doses of DNR and ara-C to obtain cell death profile. Cells were treated with low concentrations of both drugs (1-10nM of DNR and 1uM of ara-C) for an extended period of time to allow emergence of chemo-resistant cells. After 10-11 cycles of 72 hours drug treatment, the expression of various cell surface markers was quantified using flow cytometry and compared to normal THP1 cells.

Among all the markers studied (CD13, CD34, CD44, CD45, CD49a, CD49b, CD49d, CD49e, CD49f, CD61, CD73, CD90, CD105, and HLA1) control THP1 showed expression of CD34, CD44, CD45, CD49d, CD49f, CD105, and HLA1. A dose-dependent decrease in expression of various cell surface markers was observed in drug-treated cells in general, except for CD49d, which showed a 3.1 fold increase in expression at lower doses of both drugs. CD49d also known as integrin α4β1, is involved in adhesion of cells and has been touted as the strongest flow cytometry-based predictor of overall survival in chronic lymphocytic leukemia (CLL) and correlates with poor prognosis.4 CD49d has been implied in providing pro-survival signals protecting CLL cells from drug-induced damages and might be playing a similar role in these drug-treated AML cells. The primary ligands for CD49d are VCAM-1, MAdCAM-1, and fibronectin and it plays a critical role in adhesion and cell signalling. We observed higher expression of CD49d as well as higher number of adherent cells at lower concentration (10nM) of DNR after 7 days of treatment. Higher concentration leads to high cell death and a lower number of adhered cells as well as smaller colony size of these adhered cells. It can be concluded that some cells have the capability to become adherent on treatment with DNR and escape drug-induced cell death. These adhered cells also seem to help suspension cells in surviving, as transferring the remaining suspension cells, after 7-8 days of DNR treatment, to fresh wells lead to their quick decimation, even in absence of the drug. Therefore, this in-vitro model seems to capture some aspects of cancer stem cell theory and can be used to elucidate various pathways involved in this drug-induced transformation that helps cells in evading cell death.

Identification and Molecular characterization of Wild Sericigenous Insects of Assam

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Rearing of domesticated sericigenous insects plays an important role in the rural economy of Assam. Among the silk moths, mulberry silk is the most studied one followed by some other species like A. assamensis and Samia ricini. Apart from these well studies species, Assam and North Eastern part of India is rich in several other non- mulberry silk producing insects. These non- mulberry insects popularly known as wild silk moths or Vanya Silk, are primarily tropical and have worldwide distribution (Boldsystems, 2014). This diversity can be potential gene pool for improvement of domesticated livestock of silk worms and worth characterization.

Phylogenetic analysis is the most reliable and scientific method of characterizing biodiversity. Since, there is very little study regarding the distribution pattern and morphogenetic characterization of these wild silk moths of Assam, we initiated this study with the aim of identifying the different sericigenous silk moths, identifying their food plant and providing preliminary information about their phylogenetic relationship. This study for the first time describe a simple method of DNA extraction from wing clips of the collected sericigenous insects and report the phylogenetic relationship among locally available silk producing insects by analyzing both mitochondrial and nuclear locus.

Keywords: Assam, mitochondrial, nuclear, phylogenetic, sericigenous

Enhanced Oil Recovery by Combined Chemical/Gas Flooding

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Among the different enhanced oil recovery (EOR) techniques, chemical and gas flooding are the widely used methods for improving oil recovery after conventional water flooding. Currently, alkaline-surfactant-polymer (ASP) is considered as the most promising chemical EOR method and CO_2 flooding as the leading gas EOR technique. Although CO_2 flooding has been successfully applied in many lab-scale and field-scale test, all of the oil from the reservoir rocks cannot be recovered because of the low density and viscosity of CO_2 relative to oil. Low density of CO_2 gas relative to oil promotes gravity override, whereas low viscosity results in unfavourable mobility ratio leading to viscous fingering.
To overcome these limitations of CO_2 flooding, a new technique in the form of chemically-induced-water alternated gas has been developed lately to take advantage of the synergic combination of chemical and gas EOR methods. The types of chemicals commonly used are surfactants, co-surfactants, co-solvents, polymers, alkalis, salts, nanoparticles depending upon the specific application. This study makes an attempt to investigate the EOR potential of alkali-surfactant-alternated-gas/CO_2 (ASAG) flooding by lab scale core flood studies using medium gravity crude oils and sandstone core samples from an Upper Assam oilfield. ASAG flooding involves the alternate injection of chemical slug and CO_2 gas leading to the formation of foam in the reservoir at the gas surfactant contact alternating imbibition/drainage cycles [1].

The success of ASAG flooding in recovering additional oil depends on the use of correct formulation for the chemical slug. Surfactants were initially identified based on their foaming ability with crude oils through foam stability tests. Further, the alkali-surfactant (AS) slug was designed to find the best combinations of chemicals having the ability to decrease the crude oil-water interfacial tension (IFT) to ultra-low value (less than 10-2 mN/m). The fundamental mechanism of all the surfactant-related EOR methods is to decrease oil-water IFT to the lowest level. Lower IFT leads to a high capillary number and thus a low residual oil saturation. With the selected formulation for the chemical slug, the ASAG core flooding experiments were conducted to evaluate the EOR potential of the process.

Among the 4 anionic surfactants, sodium dodecyl sulphate (SDS) displayed superior foaming ability in presence of crude oil and was selected as the surfactant for the chemical slug. The lowest oil-water IFT of 5.23 x 10-3 mN/m in the ultralow level was obtained with a specific AS formulation at salinity of 2000 ppm NaCl. This AS formulation was used as the chemical slug for the ASAG core flooding experiments. The results showed that higher oil recovery of 26.62 % of the remaining oil in place (ROIP) after waterflooding was obtained by ASAG flooding compared to 19.49 % ROIP by immiscible CO_2 alternated with water (WAG) flooding. The oil recovery efficiencies during ASAG flooding was found to be depended on a number of factors including rock porosity, chemical and gas injection volume ratio, gas tapering and preflushing. In fact, higher recovery was obtained with cores of higher porosity due to stronger foam formation in the more porous cores. The optimum oil recovery was achieved when the chemical/gas slug volume in the 1:1 ratio was employed during the flooding process. It was observed that both increasing and decreasing ASAG ratio (tapering) increased oil recovery due to better mobility control and improved microscopic displacement in the cores. The best residual oil recovery of 28.08% ROIP was obtained by ASAG flooding with gas tapering-down injection scheme. Another important observation made during the ASAG core flooding experiments was the further improvement in oil recovery with preflush of 2 wt% black liquor (a natural surfactant).

References:

1. Kumar, S. and A. Mandal, A comprehensive review on chemically enhanced water alternating gas/CO_2 (CEWAG) injection for enhanced oil recovery. Journal of Petroleum Science and Engineering, 2017. 157: p. 20.

Drop size characteristics of gas-liquid-liquid dispersion in a down flow gas-liquid-liquid contactor

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As gas-aided liquid-liquid process has advantage over non-gas-aided process, it is gaining importance as a simple and inexpensive means of achieving mass transfer. In order to increase the efficiency of columns, the contact time between the two liquid phases should be increased without any back mixing. The efficiency of column can be increased by introducing an inert gas (air, nitrogen, oxygen) as a mixing agent in the two-phase liquid-liquid (L-L) system. The gas-liquid-liquid downflow three-phase contactor has the advantage by dispersing gas and lighter liquid into the contactor in a continuous denser phase without any requirement of external power. Drop size characteristics have significant impact on altering the mass transfer coefficients, as well as hydrodynamics in the downflow contactor. In the present study the drop size distribution and Sauter mean drop diameter in gas-liquid- liquid downflow contactor are studied. Drop size characteristics are studied using Paraffin liquid-water and Kerosene-water in the gas-liquid-liquid downflow contactor. A schematic diagram of downflow gas-liquid-liquid contactor is shown in Fig. 1.

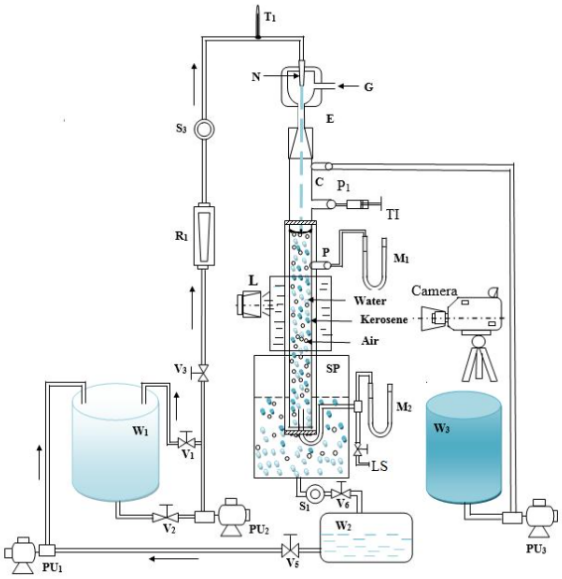

Figure 1: Schematic diagram of experimental column

The variation of drop size with fixed secondary lighter liquid volume at different gas flow rates is studied. It is observed that the Sauter mean drop diameter is decreased with jet velocity and decreases with increase in gas velocity. An empirical correlation was developed for Sauter mean drop diameter which is in good agreement with experimental value. The study of the drop size in the downflow contactor may give insight into a further understanding and modelling of the three-phase flow characteristics in industrial applications.

Keywords: Three-phase; downflow; gas-liquid-liquid; drop size; dispersion

Refrences

S. K. Majumder, Analysis of dispersion coefficient Analysis of dispersion coefficient of bubble motion and velocity characteristic factor in down and up flow bubble column reactor. Chem. Eng. Sci., 63: 3160-3170, 2008.

S. Lu, Z. Mia, L. Wang, Y. Wang, Z. Zhu, and S. Fu. Experimental investigation and simulation of gas–liquid–liquid reactive extraction process for the production of hydrogen peroxide. Chem. Eng. Sci., 60: 6298 – 6306, 2005.

Micro scale investigation of immiscible fluid displaement visualization in porous media

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The multiphase flows in the formation are having different phenomena in the displacement of the existing fluid in the formation. The study of displacement behaviour of fluids is crucial to understand the mechanism of sweeping the consistent fluids in the formation so that the micro scale investigation of fluid and formation characteristics gives more efficient understanding of characterisation.
The main purpose of this work is to enhance the Hydro carbon recovery from various reservoirs through Enhanced oil recovery (EOR) methods that can be verified by micro scale observation of displacement of fluids in various reservoirs. Despite the huge literature available on EOR methods, there is no exact injected fluid selection for a particular reservoir which has different characteristics in the same formation and the same reservoir fluid.
However this work leads to the selection of suitable injection fluids for respective reservoir characteristics. This task is facilitated by considering an X-Ray micro CT scanned sectional images of carious reservoir rock samples. Thereafter MATLAB software is used for measuring the pore radius and the mean surface area of the matrix. Further then the samples are simulated in COMSOLE interface whose results deliver then suitable methods.
Keywords: X-Ray Microscope CT scan, Enhanced Oil Recovery, Reservoir Characteristics.

Biodegradable Chitosan-Based Plastic from natural resources

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Plastic has growing demand because of its various applications ranging from the wrapping of food material to manufacture of space shuttles. It has the disadvantage of remaining in the sand for thousands of years without undergoing degradation and has become the threat to the environment. An alternative to the plastic is the chitosan-based bioplastic, which represents the safe packaging material for food and medicine with antibacterial and anti-oxidative properties. Chitosan is a naturally occurring polymer present in the hard shells of crustaceans. Every year tons of dead crustaceans wash up on shores which do not degrade. This natural resource can be effectively utilized by degrading it into useful products which will have commercial value. Since chitosan resembles the structure of cellulose polymer and also contains a replaceable amine group, modifications can be made to convert it into biodegradable plastic. The chitosan-THC (Tetrahydrocurcuminoid), chitosan-starch, chitosan-cellulose films blended with biodegradable natural plasticizers are utilized in the development of the biodegradable plastic. The membrane using cellulose acetate and chitosan was prepared using acetone and formamide solvents. Natural plasticizers obtained from cashew nut shell liquid and esterification of rice fatty acids and polyols are used. Use of plasticizers reduces the hardness, deformation tension, glass transition temperature and also the electrostatic charge of the polymer matrix. Dielectric constant, flexibility and the resistance to fracture of the matrix are improved. Fire resistance, biodegradability, optical clarity and the crystallinity degree of the matrix are also improved compared with the polyethylene in the plastic obtained using chitosan as the major component.
Keywords: Chitosan, natural plasticizers, biodegradability, crustaceans

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Detection Of Melamine In Milk Using Silver Nanoparticles

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Economically motivated adulteration, a subset category of food fraud, was defined in 2009 by the Food & Drug Administration (FDA) as "the fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production," and can often encompass public safety effects through the unknown addition of allergens, toxins, and hygienic risks (Wheatley & Spink, 2013). According to the FDA database which tracks scholarly records of adulterated foods, dairy products are the second most reported category of adulterated food products (Moore, Spink, & Lipp, 2012).
Melamine Adulteration is an economically motivated adulteration by means of dilution with milk or milk powder. It is of interest to consumers, manufacturers and governing bodies to have a simple, fast, accurate, and sensitive method to detect adulteration by melamine. Several methods have been developed to detect melamine adulteration in dairy products including immunological, chromatography, and molecular methods (Mayer, 2005).
In this a method is developed to analyse milk adulteration in milk by visual inspection. The method works on the principle that in the presence of melamine AgNPs gets aggregated and show a visual colour change from yellow (due to unaggregated silver nanoparticles) to Ruby Red(due to aggregation of AgNPs). In the presence of melamine, aggregation of AgNPs are due to the amino group and ring nitrogen of melamine which strongly bind to the surface of citrate stabilized AgNPs by the ligand-exchange and this ligand-exchange decreases the electrostatic repulsion between individual AgNP and finally results in the aggregation of AgNPs. Change in diameter before and after addition of melamine is evaluated. AgNPs based surface plasmon resonance probes can be used to detect melamine in milk.
Key words: AgNP's, Melamine, Surface Plasmon Response

A Novel Green EOR process for Upper Assam Basin, India

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In Alkaline Surfactant Enhanced Oil Recovery (ASEOR) an alkali and surfactant/surfactants are used to recover the residual oil that remains after secondary brine flooding. The alkali, which is Sodium Hydroxide (NaOH) in this case, reacts with acidic components in the crude oil to form surface-active substances. A GC-MS spectrum of Upper Assam crude oil reveals the presence of carboxylic acid groups leading to in- situ formation of surfactants, which in turn decreases the interfacial tension (IFT) between the oleic and aqueous phases for better oil recovery. While the anionic surfactants used were Black Liquor (BL) and Sodium Dodecyl Sulphate (SDS). The Critical Micellar concentration (CMC) of BL and SDS one at a time was added to NaOH to enhance the effectiveness of NaOH in further decreasing the IFT of the Alkali- Surfactant (AS) slugs. The paper also make an attempt to study the adsorptive nature of the AS slugs. The best fit adsorption isotherm was derived by using SciDAVis scaled Levenberg - Marquaradt algorithm regression co-efficient.
Keywords: Chemicals, EOR, Adsorption .

Synthesis Of Hydrogel For Agriculture Application Using Cellulose Nanoparticle.

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Hydrogel is a macromolecular cross-linking network in polymeric monomer. Hydrogel are absorb and retain water and also reversible manner.The Cellulose based hydrogel sources are largely avilable in nature and its biodegradeble , biocompatible. Cellulose nanoparticle are large surface area and good mechanical strength which are uniform distributed in large area in hydrogel and improve hydrogel property. Cellulose are large amount of natural resources such as cotton, rice starw, wood chip, banana stem .Hydrogel are used in differents field of application, In agriculture area, hydrogel are increase water holding capacity of soil . Agriculture field (muddy & desert) hydrogel are applied than holding capacity of water are increase upto 300 times. When the cultivation is watered by either irrigation & rain, the hydrogel absorbs retain the water and avoid loss of drainage & evaporation method water loss. After the time when root need water in dry period that time hydrogel release water as per needed. On other profit used of hydrogel in agriculture field, mixing of soil & hydrogel make a granule which increase soil porosity & provide good oxidation in plant root. Cellulose based hydrogel are very strong capable of water holding capacity. In further investigation has been done to determine the water retention property of soil and effect on the growth of plants with hydrogel modified growth media.
Keywords: cellulose , nanoparticle, hydrogel , agriculture area.

Development of stable green carrier for facilitated transport of CO_2 for the application of flue gas and syngas separation.

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We have seen that people believe “Swachh” (clean) means maintaining cleanliness around our surroundings. But we never talk about the “Swachh air” in “Swachh Bharat Abhiyan” (Clean India Mission) Working in this line, we tried to devote our efforts to develop a technology to clean the air (reduce global warming) by using polymeric membranes. The polymeric membranes are being used to separate CO_2 from flue gas and syngas due to its cost effective, low energy requirement, corrosion free and simple handling [1]. CO_2 pass through the dense active layer following solution diffusion mechanism and facilitated mechanism. The CO_2 flux and selectivity of the membrane following solution-diffusion mechanism are low as compare to facilitated transport mechanism where CO_2 react with amine molecule present in the active layer. However, the long term-stability of the membrane following facilitated transport is a matter of concern due to leaching out of the carrier or aging of the amines present in the active layer [2]. We report a novel membrane prepared by rational blending of two biopolymers: chitosan (CS) that acts as a matrix and silk fibroin (SF) that aids chitosan as a carrier for facilitated transport. The separation of binary gas mixture (CO_2/N2) have been studied at temperature, feed absolute pressure and sweep water flow rate ranging from 60-120 °C, 2- 5.93 bar and 0.01-0.07 ml/min, respectively. The optimum CO_2 permeance of 140 GPU and CO_2/N2 selectivity of 103 for binary gas were observed at 90 °C and 0.05 ml/min of sweep water flow rate for the membrane containing 45 wt. % of SF in blend with CS (SF45). The SF45 composite membrane exhibited CO_2 permeance of 123 GPU and selectivity of 93 and 60 for CO_2/N2 and CO_2/H2 respectively, in case of ternary gas mixtures (CO_2/N2/H2) at the similar operating conditions. The appreciable CO_2 separation performance tunable with temperature and moisture, displayed unprecedented stability of 30 days.
Chitosan (1.15 g) was dissolved in 1 vol% acetic acid aqueous solution under vigorous stirring for 12h. The solution was centrifuged at 10000 rpm for 30 min to remove undissolved particles. The pH of this chitosan solution was maintained around 5.5 by adding KOH, otherwise irreversible precipitation of the silk occurs. Now, silk solution of calculated amount has been added dropwise to the chitosan solution by magnetic stirring at 5°C. This CS-SF solution was again stirred for 15 mins and centrifuged at 10000 rpm for 30 mins. The CS-SK solution was then cast using a casting knife (GARDCO, Paul

N. Gardner, USA) onto the poly(ether sulfone) microporous support having pore size of 0.03 microns. The synthesized membranes were kept inside the laminar air flow for 48 h and heated at a heating rate of 1 °C /min from 25 to 120 °C and held for 6 h at 120°C. A litematic thickness gauge (Make: Mitutoyo, Model: VL-50) was used to measure the active layer thickness of the composite membranes.

References

[1] B. Prasad, B. Mandal, "CO_2 separation performance by chitosan /tetraethylenepentamine/ poly(ether sulfone) composite membrane"*Journal of Applied Polymer Science*, vol.134, Issue (2017), pp. 134 (2017) 45206. doi:10.1002/app.45206.
[2] B. Prasad, B. Mandal, "Moisture responsive and CO_2 selective biopolymer membrane containing silk fibroin as a green carrier for facilitated transport of CO_2" *Journal of Membrane Science*, 2017. doi.org/10.1016/j.memsci.2017.12.061.

Studies on Silk-based Bionanocomposites

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In the current work, crystalline silk nano-discs (CSNs) are extracted from waste Muga silk through novel hydrolysis cum sonication route providing an effective strategy for upconversion of 'waste to wealth'. The average diameter and thickness of CSNs is 49.1±12 nm and 3.1±0.9 nm, respectively. CSNs are hydrophobic in nature, highly crystalline (C.I. = ~93.7%) and have superior thermal stability of 310 °C. Furthermore, surface of CSNs are modified using iron-oxide nanoparticles to fabricate magnetic CSNs (MGCSNs) through one-step reduction reaction. MGCSNs have diameter and thickness of 58.2 ± 4.6 nm and 16.0 ± 2.6 nm, respectively. Subsequently, CSNs are used as reinforcement material in the poly (lactic acid) (PLA) matrix to fabricate PLA/CSN "green" biocomposite through melt-extrusion for potential high temperature engineering and food packaging applications. At optimum loadings of 1 wt. %, the formation of network like structure covering the entire matrix, corroborated through morphological analysis, leads to significant improvement in intrinsic characteristics such as thermal, mechanical, barrier, and processing capabilities. The crystallization behavior is studied using non-isothermal cold crystallization and isothermal melt crystallization using differential calorimetry. Addition of CSNs in PLA matrix results in lower cold crystallization temperatures (Tcc) and shorter crystallization half-time (t0.5) with enhanced growth rates. It was found that CSNs act as heterogeneous nucleating agents, hence improve non-isothermal crystallization kinetics of PLA. Improvement in crystal nucleation density is observed as CSNs contribute towards new nano-nucleation sites. In addition to this, effect of CSNs on the thermal degradation kinetic studies for PLA and PLA/CSN are carried out using thermogravimetric analysis (TGA) at various non-isothermal heating rates. The apparent activation energies (Ea) of nanobiocomposites, determined from kinetic models increased in comparison to pure PLA which inform that CSNs impede the thermal degradation process. The hydrolytic degradation rate of composites was slower as compared to PLA in acidic, neutral and alkaline media at pH=2, 7 and 12, respectively due to hydrophobic nature of CSN and pH. This work provides valuable insight for the application and reclamation of PLA/CSN bionanocomposites in moist and wet working environments. Further, fabricated CSNs and MGCSNs are utilized for preparation of PLA based nanofibrous scaffolds by electrospinning. Interestingly, alignment of CSN derived magnetic nanoparticles due to effective fiber drawing process during electrospinning could improve cytocompatibility against BHK-21 cells. In vitro cell cytocompatibility studies show improved cell adhesion and proliferation on the surface of the developed biocomposites scaffolds which support its biocompatible nature. Combined effect of curcumin and hyperthermia reduced the growth to ~57%.
Keywords: Poly (lactic-acid), crystalline silk nano-discs, silk, food packaging, cancer therapy.

Effect of Glucose Addition on Xylose Fermentation for Xylitol Production by Candida tropical is MTCC 184

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Xylitol is a naturally occurring sugar alcohol having five carbon atoms and five hydroxyl groups (C5H12O5) and is present in very small quantity in fruits and vegetables [1]. Yeast has been studied for xylitol bioproduction, as an alternate to chemical reduction process [2]. Candida tropicalis is one of the most successful organisms for xylitol bioproduction due to its high uptake of xylose, xylitol production capability, and alkane and fatty acids degradation in its peroxisomes [2&3]. This study has investigated the effect of glucose addition on the yield and rate of production of xylitol by Candida tropicalis MTCC 184 (viz. glucose/xylose mixture of 0, 10, 15 and 50%) in shake flask fermentation. The yield and productivity of xylitol increased with small addition of glucose and decreased as the glucose addition exceeded. The maximum xylitol yield of 0.605 g/g with a correspondi ng 66.3% of the theoretical yield of xylitol and maximum volumetric productivity of 0.482 g/L h was achieved. Optimum glucose/xylose mixture ratio was 15% for maximum xylitol yield (0.605 g/g) and productivity (0.482 g/L h).

Table 1 Fermentation parameters evaluated at maximum xylitol production in glucose/xylose mixtures fermentation by Candida tropicalis

Candida tropicalis

Glucose/xylose (%)	Yields		Specific rates			Volumetric rates	
	$Y_{X/(g+xy)}$ (g/g)	$Y_{xit/xy}$ (g/g)	μ (h^{-1})	q_{xy} (g/g h)	q_{xit} (g/g h)	Q_{xit} (g/L h)	Q_{xy} (g/L h)
0	0.375	0.564	0.026	0.067	0.038	0.425	0.753
10	0.419	0.596	0.026	0.057	0.034	0.469	0.788
15	0.423	0.605	0.026	0.056	0.034	0.482	0.797
50	0.371	0.516	0.020	0.030	0.015	0.256	0.497

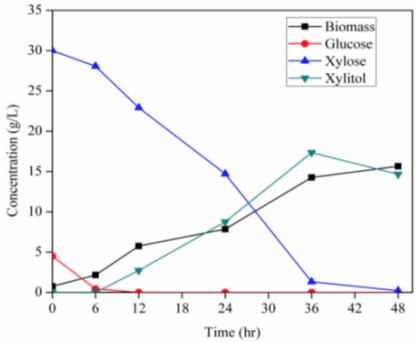

Fig. 2 Concentration profiles of 15% glucose/xylose mixture fermentation by Candida tropicalis

References:

1. Ur-Rehman, S., Mushtaq, Z., Zahoor, T., Jamil, A., Murtaza, M.A. 2015. Xylitol: a review on bioproduction, application, health benefits, and related safety issues. Critical reviews in food science and nutrition, 55(11), 1514- 1528.

2. Granström, T., Ojamo, H., Leisola, M. 2001. Chemostat study of xylitol production by Candida guilliermondii. Applied microbiology and biotechnology, 55(1), 36-42.

3. Rao, R.S., Jyothi, C.P., Prakasham, R., Sarma, P., Rao, L.V. 2006. Xylitol production from corn fiber and sugarcane bagasse hydrolysates by Candida tropicalis. Bioresource Technology, 97(15), 1974-1978.

DFT study on conversion of Ferulic acid to Vanillin

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With the growing energy demand and depletion of fossil fuel, the world is looking for alternative sources of energy. The most promising sources include wind energy, solar energy and biomass energy. While the wind and solar energy are very eco-friendly, the technology to harness them is still primitive. On the other hand, biomass energy, which is tapped in the form of bio oil and bio gas, are quite compatible with the existing energy infrastructure. However, the energy density of bio oils are significantly low due to the presence of oxy functional groups in its components. Thus, there exist a need to upgrade bio oil before being used as fuel. One way to do that is to subject the bio oil to catalytic hydrodeoxygenation. This removes the various oxy functional groups like aldehyde, ketone and carboxylic from the components like guaiacol, vanillin, etc. Ferulic acid (FA) is one such component which contains a methoxy, a hydroxyl and a carboxylic functional groups. Thus, considering it to be a model compound for bio oil, a conversion pathway from ferulic acid to vanillin (Van) has been studied and thermochemical parameters like ΔH and ΔG has been computed under density functional theory framework.

All the molecular structures are optimized in gas phase at B3LYP/6-311+g(d,p) level of theory and also thermochemical parameters are computed at same level of theory at temperatures from 598K to 898K at 1 atm pressure in gas phase. The frequency calculations are also carried out at the same level to check for minima and transition state. Finally, intrinsic reaction coordinate (IRC) calculations are carried out to determine the reactants and products of all transition state structures.

The conversion of Ferulic acid to vanillin is of particular interest since vanillin has wide application in food industry. From the bio fuel perspective, the conversion of vanillin to high energy density products have been studied by several researchers. The pathway described in the study also leads to the formation of important intermediate p-vinylguaiacol which has several possibilities for further upgrade.

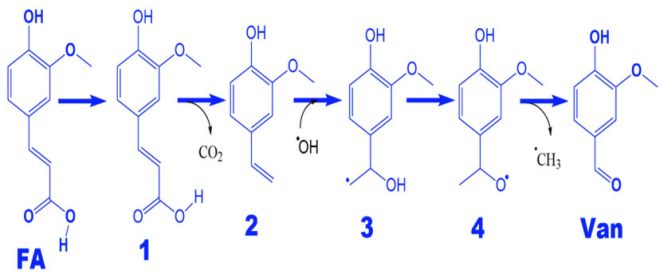
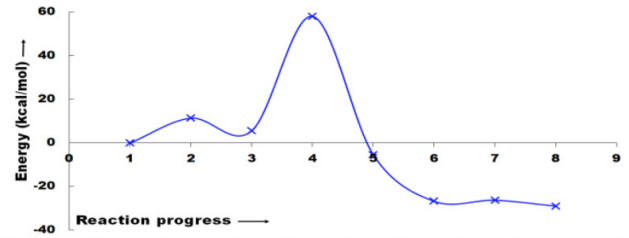


Fig 1. Conversion pathway from FA to VAN



X-axis	0	1	2	3	4	5	6	7	8
FA-Van	--	FA+·OH	TS1+·OH	1+·OH	TS2+·OH	2+·OH +CO_2	3+CO_2	4+CO_2	Van+·CH_3+CO_2

Fig 2. Potential Energy surface of the reaction pathway

The Ferulic acid is first converted to an energetically less favourable conformer (1) which arise due to the conformational change in COOH functional via dihedral change. The change of FA to structure 1 requires 11.41 kcal/mol of energy to overcome the barrier height. Subsequent decarboxylation requiring 52.53 kcal/mol barrier height yields p-vinylguaiacol and CO2. The addition of -OH functional group to p-vinylguaiacol requires 30.02 kcal/mol. This addition is done at the benzylic carbon atom. The hydrogen atom from -OH group in structure 3 migrates to the nearby methyl group yielding structure 4 that requires almost negligible energy. The removal of methyl group from structure 4 requires bond dissociation energy of 1.45 kcal/mol and produces Van. Finally, it is observed that with increase in temperature, the reaction free energy decreases (Table 1); however, there is no significant change in the enthalpy change of the conversion process with temperature.

	Thermodynamic parameter	Temperature			
		598K	698K	798K	898K
FA-Van	ΔG	-50.85	-54.49	-58.08	-61.62
	ΔH	-28.93	-29.27	-29.63	-29.99

Table 1. Thermochemical parameter (in kcal/mol) at varying temperature and 1 atm pressure.

References:
W. Fiddler, W.E. Parker, a E. Wasserman and R.C. Doerr, Thermal decomposition of ferulic acid, J. Agric. Food Chem. 15 (1967), pp. 757–761.
M. Wang, C. Liu, X. Xu and Q. Li, Theoretical study of the pyrolysis of vanillin as a model of secondary lignin pyrolysis, Chem. Phys. Lett. 654 (2016), pp. 41–45.
A.M. Verma and N. Kishore, Molecular modelling approach to elucidate the thermal decomposition routes of vanillin, New J. Chem. 41 (2017), pp. 8845–8859.
G.P. Rizzi and L.J. Boekley, Observation of Ether-Linked Phenolic Products during Thermal Degradation of Ferulic Acid in the Presence of Alcohols, J. Agric. Food Chem. 40 (1992), pp. 1666–1670.

Formulation of a New Enhanced Oil Recovery Slug

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The study aims in formulating a new Enhanced Oil Recovery (EOR) slug comprising of a synthetic polymer, which is Polyacrylamide (PAM) and a biopolymer, which is Xanthan Gum (XG). In this case the EOR will be named as XPS, where PAM will be assisted by XG. The polymer flooding application in depleted oil fields of Upper Assam Basin has faced a number of challenges, as it was unable to enhance the viscosity of the displacing fluid and reduce in the effective permeability of the displacing fluid, which led to the failure of the macroscopic sweep efficiency of the reservoir. Rheological measurements using coaxial cylinders were carried out to examine the changes in shear stress and viscosity versus shear rate with different concentrations of PAM and XG in XPSs. While the Surface Tension (ST) measurements were carried out by spinning drop tensiometer to examine the effect of XPSs on the microscopic displacement efficiency of the reservoir. The ST of the PAM was reduced on addition of XG. The rheological properties were found to be Non-Newtonian mostly shear thinning with a few exceptions in case of lower concentrations of PAM. The experimental results were validated by two Non-Newtonian time independent models. The rheological properties of the XPSs were described by the Herschel– Bulkley (HB) and Ostwald de Waele power law (OWP) models to characterize its shear thinning behaviour. Shear thinning polymer slugs are desirable for Upper Assam Basin reservoirs with a severe permeability contrast between horizontal layers.
The detailed rheology study of shear stress to shear rate and viscosity to shear rate of various concentration of XG and PAM in XPSs are important for an accurate prediction of polymer flood in a heterogeneous multi-layered reservoir like the Upper Assam Basin. Through extensive rheological study it was found that except in very low concentrations (0 i.e., DW and 1000 ppm) of PAM in varying concentrations of XG from 250 to 2000 ppm it showed shear thinning behavior. The best fit was found for XPS with 250 ppm XG and 7000 ppm PAM. Lower flow behavior index and better consistency index in both HB model and OWP model. The surface behavior exhibited lower ST for XG as compared to PAM. Therefore the best fit XPS with 250 ppm XG and 7000 ppm PAM was examined for ST and was found to have the lowest ST. It was also observed during conducting the experiments that at higher concentration, XG tends to swell and form colloid or gel in XPSs. This can be overcome by using a linker such as chromium, but a linker is not recommended as it will induce gel formation which will eventually block pores of reservoir. Based on shear thinning and surface tension behavior, the best fit XPS was found to have XPS: PAM = 250 ppm: 7000 ppm. This XPS will tend to enhance both the macroscopic sweep efficiency and microscopic displacement efficiency of the reservoir. With further studies w.r.t. to reservoir temperature, pH, salinity and adsorption, this XPS slug can be brought for pilot EOR study.

Reference
1. Atesok, G., Somasundaran, P., Morgan, L. J.: Charge Effects in the absorption of polyacrylamides on sodium kaolinite and its flocculation. Powder Tech. 54, 77-83 (1988)
2. Barnes, H. A., Hutton, J. F., Walters, K.: An Introduction to Rheology. Elsevier Applied Science 78, 78-82 (1989)
3. Bird, R. B., Armstrong, R.: Dynamics of Polymeric Liquids, John Wiley and Sons Inc. (1987) Bird, R. B., Steward, W. E.,

Lightfoot, E.W.: Transport Phenomena, John Wiley & Sons, Inc.(1960)
4. Caenn, R., Chillingar, G. V.: Drilling Fluids: State of the Art, J. of Pet. Sc. and Engg. 14, 221-230 (1996)
5. Canella, W. J., Huh, C., Seright, R. S.: Prediction of xanthan rheology in porous media. In Processing of SPE Annual Technical Conference and Exhibition, Houston, TX, USA, 2–5 October, 1988; Society of Petroleum Engineers: Richardson, TX, USA (1988)
6. Chaplin,M.: Hydrocolloid Rheology. Retrieved from http://www1.lsbu.ac.uk/water/rheology.html (2017)
7. Chhabra, R. P., Richardson, J. F.: Non-Newtonian Flow in the Process Industries: Fundamentals and Engineering Applications. Great Britain: Butterworth Heinemann, 38–71 (1999)
8. Cho, D. H., Chae, H. J., Kim, E. Y.: Synthesis and characterization of a novel extracellular polysaccharide by rhodotorula glutinis. Appl. Biochem. Biotech. 98, 183–193 (2001)
9. Das, B. M., Gogoi, S. B.: Relating IFT with oil recovery with special reference to Bhogpara Porous Media of Upper Assam Basin, J. Pet. Engg. Tech. 5, 1-8 (2015)
10. Desbene, P. L., Desmazieres, B., Even, J. J., Basselier, L., Minssieux.: Analysis of non-ionic surfactants used intertiary oil recovery, optimisation of stationary phase in normal phase partition chromatography. Chromatograhia 24, 857-861 (1987)
11. D. S., Fogler, H. S.: The effects of exopolymers on cell morphology and culturability of l. Mesenteroides during starvation. App. Microbiol. Biotech. 52, 839-844 (1999)
12. Du, Y., Guan, L.: Field-Scale Polymer Flooding: Lessons Learnt and Experiences Gained during Past 40 Years, paper SPE 91787. Presented at SPE International Petroleum Conference in Mexico (2004).

Molecular Dynamic Studies on the Extraction of Butanol from Aqueous Phase using Imidazolium based Ionic Liquids

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In our work, Molecular Dynamic Studies were performed to recover butanol from aqueous phase using four different Ionic Liquids (ILs). The ILs are based on 1-alkyl-3- methylimidazolium bis(trifluoromethylsulfonyl) imide ([RMIM][Tf2N]), where R=ethyl, butyl, hexyl and octyl chain. The hydrophobicity of these ILs is known to be controlled by the alkyl chain length. In the Liquid Liquid Experimental studies, two clear phases were observed with each of these solvents. Initially MD simulation was performed with [OMIM][Tf2N] to validate the reported experimental results. Results from extract and raffinate phases were then compared with the Liquid-Liquid Equilibrium (LLE) experimental studies for [OMIM] [Tf2N]- butanol-water to explain the effectiveness of the solvent. Further the simulations were carried out for all the four solvents by varying the solvent molecules or the composition of the feed. Simulations were run for a time period of 40 ns using OPLS-AA force field. A type II phase behaviour with a large immiscible region was observed for all compositions at T=300 K. The selectivity value computed was the highest (3583.73) for [OMIM] [Tf2N] among the different Ionic Liquids. The distribution coefficient was found to be greater than unity for all the ILs. It indicates an easier dispersion of solute from aqueous phase to extract phase. Greater hydrophobicity of [OMIM] and [Tf2N] led to an absence of IL in aqueous phase. Radial distribution function and running coordination number computation were done to provide a microscopic structure of the extract phase. From these two computational analysis, it was confirmed that a higher cation concentration was found to solvate the butanol molecules.

Engineering Plasmonic Hot-Spot for Effective SERS and TERS via Generation of Coordination Complex Conjugated Gold Nanoparticle Dimer

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Efficiency in designing nanostructures for superior surface enhanced Raman scattering (SERS) lies in the precise localization of probe molecules at the hot-spot. This also requires expertise to attain uniform gap distance and proper steric alignment of the probe molecule with the metallic surface. We therefore, propose a new idea to generate SERS active Au NP dimer using a co-ordination complex of europium (Eu) metal employing 4-mercaptobenzoic acid (4-MBA, Raman active molecule) and heterocyclic phenanthroline as precursors. The free sulphydryl group of the 4-MBA ligand in the Eu-metal complex helped to attain facile dimerization. The as - synthesized Au NP dimer exhibited superior SERS signal for the Eu-complex trapped in the hot-spot with 632 nm laser source in comparison to 532 nm laser. Further, scanning probe microscopy (SPM) correlated tip-induced Raman spectroscopy (TERS) using 633 nm laser helped us to achieve enhanced Raman scattering signal at the spatial resolution of single Au NP dimer. Based on this, the average SERS and TERS enhancement factor calculated on the order of 109 and 104 respectively, makes it an effective SERS substrate for single molecule spectroscopy and complex chemical reaction study at the hot-spot.

Reference

Dutta, A.; Chattopadhyay, A. Surface and Tip-Enhanced Raman Spectroscopy at the Plasmonic Hot Spot of Coordination Complex- Conjugated Gold Nanoparticle Dimer. J. Phys. Chem. C 2017, 121, 18854−18861.

Development of Sensors Based on π-Conjugated System for Highly Sensitive and Selective Detection of Nitroexplosive-Picric Acid

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We have designed and synthesised different types of π-conjugated polymers and utilized them in attaining simple, low cost and portable optical sensors capable of monitoring nitroexplosive-Picric acid (PA) at ultra-trace level. The conjugated polymer PFAM showed rapid and specific recognition toward PA on solid support and in solution based on IFE/PET mechanism. The non- fluorescent cationic conjugated polymer PPPy participates in indicator displacement assay resulting turn-on fluorescence selectively in presence of PA.. The cationic conjugated polymer PFBT displayed substantial fluorescence quenching for PA in solution as well as solid state based on IFE and RET mechanism at attogram level of PA and utilised in making economical paper strips for on-site detection of nitroexplosive.

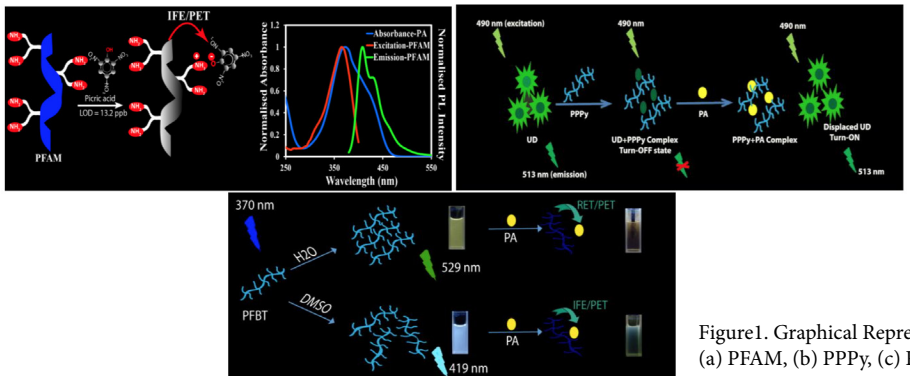

Figure1. Graphical Representation of picric acid detection by polymer (a) PFAM, (b) PPPy, (c) PFBT .

References.
1. Malik, A. H.; Hussain, S.; Kalita, A.; Iyer, P. K. Conjugated Polymer Nanoparticles for the Amplified Detection of Nitro-explosive
Picric Acid on Multiple Platforms. ACS *Appl. Mater. Interfaces* 2015, 7, 26968−26976.
2. Tanwar, A. S.; Hussain, S.; Malik, A. H.; Afroz, M. A.; Iyer, P. K. Inner Filter Effect Based Selective Detection of Nitroexplosive-Picric
Acid in Aqueous Solution and Solid Support Using Conjugated Polymer. *ACS Sens*. 2016, 1, 1070−1077
3. Tanwar, A. S.; Iyer, P. K. Fluorescence "Turn-On" Indicator Displacement Assay-Based Sensing of Nitroexplosive
2,4,6-Trinitrophenol in Aqueous Media via a Polyelectrolyte and Dye Complex. *ACS Omega*, 2017, 2, 4424–4430.

Designing of promising G-quadruplex stabilizers

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At the telomeres the single-stranded guanine (G) rich sequences can held together by Hoogsteen hydrogen bond and fold in such a way to form the four stranded organization of telomeric G-quadruplexes (G4).1-3 One of the promising steps in the indirect inhibition of telomerase is through the stabilization of the telomeric G4s. Only a small part of the reported G4 stabilizers comprising planar fused and cyclic or acyclic linked heteroaromatic compounds4 has entered clinical trial for anticancer therapeutics but failed to reach the market due to bioavailability problems.5
Implementation of advanced computational techniques such as pharmacophore modeling, molecular docking, quantitative structure-activity relationship (QSAR) and molecular dynamics (MD) aids to find alternative ways to increase the efficiency and productivity in the discovery of new and potent drug molecules.6-8 A large dataset of around 700 G4 stabilizers, with their experimental activity values, was generated for computational modeling. Geometry optimization of all the collected inhibitors were performed at B3LYP/6-31G(d) and M06-2X/6-31G(d) level of theories. These optimized geometries were used to carry out analogue and structure based modeling. Molecular docking calculations were performed on GOLD docking program using the optimized geometries of all the collected G4 stabilizers and 16 different G4 receptors (PDB-ID: 4FXM, 5CDB, 1L1H, 1O0K, 5CCW, 5HIX, 4P1D, 4G0F, 3CE5, 3EUM, 3NYP, 3R6R, 3SC8, 3CCO, 3TSE, 4DAQ). DFT based and statistically relevant QSAR models were generated for a few human cell lines and activity types. The QSAR was performed to find the relationship between the biological activity and physiochemical properties for the collected G4 stabilizers. Optimum number of molecular descriptors were used to understand the representative molecular properties. We plan to predict a few new and promising G4 stabilizers on the basis of our modeling studies.

References:
[1] Wang, Y.; Patel, D. J. Structure 1993, 1, 263–282.
[2] Parkinson, G. N.; Lee, M. P. H.; Neidle, S. Nature 2002, 417, 876–880.
[3] Davis, J. T. Angew. Chem., Int. Ed. 2004, 43, 668–698.
[4] (a) Monchaud, D.; Teulade-Fichou, M.-P. Org. Biomol. Chem. 2008, 6, 627-636. (b) Shan, C.; Tan, J.-H.; Ou, T.- M.; Huang, Z.-S. Sci. China: Chem. 2013, 56, 1351-1363. (c) Maji, B.; Bhattacharya, S. Chem. Commun. 2014, 50, 6422-6438. (d) Kaserer, T.; Rigo, R.; Schuster, P.; Alcaro, S.; Sissi, C.; Schuster, D. J. Chem. Inf. Model. 2016, 56, 484–500.
[5] Hou, J.-Q.; Chen, S.-B.; Zan, L.-P.; Ou, T.-M.; Tan, J.-H.; Luyt, L. G.; Huang, Z.-S. Chem. Commun. 2015, 51, 198-201.
[6] (a) Koseki, Y.; Aoki, S. Curr Top Med Chem. 2014, 14, 176-188. (b) Srivastava, H. K.; Sastry, G. N. J. Chem. Inf. Model. 2012, 52, 3088–3098. (c) Srivastava, H. K.; Chourasia, M.; Kumar, D.; Sastry, G. N. J. Chem. Inf. Model. 2011, 51, 558–571.

Effective Removal of Anionic Dye (Alizarin Red S) from Aqueous Solution unto Activated biocarbon Derived from Pine Cone of Pinus kesiya: Adsorption Equilibrium, Kinetics and Thermodynamic studies

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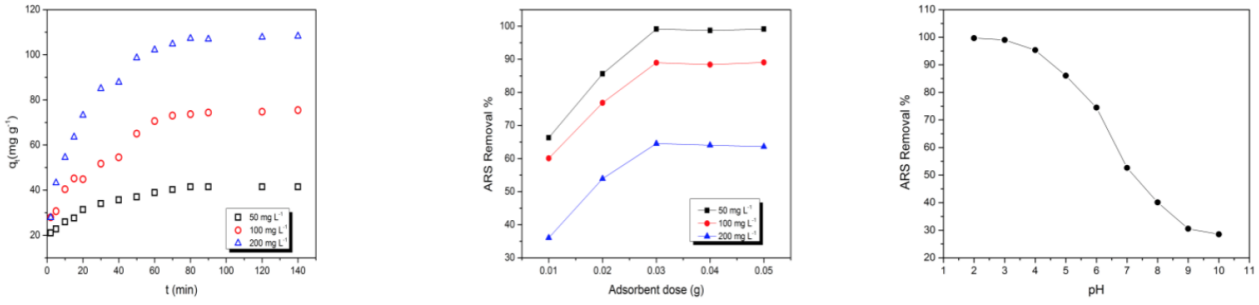
This study describes the adsorption of Alizarin Red S (ARS) onto activated biocarbon prepared from pine cone of Pinus kesiya in a batch process. Characterization of activated biocarbon was achieved by BET, elemental analysis, FT-IR, XRD and pHzpc. The surface area and the total pore volume of the prepared activated biocarbon were found to be 878.07 m2g-1 and 0.312 cm3g-1 respectively. The influence of adsorbent dosage, pH of solution, initial concentration with time and temperature has been investigated in batch method. The equilibrium time for adsorption was reached within 80 minutes and an increase in adsorption capacity was observed with increase in initial dye concentration, adsorbent dosage and contact time. While a decrease in adsorption capacity was observed with increase in pH of the solution. Adsorption data were represented by isotherm, kinetics and thermodynamics models. The adsorption isotherms could be well defined with the Langmuir isotherm model instead of Freundlich isotherm model with a maximum adsorption capacity of 118.06 mg g-1. The rate of adsorption was found to confirm the pseudo-second order kinetics with R2 > 0.99. Thermodynamic studies reveal that adsorption of Alizarin Red S unto pine cone activated biocarbon was spontaneous (negative ΔG°) and endothermic in nature (positive ΔH°).

Keywords: Alizarin Red S, activated biocarbon, adsorption, Kinetics, thermodynamics



(a) (b) (c)

Fig.1: Effect of (a) initial concentration with time (b) adsorbent dose and (c) pH on removal of ARS onto pine cone activated biocarbon

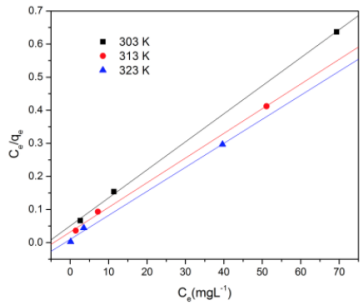


Fig.2. Langmuir adsorption isotherm for adsorption of ARS on pine cone activated biocarbon

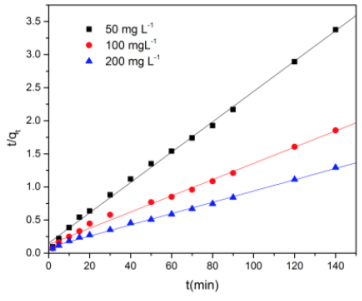


Fig.3. Pseduo-second order kinetics of ARS adsorption onto Pine cone activated biocarbon

Site-selective Probing of Reverse Micelle Surfactant Assembly using Excited State Proton Transfer of Pyranine

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Proton transfer (PT) is one of the important ultrafast fundamental chemical processes that plays a key role in numerous chemical reactions, biological functions,[1] and material properties.[2] Excited state proton transfer (ESPT), a variant of PT that occurs only in the electronic excited state of molecules; commonly initiated by photo-irradiation of a photoacid (e.g. 8-Hydroxypyrene-1, 3, 6-trisulfonate (HPTS, pyranine)). The high water-solubility, low toxicity and most importantly its disability to cross the cell membrane[3] increases importance of HPTS as ESPT probe. The disturbance of regular H- bonding network of encased water molecules inside the reverse micellar (RM) surfactant assembly lead to accomplishment of their different properties from bulk water. Moreover, the properties of RM can be tuned with variation of RM size, nature of surfactant, polarity and viscosity of the medium. These unique properties of RM enhance the uses and application of RM in the field of food chemistry, industrial and pharmaceutical industries. Using the water sensitive and site selective nature of anionic HPTS probe, we explored the different nature and behavior of entrapped water inside RM. The behavior of core water varied from hydrophobic to bulk like nature with tuning the confinement of the RM from highly to quasi-confined.[4] From the ESPT study we also able to monitor packing and rigidity of the interface of tertiary[5] and quaternary[6] RM with penetration of water molecules from the core water pool and with change of RM shape[7].

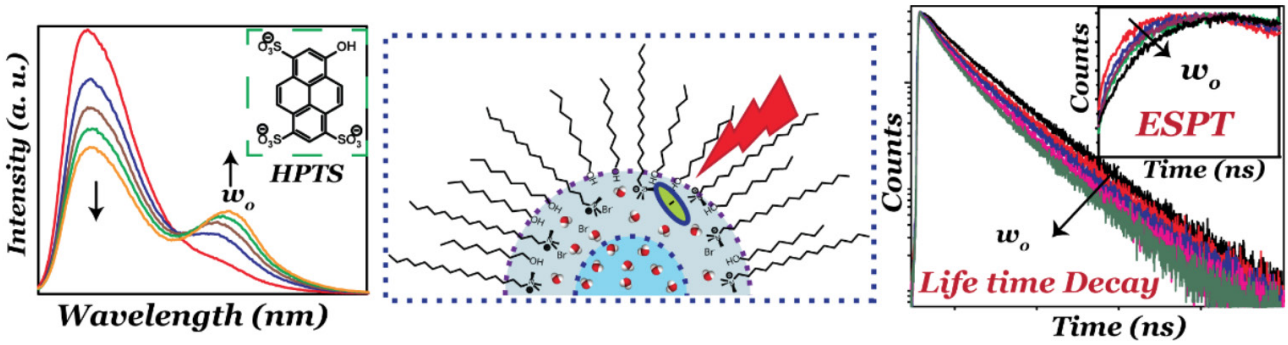

Figure 1: Photo physical behavior of HPTS inside the reverse micelle.

References:

(1) Chowdhury, R.; Saha, A.; Mandal, A. K.; Jana, B.; Ghosh, S.; Bhattacharyya, K.: Excited State Proton Transfer in the Lysosome of Live Lung Cells: Normal and Cancer Cells. *J. Phys. Chem. B* **2015**, *119*, 2149-2156.

(2) Amdursky, N.; Simkovitch, R.; Huppert, D.: Excited-State Proton Transfer of Photoacids Adsorbed on Biomaterials. *J. Phys. Chem.* B **2014**, *118*, 13859-13869.

(3) Holcomb, M.; Venn, A. A.; Tambutté, E.; Tambutté, S.; Allemand, D.; Trotter, J.; McCulloch, M.: Coral calcifying fluid pH dictates response to ocean acidification. *Scientific Reports* **2014**, 4, 5207.

(4) Phukon, A.; Sahu, K.: The strikingly different miscibility of n-octanol in highly-confined and quasi-confined water. *Chem. Commun*. **2015**, *51*, 14103-14106.

(5) Phukon, A.; Barman, N.; Sahu, K.: Wet Interface of Benzylhexadecyldimethylammonium Chloride Reverse Micelle Revealed by Excited State Proton Transfer of a Localized Probe. *Langmuir* **2015**, *31*, 12587-12596.

(6) Phukon, A.; Ray, S.; Sahu, K.: Effect of Cosurfactants on the Interfacial Hydration of CTAB Quaternary Reverse Micelle Probed Using Excited State Proton Transfer. *Langmuir* **2016**, *32*, 10659- 10667.

(7) Phukon, A.; Ray, S.; Sahu, K.: How Does Interfacial Hydration Alter during Rod to Sphere Transition in DDAB/Water/Cyclohexane Reverse Micelles? Insights from Excited State Proton Transfer and Fluorescence Anisotropy. *Langmuir* **2016**, *32*, 6656-6665.

Preparation and Characterization of Photo-responsive TPCC4-Chitosan-PVA thin film for biomedical application

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With an objective to design biostable chitosan-PVA-TPCC4 film for the biomedical applications, we have prepared chitosan-PVA conjugate film with gallic acid (GA) with TPCC4 and have characterized their physicochemical properties, biostabilty and photostability. Scanning electron microscopic (SEM) analysis revealed a well ordered with properly oriented and well-aligned interconnected structure and fibrous network of these films. The diffraction patterns show broadens in the same region of the spectrum indicating the amorphous and crystalline characteristics. FT-IR results suggest that the structural integrity of film and PVA along with GA favours the molecular stability. The hydrophobic core of the GA molecules incorporates itself into the hydrophobic areas of the chitosan-PVA groups, whereas –OH and –COOH moieties of GA establish multiple H-bonds with neighboring chitosan molecules, thereby improving the swelling and water uptake properties. These may find use in the preparation of photoresponsive biomaterials for cardiac tissue engineering applications.
Key words: Photosensitivity, TPCC4, thin film, biomedical etc.

Photocatalytic degradation of Simazine pesticide using Fe3O4/reduced graphene oxide nanoparticles under visible light irradiation

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Extensive application of herbicides and pesticides to control weed growth and to suppress the impact of plant and animal pests has become a routine practice to protect industrial and agricultural products. This has resulted in increasing public concerns. Graphene-based nanomaterials have been explored and utilized for the removal of water contaminants like these pesticides, using different degradation techniques. In this work,magnetic Fe3O4/rGO nanocomposite was synthesized and utilized as an efficient photo catalyst towards Simazine pesticide degradation under visible light irradiation. The maximum degradation efficiency of Fe3O4/rGOnanocompositewasfoundtobe100%. In this study, the effect of initial pesticide concentration, catalyst loading of the reaction medium were investigated for the degradation of Simazine pesticide. The efficient degradation efficiency was observed at acidic pH and 0.5g/L catalyst loading amount. The degradation efficiency was decreased gradually when the pesticide concentration is increased.

Keywords: Fe3O4/rGO, nanocomposite, pesticide, simazine, photocatalytic degradation,graphene, efficiency.

Copper (II) Catalyzed Peroxide Mediated chemoselective C-2 Cycloalkylation of chromone-3-aldehydes

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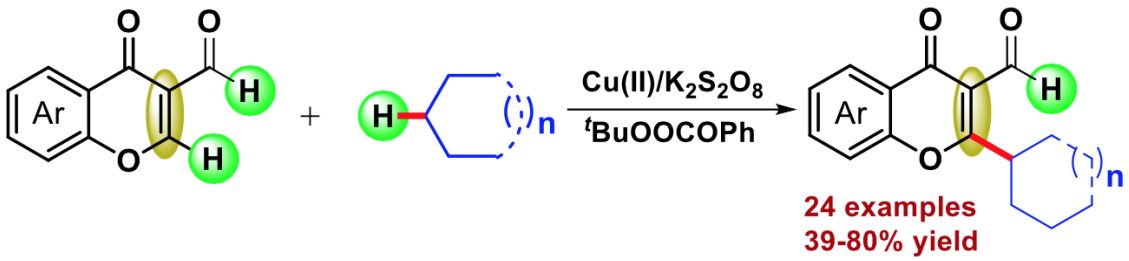
Transition metal catalyzed C-H functionalization via cross-dehydrogenative coupling (CDC) protocols has emerged as a promising and powerful tool towards the formation of C_{sp}–C_{sp}, C_{sp}–C_{sp2} C_{sp2}–C_{sp2} and C_{sp3}–C bonds. In this context cycloalkanes have been employed for CDC reactions (C_{sp3}–H functionalization) in the absence or presence of transition metal catalysts albeit with limited examples. Aliphatic C_{sp3}–H bonds are the most available natural resource. Thus, methodologies for the direct functionalization of aliphatic C_{sp3}–H bonds will expand the synthetic toolbox, allowing access to value-added products with various important applications. Herein, a copper (II) catalyzed C-2 Cycloalkylation of chromone-3-aldehydes have been achieved using tert-butyl peroxybenzoate (TBPB)/potassium persulfate (K2S2O8) oxidant combinations with a suitable solvent. In the presence of copper (II)/tert-butyl peroxybenzoate/$K_2S_2O_8$, reaction of chromone-3-aldehydes in cycloalkanes afforded exclusive chemoselective C-2 cycloalkylation via C_{sp2}–C_{sp3} coupling.



References:

(1). M. Wang, *Toxicol*. Sci. **2007**, *96*, 203-205

(2). J. M. Patel, *Lethbridge Underg. Res. J.* **2008**, 3, 1-5

(3). B. H. Havsteen, *Pharmacol. Ther*. **2002,** *96*, 67-202

(4). A. Banerjee, S. K. Santra, N. Khatun, W. Ali, B. K. Patel, *Chem. Commun.* **2015**, 51, 15422-15425

(5). B. A. Mir, A. Banerjee, S. K. Santra, S. Rajamanickam, B. K. Patel, *Adv. Synth. Catal*, **2016**, 358, 347-3476

Molecular Design And Synthesis Of Small Lingands For Selective Inhibition Of Aldose Reductase

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Aldose reductase (AR) is the first enzyme involved in the polyol pathway which converts glucose to sorbitol. It is an aldehyde-reducing enzyme and increased activity of this enzyme has been linked to the development of tissue injury and dysfunction associated with several diabetic complications. AR regulates inflammatory signaling involved in the production of cytokines and chemokines. Recently solved crystal structure of AR revealed that it has two catalytic binding sites, one for aldehyde and another one for glutathione. 4-hydroxy-trans-2-nonenal (HNE), which is the major unsaturated aldehyde generated by lipid peroxidation, is a potent smooth muscle cell mitogen, and at high concentrations induces apoptosis in several cell types. Moreover, inhibition of AR has been shown to increase HNE- induced vascular smooth muscle cell death in culture indicating that this enzyme plays a key role in the detoxification of aldehydes generated by oxidized lipids. On the other hand, overexpression of the enzyme is involved in various cancers and secondary diabetic complications like cataract, diabetic nephropathy, neuropathy and retinopathy. Based on these observations we have designed and synthesized small molecules specifically for cell signal inducing catalytic site-glutathione binding site for AR so that AR still retains its carbonyl reducing potential so that such molecule will be a promising therapeutic candidate. The molecules were designed by de novo approach and were synthesized by organic chemistry method. Binding of these molecules to AR active site was confirmed by fluorescence spectroscopy and dissociation constant (Kd) was calculated. These molecules showed protection against LPS induced inflammation and significant reduction in intracellular ROS level in RAW 264.7 cells.
Keywords: Aldose reductase, HNE, Glutathione binding site, dissociation constant, inflammation, ROS

A study on Co-cracking of Waste Plastics Polypropylene and Residual Fuel oil (RFO) in presence of ZSM-5 catalyst.

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Industrial waste Polypropylene (PP Homopolymer) and refinery residual fuel oil (RFO) were pyrolyzed together in presence of catalyst under atmospheric pressure at two different temperatures with different mixing ratios. The effects of blending ratios of two feedstocks with respect to the yield of product oil, gas, and residue were determined. The experiments were carried out in a batch reactor at two different temperatures of 500 0C and 600 0C with the blending mixture (PP: RFO=1:1) to catalyst (ZSM-5) ratio of 4:1. The optimum blending ratio of PP and RFO was found to be 1:1 at 500 0C. The percentage of liquid fuel, gas and coke was observed to be 74.8 %, 10.2 % and 15 % at 500 0C.
Key words: Pyrolyzed, Catalyst, blending, blending ratio, batch reactor, ZSM-5, liquid fuel, gas and coke.

Camphorsulfonic Acid Catalysed One-Pot Three Component Reaction f or the Synthesis of Fused Quinoline and Benzoquinoline Derivatives

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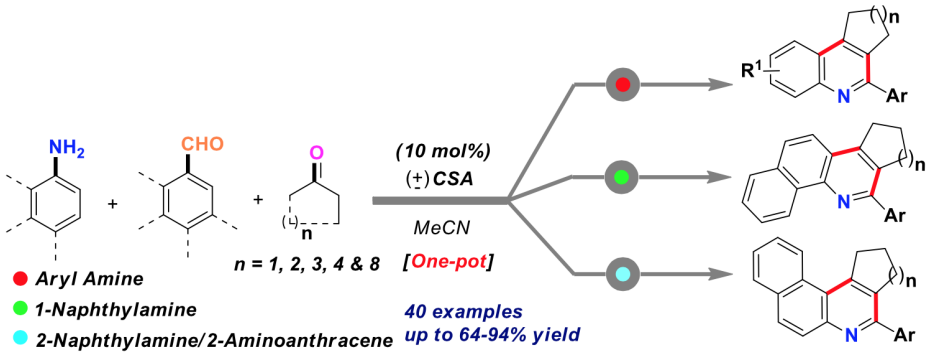
A simple and an efficient one-pot three component reaction of arylamines, aromatic aldehydes and cyclic ketones was described for the synthesis of various fused quinoline, benzoquinoline and napthoquinoline derivatives by using camphorsulfonic acid as a catalyst. The exploitation of pregnenolone steroid for benzoquinolines and terephthalaldehyde for bis-benzoquinolines synthesis was achieved with 68-75% yields. The reactivity of aryl amines and the mechanistic study for the formation of benzoquinoline was described precisely. The present protocol offers a great potential for atom-economy under mild condition.



Scheme 1 Synthesis of Fused quinolones and Benzoquinolines

References

(1) Wang, X.-S.; Li, Q.; Yao, C. S.; Tu, S. J. Eur. J. Org. Chem. 2008, 3513.
(2) Kozlov, N. G.; Basalaeva, L. I.; Firgang, S. I.; Shashkov, A. S. Russ. J. Org. Chem. 2004, 40, 518.
(3) Gattu,R.,Bagdi,P.R.,Basha,R.S,Khan,A.T.J.Org.Chem.,2017,82,12416.

A new generation of efficient coupling reagent, 'Boc-Oxyma'- one more step towards the coupling reagents

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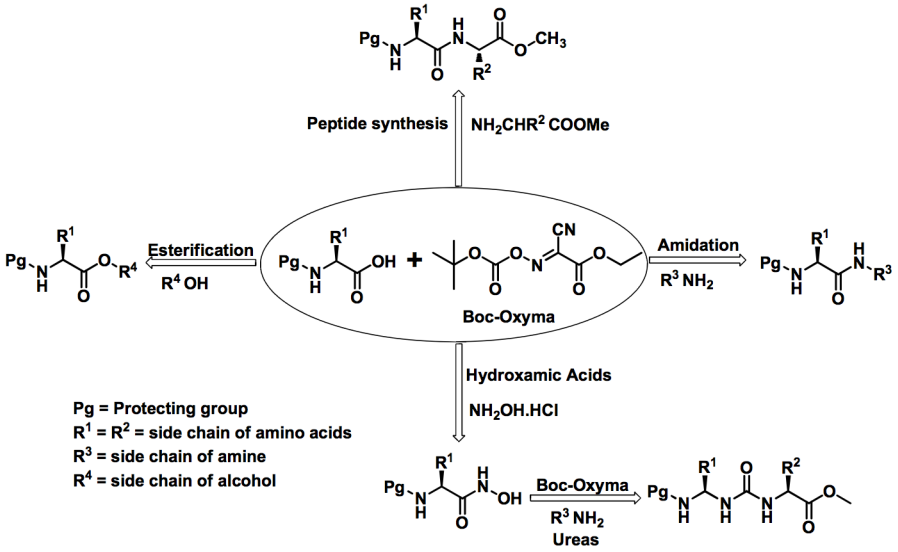
Amidation, esterification and thioesterification reactions of carboxylic acids and amino acids are key reactions in the organic synthesis of many important molecules of biological interest. To date, a variety of coupling reagents have been developed for coupling reactions. The major disadvantage of all coupling reagents till date is preparation protocol involves harsh conditions, generates toxic byproducts and unwanted side product. Thus reducing the yield of desired product, increasing wastes and complicating purification as well as racemization. We herein report a novel coupling reagent, Boc-Oxyma and its application in peptide, ester, thioester, amide, hydroxamic acid and urea synthesis which is devoid of said drawbacks.



References:

1. Manne, S. R.; Thalluri, K.; Giri, R. S.; Chandra, J.; *Mandal, B. Adv. Synth. Catal.* **2017,** *359*, 168–176. 2. Manne, S. R.; Thalluri, K.; Giri, R. S.; Paul, A.; *Mandal, B. Tetrahedron Lett.* **2015**, *56*, 6108-6111.
3. Thalluri, K.; Manne, S. R.; Dev, D.; *Mandal, B. J. Org. Chem*, **2014**, *79*, 3765-3775.
4. Thalluri, K.; Paul, A.; Manne, S. R.; Dev, D.; *Mandal, B. RSC Adv.* **2014**, *4*, 47841–47847.

Study on Effect of Bacillus cereus on Compressive Strength of Concrete

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The use of concrete is continuously increasing in the world. Cement is the main constituent of concrete and produces CO2 which is the main factor leading to global warming. Therefore, a sustainable concrete is the main requirement in today's construction industry. Hence, a much sustainable concrete called the Bio-concrete is developed which helps in increasing the strength of the concrete. Present investigation aimed at developing bio- concrete and studying the effect of addition of bio-culture Bacillus cereus on the compressive strength of concrete. Various bio-cultures were analyzed for their suitability for calcite precipitation. The bio-culture Bacillus cereus showed highest efficiency of precipitation and was further used in the development of bio-concrete.

Bio-concrete of M-25 grade was produced using Bacillus cereus in the form of broth culture which was directly added to the concrete during mixing and water cured. The M-25 grade concrete was produced using composition and methodology as per the standards. Different percentages of broth culture were added to the concrete i.e., 0%, 15%, 30%, 45% and 60% for 100 ml volume. Then, these samples were analyzed for compressive strength using compressive testing machine (CTM) as per standard procedure at 7- days. The bio-concrete with different percentages of broth culture showed gradual increase in compressive strength at 7- days. The percentage increase in the compressive strength of bio-concrete was found to be 3%, 8%, 10% and 13% for samples containing 15%, 30%, 45% and 60% bio-culture. The bio-concrete was further characterized using techniques such as Fourier-Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM) and X-Ray Diffraction (XRD) test. The results of FTIR test and XRD analysis revealed the calcite precipitation in the concrete and results of SEM study showed the composition and the surface topography of the concrete.

Keywords: Bacillus cereus, bio-concrete, calcite precipitation, compressive strength, characterization studies.

References

1. Ramin Andalib et al. "Optimum concentration of Bacillus megaterium for strengthening structural concrete". Construction and binding materials; 118: 180-193, 2016.
2. S. Krishnapriya, D.L Venkatesh Babu, Prince Arulraj G. "Isolation and identification of bacteria to improve the strength of concrete". Microbiological research; 174: 48-55, 2015.
3. Nafise Hosseini Balam, Davood Mostofinejad, Mohamadreza Eftekhar. "Effects of bacterial remediation on compressive strength, water absorption and chloride permeability of light weight aggregate concrete". Construction and binding materials; 145: 107-116, 2017;
4. Hao Ling, Chunxiang Qian. "Effects of self-healing cracks in bacterial concrete on transmission of chlroide during electro migration". Construction and binding materials;144: 406-411,2017.

Risk Assessment of dissolved trace metals and heavy metals in Puthimari river.

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The tenacious discharge of trace and heavy metals in aquatic ecosystems from either geogenic or anthropogenic sources have an adverse effect on aquatic ecosystems as well as anthropoid communities residing near these water sources. The contamination of aquatic ecosystems serves as the pathway to several human health hazards. Metals gain their entry into the body of human beings either by direct ingestion and inhalation of contaminants through mouth and nose, or by the dermal absorption of trace elements via the epidermis of the skin. In the present study, an assessment of the impact of heavy metals on nearby communities of Puthimari river (Assam) has been gauged. Samples were analysed for six metals namely Iron (Fe), Manganese (Mn), Lead (Pb) and Copper (Cu). Average concentration of these heavy metals were found as 0.19 ppm, 0.06 ppm, 0.08 ppm and 0.007 ppm respectively. The heavy metal pollution index (HPI) and Contamination index (CI) of Puthimari river were computed as 700 and 7.77 respectively both of which indicated the water quality to be highly unsuitable for animal/human consumption. The dose received by humans through different pathways were calculated by the average daily intake (ADI) and the health hazards associated with them were calculated by the Hazard Quotient (HQ) adapted from the US Environmental Protection Agency (US EPA).
Keywords: Heavy metal contamination, aquatic ecosystems, HPI, CI, ADI, HQ

A Comparative Study on Permeability Characterization of Bituminous Mixes Under Field and Lab Conditions

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An open graded bituminous mix which serves as a wearing course having thickness 20 mm constitutes PMC (Premix Carpet). It is laid to be served under the action of low to medium traffic condition. Being an open graded mix with high air void content over 20% (approx.) allows the ingression of water that makes the mix susceptible to moisture damage as it reduces the adhesiveness of asphalt binder and aggregate resulting in stripping of bitumen from aggregate leading to various forms of failures such as raveling, surface deterioration, disintegration and potholes. In regular practice, PMC is being laid along with sand seal coat so as to resist the ingression of surface water but it was found less effective mainly in urban areas. To resolve this issue, IRC suggested the use of gap graded bituminous mix i.e. MSS (Mixed Seal Surfacing) in lieu of PMC.

The main purpose of the study was to evaluate the Surface Permeability characteristics in field as well as in lab condition for four different types of bituminous mixes namely- PMC, MSS-A, MSS-B, & BC (Bituminous Concrete) grading 2 and also to select the best one in terms of moisture susceptibility and LCCA (Life Cycle Cost Analysis).

On conducting surface water permeability test (based on falling head principle), it is evaluated that PMC without sand seal coat possess very high permeability value as water is penetrating the mix as rapidly as it was poured, whereas permeability value of BC grading 2 is almost null. The descending order of permeability value for different bituminous mixes are as follows:

PMC (0% sand seal coat) > PMC (50% sand seal coat) > PMC (100% sand seal coat) > MSS-B > MSS-A > BC grading 2

Further, BC grading 2 was found to be the most economical on the basis of LCCA. Therefore, it is concluded that PMC must be replaced by BC grading 2 to serve as wearing course.
Keywords: PMC, premix carpet, MSS, mixed seal surfacing, BC, bituminous concrete, LCCA, life cycle cost analysis, Permeability.

A Study upon the effect of using GGBS as a partial replacement to cement and the strength parameters of concrete.

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The use of Supplementary Cementitious Materials (SCMs) in the manufacture of concrete has increased significantly in recent years. Utilization of SCMs in the concrete mix reduces CO2 footprint and enhances durability. In this paper, GGBS is used as a SCM due to its environmental, economic and technical benefits. The aim of this research paper is to study the effect of using GGBS as a partial replacement to cement and study the strength parameters of concrete.
Ordinary Portland Cement(OPC) was replaced with GGBS at 0%,20%,40%,60%,70% and 80% replacement levels (Ref. Fig (1)) using Manufactured Sand(M-Sand) as a fine aggregate. A constant workability was maintained at all replacement levels by using water reducing Chemical Admixtures. The Compressive and Flexural Strength of the concrete at 7 days and 28 days were reported at different replacement levels.
Desired Compressive Strength and Flexural Strength was achieved up to 70% replacement of OPC with GGBS. Beyond 70% replacement level, there was a substantial decrease in the Compressive and Flexural Strength of the concrete than the desired strength.
Keywords: Chemical Admixtures, Ground Granulated Blast Furnace Slag(GGBS), M-Sand, Ordinary Portland Cement(OPC), Supplementary Cementitious Materials (SCM), Workability.

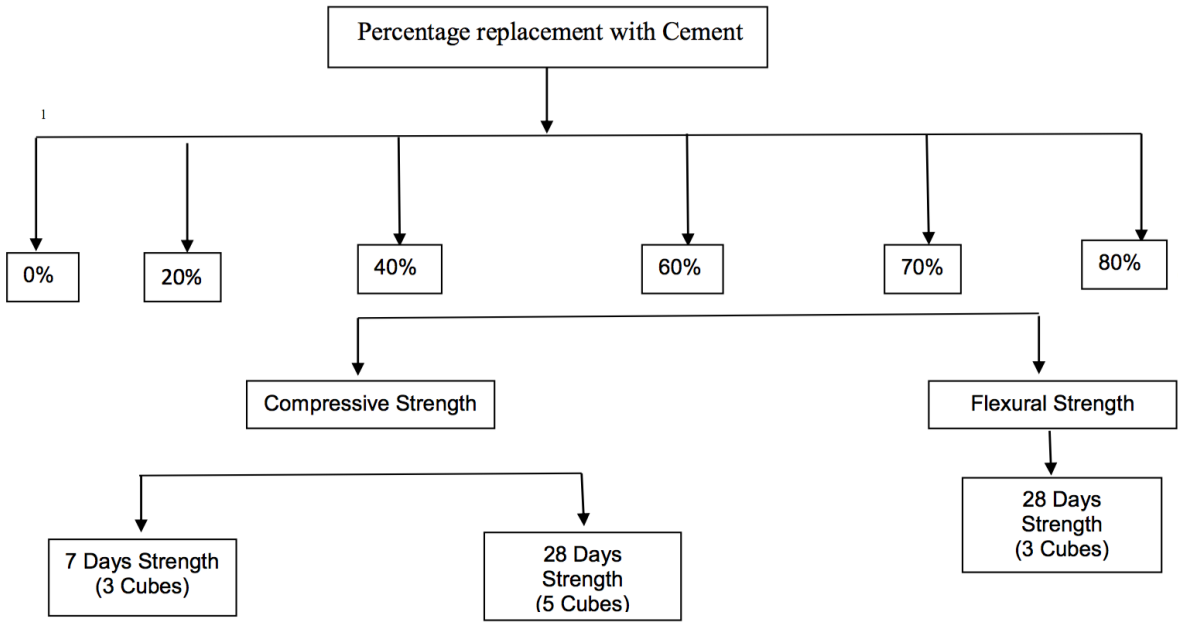

Fig (1)
Note: Tests were carried out for all the replacement levels.

Performance of Attached Growth Bioreactor on Simultaneous Removal of Arsenic, Nitrate and Fluoride

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There are several reports on co-occurrence of arsenic and nitrate in groundwater such as at Ogallala aquifer of Texas, Borrego valley California (Rezaie-Boroon et al. 2014), and in West Bengal, India (Guha et al. 2005). Along with arsenic and nitrate, there are reports on co-occurrence of fluoride in groundwater in Delhi (India) (CPCB 2007). The co-existence of arsenic, nitrate and fluoride up to 5300 µg/L, 140 mg/L and 29 mg/L, respectively, at La Pampa province, Argentina (Smedley et al. 2008) has been reported. Although there are several physico-chemical techniques available for single and/or multiple contaminant removal from groundwater, they are often associated with high operating costs, regeneration of used matrix and disposal of exhausted resins. Contrary to that biological systems often offers an eco-friendly approach by converting contaminants in innocuous forms and leaving no residual or less waste (Brown 2008). However, till now biological systems are very less practiced for simultaneous removal of contaminants from drinking water (Upadhyaya et al. 2010). Though fluoride removal by biological means is not popular, but its removal by various adsorbents including activated carbons have been widely reported (Jagtap et al. 2012).

In the present study, performance of an attached growth bioreactor (AGBR) system on simultaneous removal of arsenic, nitrate and fluoride by mixed microbial culture was evaluated. The AGBR was inoculated with mixed bacterial culture mainly collected from a wastewater treatment plant and acclimatized. The reactor was fed with synthetic ground water containing 500 µg/L of arsenic, 5 mg/L of fluoride, 50 mg/L of nitrate, 25 mg/L of sulphate along with acetate of 105 mg/L as COD and mineral salt media. The reactor was operated for a period of 34 days at 30oC and 45 min empty bed contact time (EBCT). Performance of AGBR was found to be very efficient on nitrate and arsenic removal. The arsenic was effectively removed to below 10 µg/L, which, is the drinking water standards (WHO 2011). However, fluoride removal in AGBR was very poor, which was less than 10%. The effluent COD concentration remained between 10 and 14 mg/L with removal efficiency between 86 and 90%. The final pH of the treated water remained between 7.25 and 7.35. Mineralogical analyses using Field emission scanning electron microscopy (FESEM) and energy dispersive X-ray spectroscopy (EDS) analyses indicated biogenic arsenic sulphide mineral phases are the likely mechanisms of arsenic removal in the bioreactors.

Acknowledgments
The authors acknowledge the funding by the Ministry of Drinking Water and Sanitation (Government of India), through the project (Ref. No. W.11017/44/2011-WQ) to carry out this work at IIT Guwahati. Authors are also thankful to central instrument facility of IIT Guwahati for providing facilities for FESEM/EDS analysis of some samples.

References

Rezaie-Boroon, M.H., Chaney, J. and Bowers, B. (2014) The Source of Arsenic and Nitrate in Borrego Valley Groundwater Aquifer. Journal of Water Resource and Protection 6(17), 1589.

Guha, S., Raymahashay, B., Banerjee, A., Acharyya, S. and Gupta, A. (2005) Collection of depth-specific groundwater samples from an arsenic contaminated aquifer in West Bengal, India. Environmental engineering science 22(6), 870-881.

CPCB (2007) Status of groundwater quality in India. Central Pollution Control Board, Ministry of Environment and Forests, Govt. of India. (GROUNDWATER QUALITY SERIES:GWQS/ 09/2006-2007).

Smedley, P., Nicolli, H., Macdonald, D. and Kinniburgh, D. (2008) Arsenic in groundwater and sediments from La Pampa province, Argentina. Natural arsenic in groundwater of Latin America—occurrence, health impact and remediation, 35-45.

Brown, J.C. (2008) Biological treatments of drinking water.

Upadhyaya, G., Jackson, J., Clancy, T.M., Hyun, S.P., Brown, J., Hayes, K.F. and Raskin, L. (2010) Simultaneous removal of nitrate and arsenic from drinking water sources utilizing a fixed-bed bioreactor system. Water Research 44(17), 4958-4969.

Jagtap, S., Yenkie, M.K., Labhsetwar, N. and Rayalu, S. (2012) Fluoride in drinking water and defluoridation of water. Chemical reviews 112(4), 2454-2466.

WHO (2011) Guidelines for Drinking-Water Quality World Health Organisation, Geneva 4, 315-318.

Application of Shannon Entropy in Surface Water Quality Assessment

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The water quality of surface water sources has always been a matter of supreme importance in both national and international forums. With rapid urbanization, industrialization and population growth have emerged the need for various monitoring programs to assess the surface water quality. In the present study, the assessment of surface water quality of lakes in Amingaon locality of North Guwahati in the state of Assam, India has been evaluated by employing entropy weighted water quality index (EWQI). EWQI based on information entropy serves as an improvement over conventional water quality indices by reducing the uncertainty associated by assignment of weightages to water quality parameters on the basis of expert opinions and personal judgements. Water Samples were collected from six lakes in the Amingaon locality of North Guwahati and were analysed for the major physico-chemical parameters. The EWQI was evaluated for all the lakes and brought into light a few interesting inferences. Three major lakes in the locality near North Guwahati College, Indian Oil and Bottling Plant, and Radhala had "extremely poor" water quality with EWQI values as 211.72, 205.21 and 208.86 respectively. TDS and BOD concentrations were found very high in most of the locations in the lakes and the results of the study suggested that immediate restoration efforts are required to improve the water quality.

Comparison Between Concrete and Concrete Filled Steel Tube Short Columns

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The deficiency in concrete columns is the lack of lateral confinement. To overcome this drawback composite columns have been widely used in the modern structures. Concrete filled steel tube (CFST) is a type of column that includes two different materials, i.e., structural steel and concrete. The application of such type of column can result in significant savings in column size, which can lead to significant economic savings and enhances moment of inertia of the member. It has been observed that most of the previous works dealing with rectangular and square CFST columns. The literature also indicates that very less number of works have been carried out to study the behavior of circular CFST columns. Further, it is worth mentioning that research is necessary to show the efficiency of circular CFST columns subjected to axial loading condition. The objective of the present study is to utilization of FE program to perform nonlinear numerical simulations to study the behaviour of short plain concrete columns and CFST columns under axial concentric compressive loading condition. The FE models have been developed using ABAQUS software. Three different cross-sectional configurations of plain concrete columns and CFST columns were studied. The crushing of concrete core due to local buckling of the steel tube has been studied in this work. The outcome of the studies indicates that the post-yield strength of circular CFST columns is more in comparison to the square and rectangular CFST columns because of its confinement effect. That concludes that, the circular CFST columns are more ductile than other cross-sectional configuration of plain concrete and CFST columns.

Calculation of Embodied Energy for Residential Projects

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Residential buildings serve major part in the construction sector. Due to the scarcity of the resources extracted out causing its depletion. Embodied Energy is a concept which can identify the total energy consumed in the process with the materials taking into consideration. Embodied energy can be mixed with the knowledge of carbon footprints which gives the aggregate idea to mitigate the problems faced of environment because of construction industry.Apart from it choice between Pre-cast construction method & Cast in situ method can be justified based on Embodied Energy field. This paper presents comparative analysis of embodied energy between above said methods of construction for the same location.
Key words: Embodied energy, Carbon footprints,Pre-cast construction, Cast-in-situ construction

Application of Remote Sensing and GIS Techniques for Identification of Critical Sources and Quantification of Pollutants of Nonpoint Source Pollution

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Nonpoint source pollution is a term used to describe pollution resulting from diffuse sources. Nonpoint source pollution generally results from urban runoff, automotive fluids, fertilizers & pesticides from crop production, construction industry where tracing the pollution back to single source is difficult. Being major contributor of pollutants, nonpoint sources are deteriorating water quality. Assessment of nonpoint pollution in water resources plays key role for environmental protection & provide support for decision making related to pollution control . Assessing potential contributors of nutrient export like Nitrogen and Phosphorous requires remote sensing, Geographical Information System (GIS), hydrology and soil science. Due to large range of potential pollution sources & extent of pollution, mapping and assessing from ground is almost impossible. This study is aimed at using remote sensing & GIS techniques to identify nonpoint pollution sources in Indrayani river, Pune, Maharashtra. This has been carried out by using Agriculture Non-Point Source Pollution Model (AGNPS). By using image classification techniques of remote sensing the various thematic maps were generated. While ArcGIS technique were used to process the data required for AGNPS model. Aspect map, slope coverage and curvature map of the study area were also prepared with ArcGIS .The developed AGNPS model predicted runoff using GIS modelled SCS curve number technique & identified potential nonpoint sources of pollution within the watershed contributing to Indrayani river. The obtained results match considerably with the actual values. Major limitation for AGNPS model is due to handling vast amount of input data for modelling , In this case ArcGIS is proved effective tool for spatial data handling from various sources
Keywords: Nonpoint Source Pollution Modeling; Nitrogen & Phosphorous; Remote Sensing Techniques; ArcGIS; AGNPS Model; Indrayani River;

Integration of GIS Techniques and Concepts of Hydrodynamic Modeling for Generation of Flood Inundation Maps

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Flood is a natural disaster which causes loss of life along with severe damage to economy. Flood inundation mapping is useful to understand the impact of flooding in river bank areas and important structures such as roads, railways etc. There have been frequent cases of floods in the study area i.e.Pandharpurcity, located in Solapur, Maharashtra, India. The objective of this study is to analyse flood hazard and flood inundation mapping for Bhima river basin in Pandharpur city. Flood inundation mapping is done using GIS for spatial data processing and HEC-RAS model. HEC-Geo RAS isused for interfacing between HEC-RAS and GIS. The flood maps are prepared based on rainfall of100-year return period. Water release from Ujanidam, situated in Indapur, Maharashtra and Veerdam, situated in Shirval, Satara, Maharashtra is also considered for total discharge calculation. The results show that integration of GIS techniques and hydrodynamic modeling is an eficient way for flood inundation mapping. The findings of this study can be used by local municipal authorities to identify flood risk zone sand develop flood management strategies accordingly.
Keywords : Bhima river basin ; GIS ; HEC -RAS model; HEC -Geo RAS ; Ujjanidam ; Inundation mapping

Dynamic Behaviour Analysis of Tied Arch Bridges

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Tied arch bridges have been designed and constructed since the late nineteenth century. In this type of bridges the outward directed horizontal forces of the arches are borne as tension by a chord which is tied to the both ends of the arch. These types of bridges are both aesthetic and economical.
The present work aims the design and analysis of the different types of hanger arrangements and its influence on the tied arch bridges. An eigen value analysis is carried out using FE analysis. Also the influence of arch rise to span ratio on the stability of the tied arch bridge is studied.

Impact Assessment Of Cluster Of Minor Irrigation Projects On Agriculture: A Case Study.

Water is important because it is essential to life on earth. In Maharashtra state nearly 82% area of state fall in rain- fed sector at 50% area is drought prone, uncertain, insufficient and irregular rainfall. Rainfall pattern adversely affects agriculture, drought occurs frequently resulting in shortage of water for drinking and irrigation. In view of this, the present study based on secondary data intends, the state government project "Jalayukta Shivar Abhiyaan"(JSA) on January 26th 2015 setting/targeting 25 lakh hectares of land under irrigation in 3 phases between 2015 – 2018. Maharashtra government has launched the project "JSA" in a bid to make Maharashtra a drought- free state by 2019. The project involves deepening and widening of streams, construction of cement and earthen stop dams, work on nalla's and digging of farm ponds. the mapped location can be monitored through their web page. District-wise, taluka-wise statistics is also available both in tabular and graphics form on the website. The project aims at making 5000 villages free of water scarcity ever year. Post implementation of minor irrigation projects like river bed deepening and widening has caused increase in the discharge of water in rivers, streams and canals. These irrigation projects have impacted the agriculture of India over a period of time. In parallel with development in irrigation projects, no means for quantifying the progress in cultivation have been designed and hence the need for Performance Evaluation and Impact assessment of Cluster of Minor Irrigation Project on Land Use has been raised. Using remote sensing, the minor irrigation projects are located on the map of Latur district of Maharashtra and impact assessment of the project, 'JSA' is carried out by deriving NDVI(Normalized Vegetative Index) & LST(Land Surface Temperature) maps from Landsat 8 OLI for the years 2014-2017. Preparation of GIS based data of JSA on District level. Qualitative and Quantitative analysis of NDVI and LST. Qualitative and Quantitative analysis of conservation of water.

References: [1] A. Mishra, S. Ghosh, R.K. Mohanty, P.S. Brahamand ,Performance evaluation of a rehabilitated minor irrigation projects & augmentation of its water resource through secondary storage reservoir. Published by Elsevier in 2013.
[2] P.R. Reddy, Relevance of minor irrigation and its restoration to sustain agriculture in Andhra Pradesh. Published byJ. Ind. Geophys. Union in 2013.
[3] C.Gutzler, K. Helming , D. Balla , R. Dannowski , D. Deumlich , M. Glemnitz, A. Knierim , W. Mirschel , C. Nendel , C. Paul , S. Sieber , U. Stachow , A. Starick , R. Wieland , A. Wurbs , P. Zander, Agricultural land use changes – a scenario-based sustainability impact assessment for Brandenburg, Germany. Published by Elsevier in 2014.
[4] Célia Toureiro, Ricardo Serralhei , Shakib Shahidian, Adélia Sousa, Irrigation management with remote sensing: Evaluating irrigation requirement for maize under Mediterranean climate condition. Published by Elsevier in 2015.
[5] J.J. Cancela , M. Fandino, B.J. Rey, Dafonte, X.P. González, Discrimination of irrigation water management effects in pergola trellis system vineyards using a vegetation and soil index. Published by Science Direct in 2016.
[6] R.P.R.K. Amarasingha, L.D.B. Suriyagoda, B. Marambe, W.M.U.K. Rathnayake, M. Howden, Improving water productivity in moisture-limited rice-based cropping systems through incorporation of maize and mung-bean. Published by Elsevier in 2017.

Future of IOT

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No matter which way you look at it, technology has been headed towards automation for a long time now. In fact, isn't the very basic principle of technology to make our lives easier by leaving fewer things to be explicitly done by us? It might be making us all lazier everyday, or one might argue that it is giving us far greater time to pursue whatever we desire. Whatever might be the effect, there is no doubt that automation is the future and place that it is happening the most significantly is right in our homes. 1 .Safe Driving: With connected cars, insurance companies can offer incentives to drivers to drive well in return for lower premiums. This will make our roads safer and improve the driving experience.2. Predictive Maintenance: Drivers and fleet managers will now get inputs on vital vehicle diagnostics data leading to detection of issues before they turn into a major problem. This will reduce vehicle breakdowns and ensure hassle free driving as well as improved mileage. Well maintained vehicles also minimize emissions.3.The Data Opportunity: According to a recent research, a single connected vehicle has the potential to generate more revenue than 10 conventional non connected vehicles. In the future, the market share of OEMs will not be based on units sold but on the data revenue generated per vehicle. Data monetization in an IoT context is still in its infancy and we will see plenty of actions on this front in the near future. A connected car can dig into its database to come out with suggestions on your favourite number or best route available to pick up your child from her piano class every Friday. With the arrival of 5G, connectivity issues will be a thing of the past. 5G will enable connected cars to send and receive messages faster(up to 10 times a second). 5G will also enable more situational awareness and provide advance warning in case any roadblock or hindrance were to appear on the road you are driving on thereby giving you more time to react.

Online Medical Facilities for People in Rural as well as Urban Areas

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Nowadays people are so busy with their schedule that they even don't get time for themselves. They can't manage time to go to a doctor and take an appointment and then wait till their treatment ends. Therefore we have developed "ONLINE DOCTOR", a mobile application which will help people get advice and online medication by the doctors of their choice. Moreover they can fix appointment with the doctors sitting at their homes. People just need to login (or signup) in this application either as a doctor or an individual. After they login as an individual and if they feel the need of a doctor then they can search the doctor of their choice and get appointment or online treatment by paying very less or no fee for the doctor. Usage of this application is totally free of cost. Therefore by using this application they can have their treatment live with their job. If there is a huge problem then they can even fix an appointment online without wasting much time. Using this application people can have their treatment online and can fix appointments for major issues thus saving their time. This application uses GPS (Global Positioning System) to find the best doctors near your locality. You can convey your problem(s) using text messages and images. Voice and Video calls are also supported for better interaction between the patient and the corresponding doctor. This will enhance the medication procedure. Instant first-aid guidance is also available using automated software. The registered Medical practitioners will be available "24x7" for your convenience. You can also call an ambulance instantly using this app. Emergency cases are also entertained here. You just have to file an emergency case on this app and an ambulance will instantly pick and drop you to the nearest Hospital. The cost for the ambulance and medical services, the hospital charges, are less compared other-ways. In this way using this, people will be largely benefited as this will save both their time and money. On the other hand we have provision for doctors also. They will earn easily while sitting back by charging some money for their medicational advice. Hence this is a two way process benefiting both the ends. Thus in this way every user of "ONLINE DOCTOR" will be benefited.

Addressing Manufacturing Channel-Shorts in On-Chip Networks

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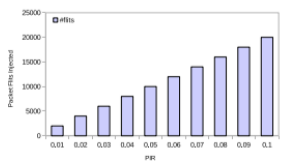
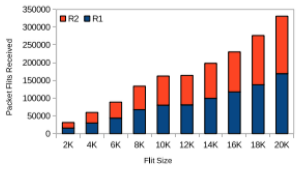
With the rapid growth in VLSI technology, the past decade has witnessed an ever-increasing demand for the practice of high-performance communications and computing (HPCC) by many applications to sustain with. However, traditional bus-based multi- core/multiprocessor systems-on-chip (MPSoCs) are unable to satisfy these requirements due to the communication bottleneck. A NoC (an embedded packet switched network that makes interconnection of IP cores in a SoC) has become a promising solution and is continuously replacing the SoCs in the place. And, more metallic wires are placed in a channel in order to overcome the communication bottleneck of the SoCs. Simultaneously, the wire density is boosted. As a result, NoC channels become more prone to growing number of manufacturing faults such as shorts. On the other hand, channel-shorts put a network (NoC) architecture into various system level failure modes that have the significant impact on the performance behavior of the network. For example, network performance is influenced by overloading (duplication), misrouting, delay, and dropping of packets when channel-wires experience shorts. Not only these channel short faults have the severe impact on the network performance but also may make the architecture useless. Therefore, reliability and yield improvement in a NoC architecture become a major concern. Additionally, the performance has become a key requirement for large and complex problems in NoC-based communication systems. Thus, a capability of detecting these faults on and locating faulty channel-wires is, therefore, mandatory to yield improvement and establish reliability in NoC-based SoCs.

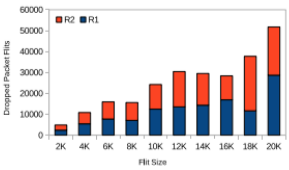
A distributed test paradigm that tests all shorts in same channels (intra-shorts) and pairwise shorts between channels (inter-shorts) of a node (router+core) is proposed. Shorts experienced in data, control, and handshake wires in channels are addressed here. The testing of channels is completed in two test rounds. Each round is executed iteratively by nodes at a diagonal level. The nodes at a diagonal level known as diagonal nodes are determined by matrix modeling of a NoC topology. Diagonal nodes in an iteration run the test algorithm concurrently. The proposed test paradigm analyzes the effect of these short faults on network performance. Simulation results show that implementation of the test algorithm takes little hardware area NoC nodes and few clocks to detect the modeled short faults. Also, we see that underlying fault simulation achieves 100% coverage metrics. We consider here test and fault coverage metrics. The on-line evaluation of the proposed test scheme results to reveal deep insights into the impact of the short faults on various but common performance metrics at large traffic (Figure 1). We observe that the test clocks are reduced by 2.4–9.8X (Figure 4 and 5) for a set of NoCs considered under simulation. We also see on these NoCs that average packet latency is improved by 15.14–46.79% while energy consumption is reduced by 13.68–39.13%. This speedup increases with NoC size. Moreover,



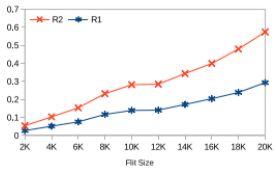
(a) Amount of packet flits sent in NoCs.



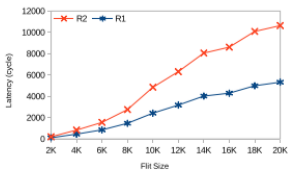
(b) Amount of packet flits received.



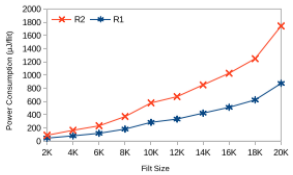
(c) Amount of packet flits lost.



(d) Throughput behavior.



(e) Latency Behavior of a packet.



(f) Power consumed by a flit.

Fig. 1: On-line evaluation of the proposed test method on the 8 × 8 NoC.

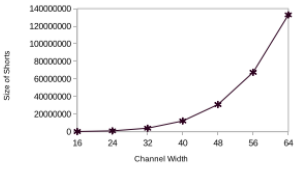


Fig. 2: Scalability of the proposed solution with channel width n.

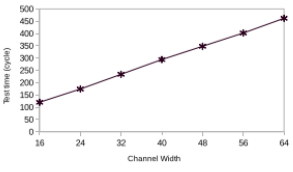


Fig. 3: Behavior of test time with channel width.

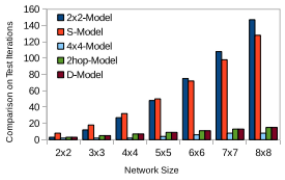


Fig. 4: Comparisons on test iterations with the models.

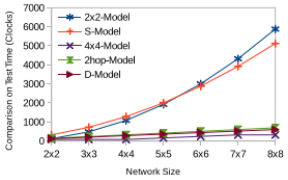


Fig. 5: Comparisons on test clocks among the models.

the proposed solution scales to all NoCs irrespective of size, topology, and channel width (Figure 2 and 3). Proposed test paradigm is exemplified by the well-known walking one (W1) test vectors and can be easily applied for other channel faults such as stuck-at and open faults. Furthermore, our test paradigm is applied in the on-line mode where the whole network is kept functional except a subset of channels are under test.

Main contributions of the current work include-

• Detection of all intra- and pairwise inter-shorts in channels of a node. It ensures the state of faultiness or non-faultiness of channel- wires.

• Diagnosis of above shorts in channels. It identifies faulty wires in the channels.

• Scheduling the nodes so that the test time is lowered.

• Analysis of the shorts that are inclined to various system level failures in terms of network performance.

• Establishment of the scalable behavior of the proposed test

(a) Amount of packet flits sent in NoCs.

(c) Amount of packet flits lost.

(e) Latency Behavior of a packet.

Design of Protection system for grapes farming

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Agriculture sector is changing the socio-economic environments of the popula- tion due to liberalization and globalization. About 43% of India's geographical area is used for agricultural activity. Grape is an important commercial fruit crop of Maharashtra state in India having vast export potential. The state ranks first in respect of area (70,000 hectares) of produc- tion (1650000MT) and productivity (28MT/ha) of grapes in the country. The total area under grape plantation in Maharashtra is around 3 lakh acres, including 1.75 lakh acres in Nashik district. Temperature, humidity and light are important for grapes. Hot and dry climate is ideal. Water requirement of grape are very high during berry growth. To create a special controlled and protected environment for grapes. To increase the productivity and to increase the grapes quality and decrease the damaging caused by untimely climatic changes. The aim is to design solution for protection of grapes against untimely climatic changes. The solution should be assembled/disassembled in quickest possible time with minimum labor.
Keywords: Climate impact · Grapes farming · protection · environment · sustainability

Inspirations from Folk Traditions of Madhubani Art in Contemporary Designs

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India is known for its rich variety of folk art and crafts. Each state has its own identity as a cultural unit which is evident in ethnic clothes, food and art. One such district is known as Madhubani in the State of Bihar. Age long tradition of Madhubani paintings done on various surfaces and objects have captured the attention of the world due to its conceptual depth of visuals depicting deities, birds, animals and humans prolifically represented majorly by women artists of that region. The study of this paper is to understand the role of folk tradition of Madhubani Art in Contemporary Designs.

e-modeling the 'phonebook' in a smart phone: Personalization based on intimacy and immediacy

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With rapid innovations taking place in smartphone technologies, features in the phonebook has evolved significantly to provide us more options for managing our social network. Personalization of these kinds of intimate social networks with the closest, most meaningful ties, such as between close friends, family, relatives and even close colleagues, are characterized through classification based on high frequency of interaction, but also by an inherent need to feel connected, to be in touch. In a qualitative study following ethnographic research and analysis of phone call logs revealed that, people interact with only a small fraction of the people actually present in their phonebook contact list. Our experiments examined the manner in which the users manage the phonebook and their co-relation to the frequency of interaction and intimacy and immediacy of need with the people they contact. Based on the research conducted, we propose a design approach that enhances the personalization of the mobile phonebook to provide the user with option of reordering hierarchies of their own intimate networks. In the paper, we also study the efficiency and usability of such a personalization tool.
Keywords: Contacts · phonebook · personalization · social network · interaction

Conceptual Design and Evaluation of Exoskeleton to Augment Load Carrying Capacity

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This paper presents the first part of product design phase in designing and evaluating a wearable lower limb exoskeleton suit, the device is intended to be used for emergency personnel especially, for soldiers to augment load carrying capacity during harsh walking with heavy loads which is common in military missions. Currently the technological developments in military combats mainly focus on designing devices as an added weight of personal belongings to be carried by infantry soldiers for personal safety and mission accomplishment, but this technological development has not given more focus in supporting mechanism with respect to the added weight to individual soldiers, although in most countries military group including the present study group of this paper, the recommended weight is considered as (23-25) Kg, this limit has not been kept as a rule from biomechanics point of view due to the above reason. In this paper a new design is included in exoskeleton that supports a load based on gravity compensating mechanism at the hip joint and reduces the torque at the knee joint, this device develops a compensating torque due to the stored energy in the torsion spring mechanism. Preliminary design synthesis and product design process has been implemented using digital human modeling software considering comfort of the users and adjustability of the device for various populations. Finite element analysis is conducted in addition to analytical results that will help in deciding the structure. In the result section four data of masses (25Kg, 30Kg, 35Kg and 40Kg) are used for evaluating newly designed load compensating mechanism with four height variations, thus to arrive at an appropriate knee joint torque requirements which will help in selecting an effective actuator. Finally a comparison has been made for the actual torque required at knee joint, firstly without considering the effect of gravity compensating torque an average result was found as 248.32 Nm and by considering the effect of gravity compensating torque it is found to be 174.4 Nm which is 29.8% decrease due to gravity compensating system, the rest of the load will be transferred through the main links. Hence this result shows an improved design that helps for future research direction.
Keywords:Exoskeleton; Digital human modeling; Design synthesis ;Gravitycompensation, Product design process

System of Productivity Improvement through Value Stream Mapping in Continuous Production Sectors (Case Study on Barrel Manufacturing in Gafat Armament Industry of Ethiopia)

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In today's competitive environment the more success and survival of any enterprise depends up on lean manufacturing system to eliminate wastes like inventory, over-production, transportation, waiting, motion, defect and reworks. Value stream mapping is the best lean tool to expose those wastes and to identify improvement areas. It is used to define and analyze the current state for a product value stream and design a future state focused on reducing waste, improving lead-time, and improving workflow.
The main aim of the paper is to suggest improvement measures so as to reduce the process cycle time and to eliminate non-value added activities by evaluating the Current State Value Stream Mapping and implementing Future State Value Stream Mapping.
In this study, a practical works was carried out in Gafat Armament Manufacturing Industry of Ethiopia for the manufacture of AK-103 gun barrel (bottle neck process) was discussed through Value Stream Mapping. VSM technique involves flow charting the steps, activities, material flows, communications, and other process elements that are involved with a process or transformation so that it helps an organization to identify the non-value adding elements through the main process flows.
The study philosophy follows the following procedures:
• Developing or creating the Current Value Stream Mapping of existing production scenario.
• Identifying wastes and improvement areas from Current Value Stream Mapping.
• Eliminating those wastes through various measures and creating the future value stream mapping based on the takt time to satisfy the customer demands.
• Finally, planning, implementing and maintaining the improvement measures based on Future State Value Stream Mapping.

From the evaluation, it was observed that there is high level of non-value added elements, delays, inventory, defects & unbalanced work load in most processes. Currently, the customer demand per day is 28 items but the evaluation result of Current Value Stream Mapping indicated that the maximum quantity of items to be produced per day is 6 or 7 items which mean the production is under the customer demand.
Thus, Future State Value Stream Mapping was designed to produce up to 28 items per day based on takt time in order to satisfy the customer needs. Therefore, the productivity of the industry is expected to increase by at least 4.5 times of the existing productivity in negligible expense if the suggested improvement has been implemented.
This study addresses the techniques how to apply the ideal tool called Value Stream Mapping in the continuous production sectors for the purpose of exposing waste and identifying improvement areas. It is inferred that the effectiveness of lean principle is substantiated in a systematic manner with the help of VSM. This can motivate the organization during the actual implementation to obtain the desired benefits.
Key words: process cycle time, takt time, value stream mapping, lean manufacturing, value adding activities, non-value adding activities

Performance Evaluation Of Single Operator Handheld Battery Powered Tea Harvesting Machine In Context To Tea Gardens Of Assam

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Tea is a widely consumed drink in the world as a beverage. The history of tea cultivation in India is quite old. After China, India is the second largest producer of tea. Presently tea industry is facing a shortage in the workforce, and so the industry is looking for suitable automation alternatives in various stages of tea production. Indian Institute of Technology Guwahati has designed and developed a single operator handheld battery powered tea harvesting machine. This paper reports the results and analysis of the experiments carried out with the newly developed single operator handheld battery powered tea harvesting machine from performance point of view. The experiments were performed in a tea garden of Assam, India.
Keywords: Product design, tea, machine, agriculture, ergonomics

Ephemeral Architecture in Humanitarian Aid

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The ephemeral concept in contemporary architecture implies a fleeting temporality, with a timeline so short that the creation itself admits destruction. There are two aspects of design, first which reflects an artistic thinking, seeking innovation and exuberance that communicates with the user's emotional perception, and second, is an investigation for a functional adaptability, referring to a language of material reuse, methodical and rational structural system, subsequent to a sustainable future. This study is an endeavour to establish the crucial characteristics that make it successful. The built environment today is effected more and more by rapid and drastic change due to manmade and natural disasters. Ecological considerations, social and cultural impact establishes the need for a form of architecture that is flexible, lightweight in construction and has the minimal environmental impact and is responsive to adaptive architectural design. A design and manufacture of a post- disaster transitional shelter with partial prefabricated and portable elements show that portable buildings are feasible, and can fulfill many different roles and are economically viable to build and operate. The genre of transportable, flexible and ephemeral architecture is rapidly expanding in the Humanitarian Shelter Aid sector. This study takes a case study approach to explore in details the strategy and design considerations taken to achieve the objectives of creating a quality environment during humanitarian emergencies.
Key Words: Architecture; Ephemeral; Disaster ; Transitional Shelter

Designing of a Low-Cost 10 Watt Wind Panel and its System Using Micro- Wind Turbines

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Wind is a form of alternative source of energy. In our country, 83.3% of people living in the rural areas are devoid of energy and power. A 1 OW low cost model has been designed consisting of 12 numbers of DC generators where six of them are arranged in each row. The wind turbines used in this model are very peculiar, each of them consists of three blades of length 5.5 inches, cut-in-speed of 1.7 m/s and 0.9 m/s required for keeping the blades to rotate. These special turbines are adaptive to those areas where the wind speed is low, blowing at a base speed of 1-3m/s. Each of the wind turbines are coupled to 9V DC generators which are capable of producing a minimum voltage of 3V at the speed of 1.7m/s. The framework of the panel is made of local woods cascading the turbines at a distance of1 foot from one to other in both dimensions.

Fig. 1: Wind turbine

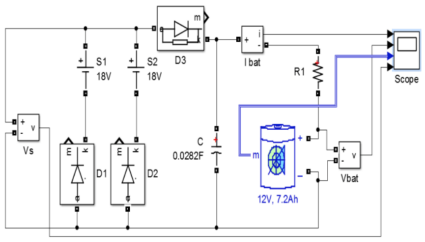

Fig. 2 Charging circuit the battery

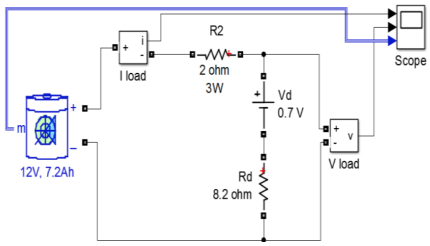

Fig. 3 Discharging circuit of battery to load

In this model, 51 and 52 are the two rows of generators connected in series for charging the battery and providing power to 1 OW load for duration of 7 hours. An equivalent circuit of the diode is used consisting of a voltage source of 0. 7 V and series resistance of 10 0. The manufacturing cost of this model would be within the range of Rs. 3400-3500 and this price may lower down if produced in the commercial production line. This process of power generation using micro-turbines can be implemented in a village or a locality by cascading with solar panels and micro hydro plants to make it adaptive to all environmental conditions. The model has been designed in simple method so that ifany defects occur may be resolved by local technicians. Again, the cost of spare parts of the model is cheap and easily available in the market. The project is planned with a novel promise to glow atleast two 5W LEOs in every house of the rural community.

Moving Object Tracking Using A Camera Mounted On 2-Dof Robotic Platform (Pan-Tilt Mechanism)

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A real-time visual servo control system which uses the visual feedback comes from a single camera mounted on a DC-motor driven robotic platform to track moving object has been described in this work. A pan/tilt platform has been designed and fabricated. Frame differencing algorithm along with colour segmentation have been implemented using openCV-python for detecting the moving object and keep tracking it. DC motor modeling and identification has been done and PI controller has been designed accordingly to give command to the platform to keep the object in the centre of image plane. The results show an effective and stable tracking for the object in both panning and tilting.
Keywords: Robotic vision, Pan/tilt camera, Visual servo control.

Design of H-Plane SIW Horn Antenna

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Horn antennas based on rectangular metallic waveguide have extensively been used in many applications for their unique radiation properties such as high gain, wide bandwidth, and symmetrical patterns. However, their implementation in planar form is difficult due to the bulky geometry and especially their three dimensional structures. These difficulties have been resolved in recent years by introduction of Substrate Integrated waveguide (SIW) A horn antenna is simple to design and provides good performance. Generally a three-dimensional horn is used, which is fed using a waveguide [1]. Waveguide feeding has the advantages of low spurious radiation and less leakage in comparison to the micro strip feed lines and the major disadvantage of these structures is their volume making it difficult to integrate them with Microwave integrated circuit (MIC) components. The substrate-integrated waveguide (SIW) horn is a planar configuration containing all the advantages of classical waveguide horn antenna. Substrate integrated waveguide (SIW) is a type of transmission line which allows a non-planar structure like an antenna to be transformed into a planar form by integrating it on a single substrate. This results in a compact structure. [2] The substrate-integrated waveguide (SIW) technique has been investigated and developed to construct the planar rectangular waveguide. It implements a waveguide on a piece of printed circuit board by emulating the side walls of the waveguide using two rows of metal posts. It inherits the merits both from the micro strip for compact size and easy integration, and from the waveguide for low radiation loss, and thus allows design of efficient microwave circuits and antennas at a low cost.[3].Here, a low profile Substrate Integrated Waveguide (SIW) probe-fed H-plane horn antenna with acceptable gain is proposed. It consists of two waveguides, including a rectangular and a tapered one, in which both the first and third modes of the structure are simultaneously excited leading to a uniform field distribution along the radiating aperture of the antenna and in turn, its directivity is improved. Moreover, using a coaxial probe to excite the antenna, spurious radiation due to the feeding network is suppressed. The antenna structure is numerically analysed using a software package, and a prototype is made using a single thin substrate layer. A good agreement is obtained between simulated and measured results. The measured result shows a gain of 3.33dB at 18.2GHz

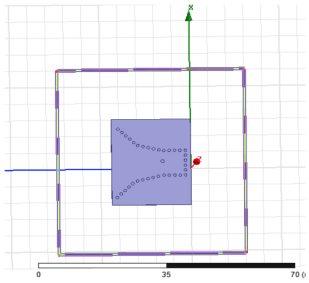

Fig 1. SIW H-Plane Horn Antenna

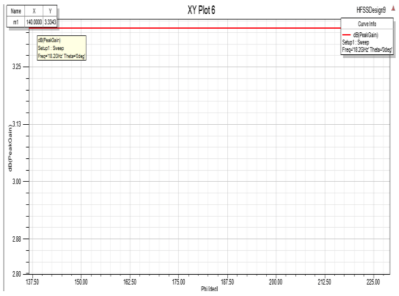

Fig 2. Gain Plot

References:

[1] Constantine, A. Balanis.: Antenna theory-Analysis and Design, Chapter 13, Wiley, New Jersey, 2005
[2] Z. L. Li and K. Wu, "A new approach to integrated Horn Antenna," in Proc. Int. Symp. on Antenna Technology and Applied Electromagnetics, Jul. 2004, pp. 535–538
[3] Razavi, S. A. and Neshati, M. H.; "Low Profile H-Plane Horn Antenna Base on Half Mode SIW Technique," 20th Iranian Conference on Electrical Engineering, Tehran, Iran, pp. 1351–1354, 2012.

Constitution of Novel Parallel DC-bias Bridge-Type FCL to Improve the FRT Capability of the DFIG- based Wind Turbine

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The doubly-fed induction generator (DFIG) based wind turbine faces challenge to maintain fault ride through (FRT) as they are vulnerable in nature under the grid faults. The symmetrical/asymmetrical faults introduces electromechanical instability of the wind turbine system, they may cause violation Indian grid code. In this paper, to enhance the FRT credibility of a DFIG-based wind turbine, novel parallel DC-bias bridge-type fault current limiter (PD-BTFCL) has been proposed. To observe the effectiveness of the proposed PD-BTFCL, its performance has been compared with that of the non-superconducting fault current limiter (NSFCL). The simulation results shows that the PD-BTFCL is a very effective auxiliary device to achieve better FRT. Moreover, it was found that the PD-BTFCL outperforms the NSFCL. The simulations have been carried out using PSCAD/EMTDC environment.
Keywords - Doubly-fed induction generators (DFIG), fault ride through (FRT), grid code, non-superconducting fault current limiter (NSFCL) and wind turbine.

Solar Panel Temperature Prediction

Chayapathy V, Anitha G S, Raghavendra

The role and relevance of solar energy has been increasing at a very rapid pace in the modern day. Increasing population and decreasing sources of conventional energy sources has resulted in decreased availability of energy per person. Solar energy being readily available throughout the world is a clean energy and thus there is a need to harness its potential.
It is common knowledge that the output of a solar panel increases with irradiation. However extended exposure to sunlight leads to rise in temperature. In order to operate the solar panel at optimum efficiency, it is vital to monitor the rise in temperature. This is because after a certain temperature, solar cells operate at decreased efficiencies. Moreover, in tropical countries like India this can be a chronic problem
This work aims to compare and develop temperature prediction schemes for solar panels in the Indian environment and thus bring the error in prediction down in the range of 5-10% or less ..A collection of mathematical models made by various researchers is tested for daily averages of data available for two different types of solar cells to test efficiency.. Few well behaving models are shortlisted and tested for per second and five minute average data available. An extensive workflow is developed and described for the same. The workflow gives a visual representation of the error thus enabling us to combine different models based on their regions of optimum operation. As a result of this, the accuracy of mathematical models in the Indian context can be established. Further the work looks to develop an appropriate architecture for a Neural Network for the same and test its validity for the data in hand. The different schemes of prediction are then compared.

Design of ultra-fast all-optical NOR gate in single ring-resonator using quasi-polarized mode

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The technique of conversion of quasi-polarized mode in an optical ring-resonator has been utilized to realize all-optical NOR logic gate. The structure is ultra-compact, ultra-fast and compatible to CMOS technology as well as in SOI platform. The race-track single waveguide-coupled single silicon ring-resonator is used in the design. The suitability in source and pump power and the selection of proper wavelength for source and pump is the main parameter to obtain conversion of light in ring resonator.
Keywords- polarized mode, all-optical logic gates, silicon photonics, and ring-resonator.

Codebook based descriptors for online writer identification

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In a writer identification system, the main objective is to decide the authorship of a piece of handwritten document. Essentially we establish the identity of a handwritten sample by matching it against a set of enrolled samples with known authorship stored in a database. Based on the mode of data capture, such systems are categorized into either online or offline. The recent advances in technology have enabled the release of hand-held devices, wherein the data entry is captured through an electronic pen / stylus. The tip of the stylus, as such, has the capability to capture the trajectory information such as (x,y) coordinates, time stamp and pen status from the handwriting. In the literature of writer identification, the analysis of such temporal data is referred to as `online'. The input to such a system consists of a set of strokes, each of which containing the sample points of the trace captured between a pen-down and pen-up signal. Off-line writer identification systems, on the other hand, capture the data as an image and subsequently establish the authorship by applying image processing techniques [1-4].

Another classification for online writer identification systems are those of text dependent and text independent approaches [5]. In the former, the handwriting samples of a writer are processed based on a specific transcript usually with the aid of recognizer. The problem of signature recognition / verification is one such popular instance of text dependent writer identification [6-8]. In general, the use of the knowledge of the content of the data increases the accuracy of such systems. However, they fail in scenarios that require the textual contents of the documents to be different. Hence, as an alleviation to this, text independent writer identification systems capture the style information of handwriting and can identify the writer irrespective of the textual content.

We focus our research on the problem of text independent online writer identification. We derive a strategy that encodes the sequence of feature vectors extracted at sample points of the temporal trace with descriptors obtained from a codebook. The derived descriptors take into account, the scores of each of the attributes in a feature vector, that are computed with regards of the proximity to their corresponding values in the assigned codevector of the codebook. A codebook comprises a set of codevectors that are pre-learnt by a k-means algorithm applied on feature vectors of handwritten documents pooled from several writers. In addition, for constructing the codebook, we consider features that are derived by incorporating a so called 'gap parameter' that captures characteristics of sample points in the neighbourhood of the point under consideration. We formulate our strategy in a way that, for a given codebook size k, we employ the descriptors of only k -1 codevectors to construct the final descriptor by concatenation. The usefulness of the descriptor is demonstrated by several experiments that are reported on publicly available databases.

References:

[1] I. Siddiqi, N. Vincent, "Text independent writer recognition using redundant writing patterns with contour-based orientation and curvature features", Pattern Recognition 43 (2010) 3853-3865.
[2] D. Bertolini, L. S. Oliveira, E. Justino, R. Sabourin, "Texture-based descriptors for writer identification and verification", Expert Systems with Applications 40 (2013) 2069-2080.
[3] A. Nicolaou, A. D. Bagdanov, M. Liwicki, D. Karatzas, "Sparse radial sampling LBP for writer identification", in: 13th International Conference on Document Analysis and Recognition (ICDAR 2015), 2015, pp. 716-720.
[4] V. Christlein, D. Bernecker, F. Honig, A. Maier, E. Angelopoulou, "Writer identification using GMM supervectors and Exemplar-SVMs", Pattern Recognition 63 (2017) 258-267.
[5] A. Namboodiri, S. Gupta, "Text independent writer identification from online handwriting", in: Tenth International Workshop on Frontiers in Handwriting Recognition, 2006.
[6] Kholmatov, B. A. Yanikoglu, "Identity identification using improved online signature identification method", Pattern Recognition Letters 26 (2005), 2400-2408.
[7] J. F. Vargas, M. A. Ferrer, C. Travieso, J. B. Alonso, "Off-line signature verification based on grey level information using texture features", Pattern Recognition 44 (2011) 375-385.
[8] M. Parodi, J.C.Gomez, "Legendre polynomials based feature extraction for online signature verification. consistency analysis of feature combinations", Pattern Recognition 47 (2014) 128-140.

Novel design of perfect metamaterial absorber for wireless power transfer application

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In this article, a new design of perfect metamaterial absorber resonating at the 2.45 GHz frequency is proposed. The metamaterial has negative refractive index at the resonant frequency. About 96% absorption is achieved at 2.45 GHz. The magnitude of reflection at 2.45 GHz is 0.2 and the transmission throughout the band (2-3 GHz) is zero, thus giving better absorption. The proposed structure can be used with the antenna to harvest more power at the receiving side of wireless power transfer.

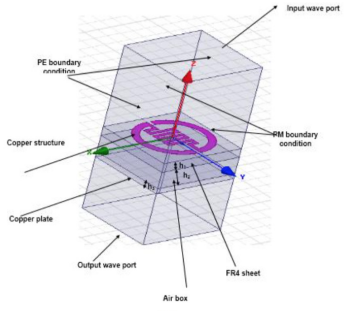
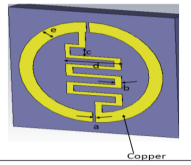


Fig.1. Unit cell with the boundary conditions.

TABLE I. VARIOUS PARAMETERS

Parameter	Value in mm
h_1 (FR4 layer)	0.4
h_2 (Air layer)	3
h_3 (Copper layer)	0.95
a	0.2
b	0.35
c	0.8
d	4
e	1.045



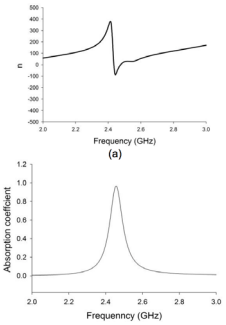


Fig. 3. (a) Refractive index plot, and (b) absorption coefficient plot.

Fig. 1 shows the proposed structure with the various layers. The. copper structure is made on the 0.4 mm thick FR4 sheet. The boundary conditions, i.e., perfect electric (PE) and perfect magnetic (PM) is shown in the figure. The dimensions of the FR4 sheet is varied to tune the structure to the 2.45 GHz frequency. The various optimized dimensions of the metamaterial unit cell are presented in the Table. I. Fig. 3(a) shows the refractive index (n) with the frequency. It is seen that the n at the resonant frequency is negative, thus validating negative refractive index. Fig. 3(b) shows the absorption coefficient. It is seen from the figure that the peak value of 96% absorption is observed at 2.45 GHz with the bandwidth of 1.01:1. The metamaterial unit array can be used for various applications where more energy is to be harvested like in the biomedical applications, WPT, charging robots, drones etc.

Realtime imitation based numerical computational analysis of Lightning spark to store energy within supercapacitor integrated with Seven Level inverter

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Lightning is very high voltage electrostatic discharge consisting of high value electrostatically charged particles. But limited literatures are available in the field of Lightning energy harvesting system due to the intermittent nature of lightning and the hazards involved. Through this paper, it is intended to give an overview on the Lightning energy storage system modelled with supercapacitor in numerical computing environment.
The system is integrated with Seven level inverter to measure the response of inverter with Lightning energy storage system. All the system imitated with the real-time weather parameters collected from Meteorological and Weather data centre, Mizoram. The real-time imitation has been carried out using the pulse generator designed with microcontroller interfaced with numerical computing environment. The Atmel ATMEGA328P-PU is used to generate real-time pulse for Seven level inverter. The MATLAB Simulink environment is interfaced with real-time pulse generator to imitate the system designed. The imitation experienced with Permanent magnet synchronous machine load and Grid type load.
Keywords-- Lightning Energy, Multilevel Inverter, Seven Level Inverter, Supercapacitor, Supercapacitive storage, Inverter, PMSM Load Inverter, Grid Connected inverter

Electrical Characterization of Nano-Level Printed Resistors of Silver Nanoparticles for Sensing Applications

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Nanoparticles (NPs) have unique chemical, physical and electronic properties due to their small size, larger surface-to-volume ratio which classifies them as potential alternative to develop non-silicon based low cost electronic devices for diverse applications especially in the field of sensing technology. Semiconductors and metal- oxides have been favourite choice as sensing material in the fabrication of sensing devices. However, there are very less reports which discuss the usage of metal nanoparticles as sensing material for electrochemical sensors or biosensors. In this work, we have utilized silver nanoparticle (Ag NP) ink dispersion in triethyle glycol monoethyl ether (TGME) with particle size of 50 nm to print microstructures of varied dimensions over substrates like glass, polyethylene terephthalate (PET) and silicon. There are reports which describe the usage of Ag NP in optical and colorimetric based sensors whereas there are very few reports where Ag NP has been used as sensing material for an electrical sensor. Therefore, a detailed analysis has been carried out in this report based on electrical characterization of printed features of Ag NP which shows that these printed structures can be treated as electronic resistors. The measured current range is in mA-μA for very low applied voltages which confirms that the printed resistors can be effectively used as chemo-resistive sensors. The Ag NP structures have been printed via a superfine resolution molecular printing system (MPS) which is a micro-cantilever based printing system that uses picoliters of ink for deposition at precise locations based on piezoelectric response from the micro-cantilever. Moreover, the printed resistors are single material electronic devices as we have used only Ag NP ink for complete fabrication in order to avoid any interfacial irregularities at nano-scale.

Development of GaP based junctionless nano transistor as a high voltage, high frequency and linear high power switching regulator for power electronics applications

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In this paper a design of 34nm scale length junctionless transistor (JLT) is proposed using Gallium Phosphate semiconductor channel material having the N type doping state at 3x1019/cm-3 throughout the channel. The design shows high voltage and high power linear switching possibility. This JLT transistor is exhibit more than 620 watt first switching power handling capability at 100 Pico second fall and rise time on/off transition characteristics within the source drain applied voltage range of 200 Volt. The current transport capability is maximum 3 Ampere and power regulation shows excellent linear characteristics with respect to applied gate voltage. The performance of the suggested design is possible to fit in various power electronics applications area like space, automotive and other high voltage low current based power prospects area. Study of the JLT and complete simulation results are obtained through TCAD simulator.
Keywords: Junctionless Transistor (JLT), Linear switching, High Voltage, High Power, Low current.

Improving the Performance of Text Dependent Speaker Verification Using Second Level Authentication

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Email: {r.bhukya,prasanna} @iitg.ernet.in Abstract

This paper presents the two-level authentication process to improve the performance of the Text dependent speaker verification (TDSV) system, under degraded and practical testing conditions for speech biometric based student attendance system as an application. The telephone network system is designed for users to access the system by making a call from few pre-defined mobile phones to the toll-free number which connects to the voice-server from any of those pre-defined mobile phones. The text dependent utterance focuses on the begin and end point detection, to detect the begin and end points of the speech utterances, vowel-like region (VLR) detection method is used. In the first level, conventional Mel-Frequency Cepstral Coefficients (MFCC) features and Dynamic Time Warping (DTW) algorithm is used to verify the claimed identity of the user by considering the warping path scores for matching the utterance of the test speech with that of the train template. In the second level, the DTW scores are generated and then passes as features to a 32-mixture Gaussian mixture model (GMM) learned from the obtained scores generated from intra-matching of the training utterances. Then evaluated the performance on the GMM learned scores from the second level authentication. Two databases- the RSR2015 database, and the IITG database are used for the experimental analysis. It is observed that second level authentication improves the performance of the TDSV system by 2.45% of EER, for both the databases, compared to the baseline DTW speaker verification system alone.

Index Terms
Text-dependent, begin and end point detection, vowel-like region detection, second level authentication, DTW, MFCC, GMM, speaker verification.

Design of novel Microstrip Antenna and Line Geometries employing Graphene for Terahertz Band Applications

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In this work we present the effect of coplanar patches of Graphene on the input impedance and radiation characteristics of semicircular and trapezoidal microstrip antennas designed to work at the Terahertz (THz) frequency band. Additionally, we also study the transfer and isolation performance of a microstrip transmission line employing graphene at THz frequencies. The uniqueness of the work lies in the utilization of the variable conductivity property of Graphene by application of a DC bias voltage. The presence of the highly conductive patches in the neighbourhood of the coplanar microstrip components causes a disruption in the typical current distribution on the components thereby altering their characteristics. These variations in the characteristics, used suitably, can lead to novel and interesting antenna and line designs having several potential applications.

Electromagnetic response of dielectric nanostructures in liquid crystals

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Sub-wavelength periodic metallic nanostructures give rise to very interesting optical phenomena [1] like effective refractive index, perfect absorption, cloaking, etc. However, such metallic structures result in high dissipative losses and hence dielectric nanostructures are being considered increasingly to be an efficient alternative to plasmonic materials [2]. High refractive index (RI) dielectric nanostructures exhibit magnetic and electric resonances simultaneously giving rise to interesting properties like perfect magnetic mirrors, etc. In the present work, we study light-matter interaction of cubic dielectric structures made of very high refractive index material Te in air. We observe a distinct band-like structure in both transmission and reflection spectra resulting from the interaction between magnetic and electric dipolar modes. FDTD simulations using CST software are performed to analyse the different modes excited at the band frequencies. The medium when replaced with liquid crystal gives rise to asymmetry in the band structure emphasizing one of the dominant magnetic modes at resonance frequencies. This will help in achieving a greater control on the excitation of the predominant magnetic dipolar modes at resonance frequencies with applications as perfect magnetic mirrors.

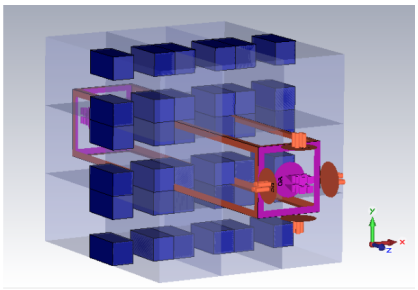

Figure 1:Layer of periodic dielectric cubes of Te after applying periodic boundary conditions.

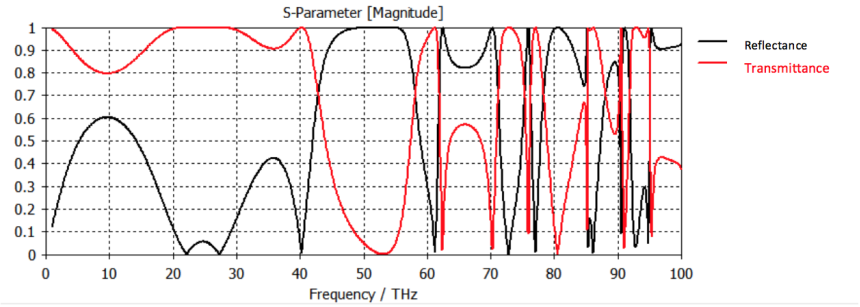

Figure 2: S-parameter plot for transmitted and reflected waves for cubes placed in the liquid crystal medium.

REFERENCES:

Figure 2: S-parameter plot for transmitted and reflected waves for cubes placed in the liquid crystal medium.

[1] Jia, D., Yang, C., Li, X., Peng, Z., Liu, Y., Cao, Z., Mu, Q., Hu, L., Li, D., Yao, L., Lu, X., Xiang, X., Zhang, H. and Xuan, L., \Optical hyperbolic metamaterials based on nanoparticles doped liquid crystals",Liq. Cryst., Vol. 41, No. 207, 2013

[2] Saman Jahani and Zubin Jacob, 'All–dielectric metamaterials', Nature nanotechnology, Vol 11, 2016.

Face Recognition Based Smart Attendance System

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Face Recognition is a biometric method of identifying an individual by comparing live capture or digital image data with the stored record for that person. It is considered as an optimal solution for enrolment of attendance among all biometrics applications such as fingerprint and has a high potential to replace the current manual attendance system. In this paper, we have proposed an idea where Viola Jones Algorithm is used for face detection and then pose estimation/alignment [3] is done by Face Landmark detection followed by Deep Convolution Neural network as feature extractor and SVM as classifier for face recognition. Raspberry pi 3 model B with Broadcom BCM2837 processor is used for controlling and data storage purpose. Raspberry pi 3 model B contains 1 GB RAM to achieve high speed of operation and accuracy [1].
Figure: 1 shows the outline of the proposed method. An infrared sensor detects the presence of a student near the entrance and triggers a camera to click photo. This photograph is then processed using our proposed method and compared with the database to register the particular student's attendance.
Face Recognition basically involves two most important procedures:
A) Detection of a face (determining whether the recorded or clicked picture is that of a face or some other body part) B) Face verification (confirmation of the face from the faces stored in the database).
After the student attendance is recorded, the particular student receives a message via app notification for conveying that his/her attendance has been recorded. In case a student is absent, the parents are notified via app notification.

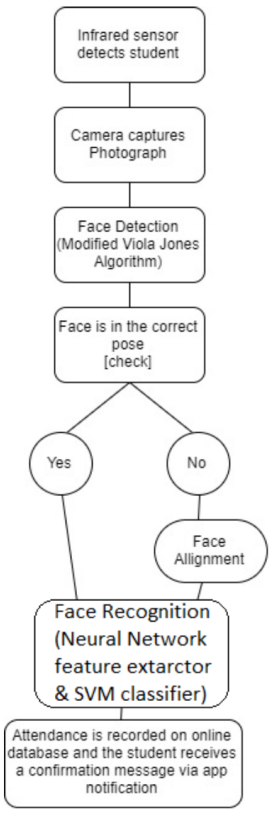

Figure 1: Outline of Proposed Method

Figure 2: Raspberry Pi 3

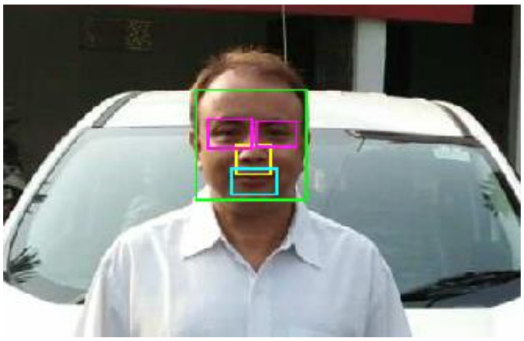

Figure 3: Output of modified viola jones face detection algorithm

References:

[1] Gaddam, S.C. and Ramesh, N.V.K., 2016. Attendance Management and User Security System's based on Eigen Faces Algorithm using Raspberry pi 2 and Ethernet. Indian Journal of Science and Technology, 9(17).

[2] Baltrušaitis, T., Robinson, P. and Morency, L.P., 2016, March. Openface: an open source facial behavior analysis toolkit. In Applications of Computer Vision (WACV), 2016 IEEE Winter Conference on (pp. 1-10). IEEE.

[3] Kazemi, V. and Sullivan, J., 2014. One millisecond face alignment with an ensemble of regression trees. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 1867-1874).

Wind farm modelling for Horizontal Axis Wind Turbine

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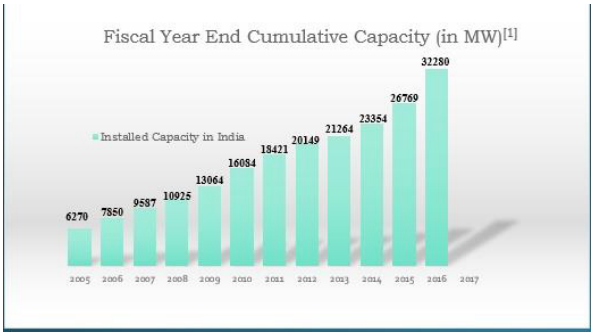
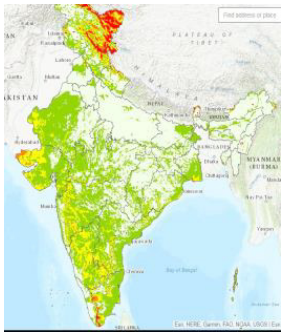
To fulfil the growing energy demand with sustainable source and ensuring the preview of environmental friendly generation, Wind Energy plays a vital role in providing the same with eco-friendly perspective. In present era of high tech, booming industrialization, population growth and global collaborations there is drastic increase in energy demand. Wind energy being the source of highest renewable energy in India [1] [3] has the ability to provide efficiently because of vast ability of wind flow mostly in southern coastal region [2]. North eastern part of India also show good potential for wind energy development but mostly at high altitude from sea level [2].





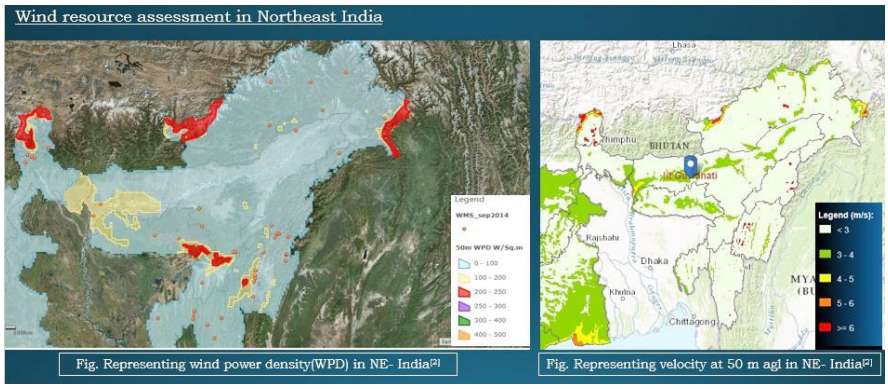


Fig. Representing wind power density(WPD) in NE- India[2]

Fig. Representing velocity at 50 m agl in NE- India[2]

For large scale energy demand, designing and forecasting proper layout of wind farm is of great interest by many researchers and because of the stochastic behaviour of wind flow, annual flow variation, atmospheric boundary layer effects, seasonal climatic change and most importantly the effect of wake flow downstream of wind turbine in subsequent arrays of turbine makes the wind farm modeller a difficult task. So, in our present research study a Computational and experimental investigation work will be carried out in Wind Tunnel to understand the wake flow down steam of HAWT (Horizontal axis wind turbine) and subsequently designing of efficient wind farm for various flow conditions.

References

1. http://www. mnre. Gov.in
2. http://niwe.res.in/index_map.php
3. http://www.renewindians.com/2013/02/indian-renewable-installed-capacity-has-reached-27.7GW.html

Design and Development of High Performance Double Pass Solar Air Heater with Fins

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The future of our planet is intricately entwined with the future choices of energy, effective exploitation of non-conventional energy sources is becoming increasingly essential for modern world as fossil fuels are hazardous to environment and cannot sustain supply for long time as they are not renewable. In this scenario, solar energy is being seen as potential viable resource for ever increasing hunger of the energy for the development of nation and by and large globe. Further more numerous new designs of Solar Air Heater are emerging in various aspects, in different number of roughness, in different cost. Extensive review of research done in this field in recent past is covered with their design characteristics and their suitability for specific conditions and applications with respect to their merits and demerits.
A model of double pass solar air heater with selective coating and lateral fins attached to the absorber plate has been prepared to produce hot air by consuming solar radiation in the day time. It is kept in a position such a way that air flow due to forced convection and the entire setup placed in Guwahati region (26.110 N, 91.720 E). Air flow is through blower of 0.5 HP capacity and control by ball valve. Experiment has been done on different mass flow rates of 0.015 kg/s, 0.02 kg/s, and 0.03 kg/s. It is found that instantaneous efficiency is 81% and out let temperature is 62 0C, at the flow rate of 0.03 kg/s. And optimum result obtained at 0.02 kg/s.

Commonly observed degradation and its mitigation in field-aged photovoltaic modules in India

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The solar energy sector has experienced remarkable growth in recent years due to technical developments, encouraging government policies and cost reduction. But the quality control is the major concern with escalated targets. Major research has been conducted to study and analyze the factors contributed to accelerating the degradation effects of PV cells and modules which are responsible for significant power losses observed in solar photovoltaics (SPV) systems. SPV modules deployed outdoors can degrade due to exposure to the several components. This includes a range of fluctuating spectrum, temperature, humidity and operating system voltages. This paper presents the analysis of degradation effects over field-aged SPV modules have been operating for 18–22 years. It has been observed that the degradation includes discolored EVA and PV cells. Owing to material properties solar cell degradation is inevitable. The paper also reported the several degradation phenomena that are discovered in the commissioned plant at National Institute of Solar Energy, Gurugram which possess composite climate. A solution is later provided to increase the energy yield of the existing solar power plant. The paper also proposes a new methodology to decrease the degradation in the initial years of commissioned a new solar photovoltaic plant.

Performance analysis of high efficiency Sun Power based MaxeonTM PV modules in composite climate of India

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The objective of the analysis is to evaluate the suitability of high efficiency PV technologies under Indian climatic conditions installed at the National Institute of Solar Energy, Gurugram, India. Performance evaluation of Sun Power based MaxeonTM PV technology plant is based on the basis of Performance Ratio (PR), Thermal normalized PR (PR STC), Fill factor study against the module temperature. The system found to be operating in the satisfactory range. The average PR and the PRSTC found to be maximum in June and minimum in December month. The seasonal variation the PR and the PRSTC has been analyzed for four seasons and it has been found out that the range of PR is 0.94-0.96 during winter, 1-1.01 during summer, and 0.95-0.98 during the post - monsoon and 0.93-0.98 during Monsoon.
Keywords: Sun power, IEC 61724, Seasonal performance, performance ratio, Degradation

Modelling of Traction Power for an Electric Scooter

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Electric vehicle drives offer a number of advantages over conventional internal combustion engines, especially in terms of lower local emissions, higher energy efficiency, and decreased dependency upon oil. Over the long term, electric vehicles could represent a sustainable technology path. In several countries, Two-wheelers are the most common mode of public transport used for local commute. Two-wheeler electric vehicles are becoming popular nowadays, but there are no guidelines or standards to select the motor and battery specifications. An attempt has been made to fill this gap by simulating a two-wheeler electric vehicle to calculate the torque and power requirements of the electric motor with all possible vehicle dynamics parameters with reference to Indian Driving Cycle. A comparative investigation on different slopes and loads is carried out. A methodology to arrive at the motor specifications of a typical two-wheeler electric vehicle for the selected drive cycle is proposed. Simulations have been carried out to select a suitable electric motor by considering the continuous and short time loadings of the drive according to the RMS and peak rating of the electric vehicle drive motor.

Ultrasound enhanced bioconversion of total reducing sugar obtained from mixed Invasive Composite biomass to ABE fermentation: A mechanistic investigation

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Biofuels in today's era are considered as most favoured technologies when we considered various environmental and socio-economic issues by both developing and industrial countries. Though its expansion is mainly government policy dependent, yet its feasibility also depend on the quality of the fuel produced and availability of feedstock. n-Butanol is the better alternative to ethanol due to its versatile and sustainable front runner properties.

However, cost of raw feedstock which contributes approximately ~30-40 % of total production cost, less Butanol titre and energy consumption during separation and purification (Tracy et al., 2012) has limited so far biobutanol industrialization. In the present study, an attempt was made to simultaneously solve two daunting problem associated with ABE fermentation. The multiple invasive biomasses as a feedstock for Butanol production were used. These weeds cause enormous loss to various agricultural ecosystems. These weeds has been to contain sufficient sugar content (Borah et al., 2016), which can be utilized for Biofuel fermentation. The kinetics and yield also plays a major role in the overall efficiency and the economy of the process. The biochemistry of ABE fermentation leads to accumulation of five end products (three solvents, CO_2 and H_2 gases) via two intermediate metabolites (acetic and butyric - acids). The intriguing microbial physiology associated with the obligatory anaerobic Clostridia make it a challenging model system for study and optimization. Ultrasound irradiation for intensification process of ABE fermentation was used. Although it has been familiar practice in ethanol fermentation, it is relatively new for ABE fermentation. A mathematical model has been addressed based on original batch process experimental data from anaerobic fermentation using multiple invasive biomasses as a feedstock. It will summarize biochemical as well as physiological aspects of growth and metabolite synthesis by the production strain. This model comprises eight simultaneous ordinary differential equations (ODE), one each for the time profiles of cell mass concentration, glucose concentration and ethanol concentration in the fermentation broth. After fitting the simulation results to the experimental data of fermentation (using Runge– Kutta ODE solver coupled with Genetic Algorithm code), the variations or trends in the kinetic and physiological parameters of the mathematical model, gave an interesting mechanistic account of the mechanism of influence of ultrasound on fermentation process, as described in the subsequent sections. Moreover, multiparametric flow Cytometry (FCM) has been exclusively explored to gather substantial information on the physiological status and heterogeneity within bacterial population subjected to stress. (Khanna et al., 2012, Singh et al., 2015).

Keywords: ABE fermentation, mathematic modelling, flow cytometry, Clostridium acetobutylicum. etc

Grain Size Analysis of Moran and Naharkatiya Oil Fields Of Upper Assam Basin

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The grain size analyses for 6 conventional core samples obtained from various depths of Moran and Naharkatiya oil fields of Upper Assam Basin. We carried out Mechanical sieving method using a Ro-tap shaker was chosen for the analysis. The cumulative frequency curve is obtained by plotting grain size (in phi scale) versus cumulative percent using the Probability paper. The phi (Ø) values of the percentiles 5%, 16%, 25%, 50%, 75%, 84% and 95% were read off from the ogive curve and were plotted. These were used to calculate the statistical parameters of standard deviation, skewness, kurtosis and graphic mean. Studies have been used to understand the provenance of the core samples and also the deposition environment of both the study area.

SL	ASTM Sieve size	wt (gm)	Cumulative wt %	Ø
1	35	0.632	0.632	1
2	45	1.918	2.55	1.5
3	60	3.412	5.962	2
4	80	4.069	10.031	2.5
5	120	47.52	57.551	3
6	170	29.443	86.994	3.5
7	230	9.978	96.972	4
8	325	0.73	97.702	4.5
9	Retained	1.298	99	5
	Total	99		

Table:1 Data of a core sample from Moran oil field.

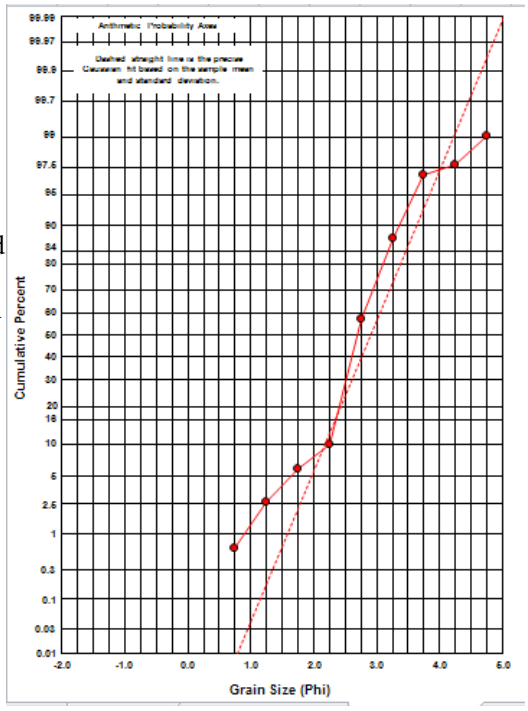

Fig 1 :Ogive/ Cumulative frequency curve of the table 1.

Development of IoT based Energy Management System for Smart Farming Applications

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In this paper an energy management system based on Internet of Things (IoT) is proposed that optimizes the storage and consumption of the available energy in several growth stages of a crop farmed in a controlled environment. Operating costs related to energy scheduling in currently available smart farming technologies are observed and an approach has been made to minimize the cost. An operating point characterized by period of sunlight and artificial light that can provide the system sufficient light and heat energy is obtained by keeping yield and production cost as constraints. Field parameters such as temperature and light intensity are constantly monitored and any change from the optimal values is automatically compensated by the system.

Potential Thermal Probe for Calibration of Shock Tube

Shock tube has potential to replace large scale on-field tests into laboratory versions as it can produce shock waves with peak dynamic pressures and temperature of wide range, within duration of a few hundred microseconds to several milliseconds. The velocity measurements are traditionally studied using pressure sensors which are fast responding but are of high cost having complex fabrication techniques. In this paper, an attempt has been made to completely replace these pressure transducer with in-house fabricated E-type CSJTs .The thermal sensors are a potential field of study to capture the flow diagnostics and are also very easy to fabricate with low cost. The primary Mach number is calculated with CSJTs and verified with pressure sensors and also from the formula (known pressure ratio). The work includes the design and fabrication of a low cost moderate sized (7.6m) shock-tube and calibrating it successfully by measuring and estimating primary shock Mach number through experiments and analytical calculations with average deviation within ± 10%.

Effect of electrohydrolysis pretreatment on anaerobic digestion of water hyacinth

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Phenomenal reproduction potential of water hyacinth and burning of fossil fuel is a problem worldwide. Anaeerobic digestion of water hyacinth is the solution for managing the noxious weed as well as produce eco-friendly biogas. However, biodegradability of water hyacinth decreases due to the presence of lignin, high cellulose crystallinity and confined available surface area. Thus, making hydrolysis a lengthy step and restraining the production of biogas. This study investigates the effect of electrohydrolysis pretreatment on water hyacinth to accelerate the hydrolysis step and as well as enhance biogas production. Electrohydrolysis pretreatment of water hyacinth at 20 V for 60 min demonstrated enhanced solubilisation of 42.9% than the untreated water hyacinth. Hence, bio-chemical methane potential (BMP) test was conducted for water hyacinth pretreated at 20 V for 60 min and untreated water hyacinth. By the end of 30 days, cumulative methane production of 2455 ± 17 mL for electrohydrolysis pretreated water hyacinth and 1936 ± 27 mL for the untreated water hyacinth was achieved. The results revealed the efficiency of electrohydrolysis pretreatment in dissolving the lignin content and reducing the cellulose crystallinity of water hyacinth.

Satellite observations of an Invasive plant bloom of ramsar site Deepor beel, Assam

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The study area is permanent fresh water lake, located in south west city of guwahati in Kamrup Metropolitan district of Assam. It is called wetland under Ramsar convention site. The rapid growth and accumulation of plants is of great concern,specially over water bodies. Deepor beel harbours a very large proportion of Aquatic Flora as well as fauna. However the growth of invasive plant in form of Surface water blooms is of major concern. The present study was done during monsoon period when the spread and growth of aquatic plants rises, also growth of weed plants enhances. This study is an attempt to measure spread done by an invasive alien plant Eicchornia crassipes (Water hyacinth), designated as world's worst aquatic weed. This aquatic plant is native to Amazon Basin and act as highly invasive species outside its native range. The study is based on observations taken by time series Landsat satellite imagery. The hydrology, Invasive plant coverage, Water body shrinkage changes has been analysed using Landsat 5TM, Landsat 8 satellite data in fixed time intervals. The study revealed shrinkage of not only the Beel area but also the extent of drastic spread of Water hyacinth. Also the gradual loss of water body for other species over the period of time has been determined. The study helps us to understand the use of remote sensing applications to evaluate and carry out ecological assessment at such large scale.

Keywords- Ramsar Convention, Invasive, Alien, Landsat, Remote sensing, Ecological.

Sustainable Solvents for Green Extraction Processes

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The solvents to be qualified as a green medium, these solvents have to meet different criteria such as availability, non-toxicity, biodegradability, recyclability, flammability, and low price among others. Up to now, the number of available green solvents are limited. Here we discuss a new family of ionic fluids, so-called Deep Eutectic Solvents (DES), that have emerged over the last decade as a novel class of ionic liquids (ILs). A DES is a fluid generally composed of two or three cheap and safe components that are capable of self-association, often through hydrogen bond interactions, to form a eutectic mixture with a melting point lower than that of each individual component. DESs are generally liquid at temperatures lower than 100°C. These DESs exhibit similar physicochemical properties to the traditionally used ionic liquids, while being much cheaper and environmentally friendlier. Owing to these remarkable advantages, DESs are now of growing interest in many fields of research. In this work, we report the major contributions of DESs as sustainable extractants in a variety of scientific and technological processes, namely, removal of pollutants, isolation or fractionation of target compounds, purification of fuels, dissolution and extraction processes and separation of azeotrope mixtures. All works discussed here aim at demonstrating that DESs not only allow the design of eco-efficient processes but also open a straightforward access to new chemicals and materials.

Keywords- Ramsar Convention, Invasive, Alien, Landsat, Remote sensing, Ecological.

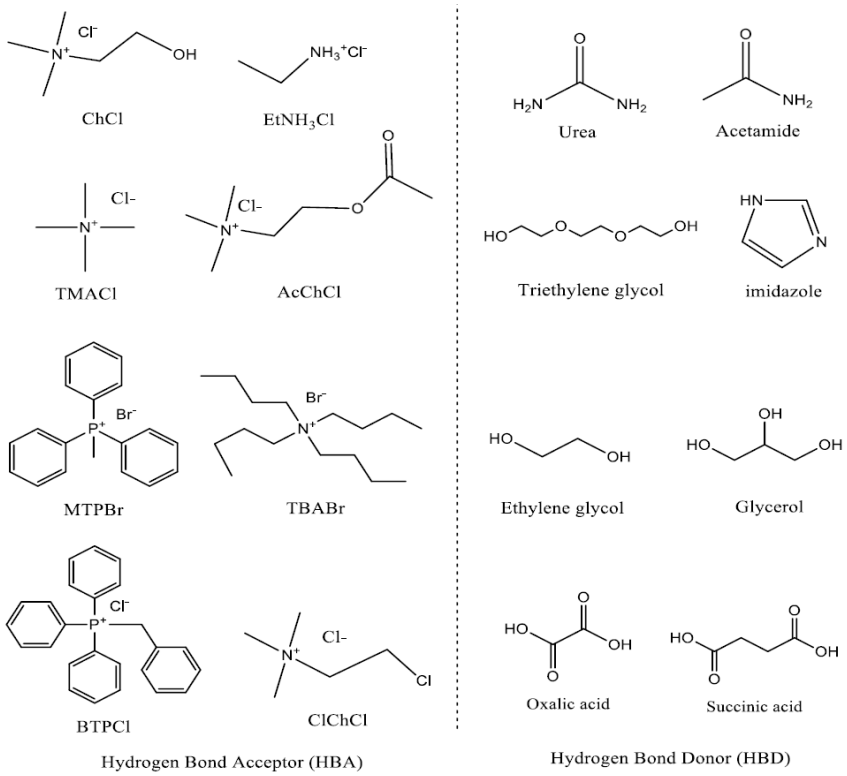

Figure-1. Typical structures of some halide salts as hydrogen bond acceptor and hydrogen bond donors used for DES syntheses.

Adsorption of textile wastewater using Alkali-activated sand

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This paper deals with the removal of dyes from textile wastewater with the help of alkali-activated sand as an adsorbent. The adsorption potential of sand particles (75-150 μm) has been reported to be reasonably higher and cost-efficient due to its stability, high surface area, mechanical resistance and abundant availability. The activation process, in general, increases the surface area and charge on the sand surface. In this research, Sodium Hydroxide was used for activation process. The batch adsorption studies were carried out with respect to time of contact and adsorbent concentration to evaluate the removal of dyes from wastewater. The surface of natural, modified and dye adsorbed sand was characterized using X-Ray Diffraction (XRD), Scanning Electron Microscopy (SEM), Zeta Potential Analysis and Fourier Transform Infrared Spectroscopy (FTIR). To examine the adsorption behaviour, Lagergren's Pseudo first order, second order, and Elovich's model were applied for kinetic studies. These studies indicated that pseudo-second-order model fitted best with the adsorption data with a correlation coefficient of R2 > 0.995 signifying that the reaction rate was solely dependent on the availability of adsorption sites, i.e., the surface adsorption interactions. The results reveal that the activated sand can be used as a cost-effective adsorbent for colour removal from wastewaters of the cotton textile industry. Moreover, the leaching of colour from the sand obtained after adsorption with colour imparting agents was found to be negligible when placed in clear water for longer durations due to formation of strong chemical bonds between dye molecules and sand surface. Therefore, this proves to be a favourable outcome for usage of sand as a replacement to fine aggregates for construction purposes.

Keywords: Textile Wastewater, Sand, Adsorption, Dyes.

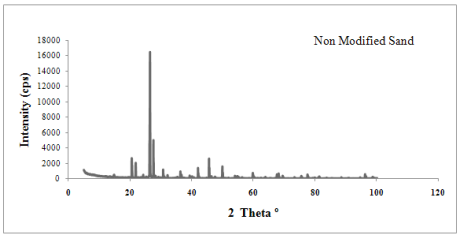

Fig. 1: XRD pattern of non-modified soil

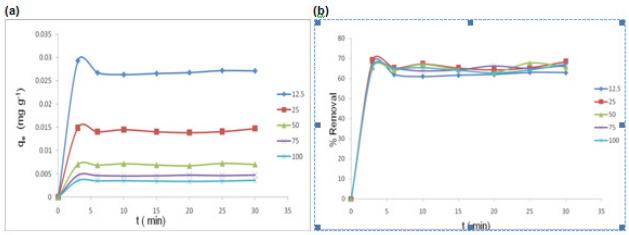

Fig. 2: Effect of absorbant dose and contact time on (a)removal per gram and (b) percentage removal

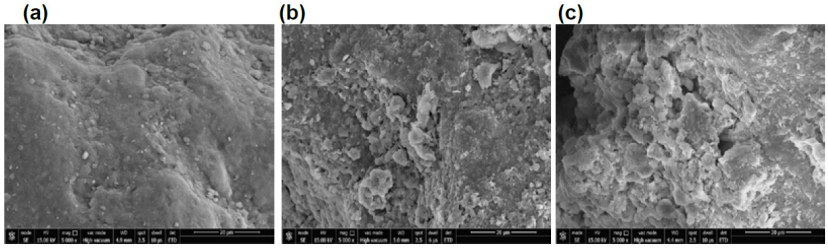

Fig.3. SEM and EDS images of (a) Non-modified sand (b) Alkali modified sand (c) Textile wastewater adsorbed sand

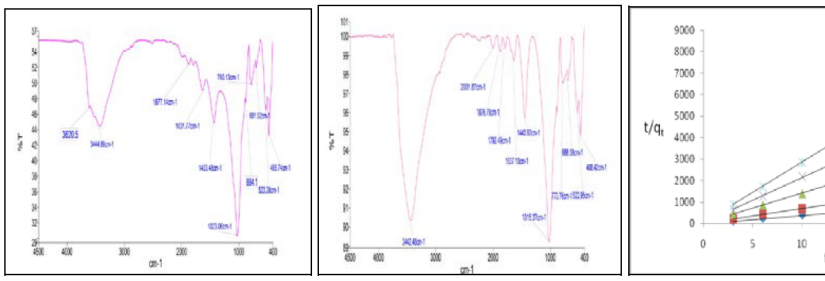

Fig.4. FTIR of Non modified sand and alkali modified sand

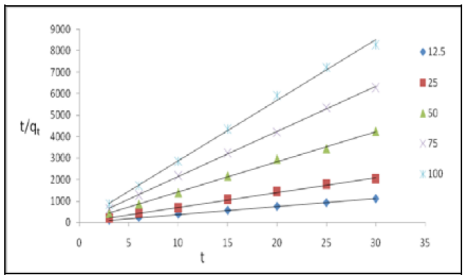

Fig.5.Pseudo Second order Kinetic model

Transformation of an industrial and municipal waste composite into a high value soil ameliorator

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Reclamation of wastes has been the key focus for sustainable environmental practices throughout last few decades. Specifically among these are industrial wastes, the generation of which are detrimental but unavoidable and defines the economic growth of the industry. Paper mill sludge is an organically rich waste generated from the virgin pulp and paper mills, difficult to degrade owing to its recalcitrant nature. Moreover, the industry suffers huge expenses for disposal of these wastes. However, these wastes have ideal properties for conversion into potential soil conditioner though being deficient of nitrogen through amendment with nitrogen rich material. Vegetable waste constitutes 45-80% of the organic fraction of municipal solid waste, creating menace for the municipal authorities. Instead it has about 2.5% nitrogen and therefore can complement paper mill sludge beneficially to serve as potential organic fertilizer. Current study therefore emphasized high rate composting (rotary drum composting) of paper mill sludge and vegetable waste composite to bring about a potential nutrient rich organic fertilizer. The composite mass was witnessed to acquire 2.53% in total nitrogen with about 16.7% reduction of organic matter. Moreover there was 16-26 % increase in nutrients i.e, Na, K and Ca including 39-26% increase in available and total phosphorus. However there was apparently 42-16% reduction in bioavailable and leachable fractions of heavy metals conforming the utilization of the compost of premium standards.

Keywords: Paper mill sludge; vegetable waste; rotary drum; composting; organic matter degradation; nutrients; heavy metals.

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A novel technology for treatment of oil field produced water

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Large volumes of water are produced during oil and gas production from various oil fields of Upper Assam Basin. Produced Water (PW) is a complex mixture and contains different toxic compounds that adversely affect the environment. PW separated from oil and gas is either injected into the reservoir for pressure maintenance or discharged to the environment. Therefore this paper makes an attempt to characterize and treat the produced water by self-designed novel technology. This study deals with the characterization of PW generated from different depths and horizons of Upper Assam oil fields. The characterization includes the quantification and qualifications of physical, chemical and biological parameters. These characterization are evaluated by comparing with the World Health Organization (WHO) standards to meet government discharge regulations of waste water for a greener ecosystem. This paper also tries to design a PW treatment technology by incorporating adsorpti1`on with intervention of different membrane technologies. The results of the treated PW from the treatment technology confirm to the WHO standards. Conductivity (1.76-19.5) mS, Turbidity (4.4-187) NTU, Alkalinity (28.7-725.29) ppm, Hardness (40-70) ppm, oil & grease (O&G) (1000-3500) ppm, Na (277-2794) ppm showed values much higher than the safer limits for its disposal. Whereas DO value is (2.3- 5.3) ppm which is lower than the permissible limits indicating low level of free, non-compound oxygen present in water. For the safer disposal the PW is treated with both ultrafiltration (UF) and microfiltration (MF) membrane in continuous cross flow cell (CFC) and UF, MF and Nano filtration (NF) membranes in hollow fibre (HF) membrane setup. All the membranes showed optimum efficiency with respect to their treatment performance. Due to the contaminants, a film of suspended or dissolved solids is deposited on the membrane surface or on the membrane pores which decreases the performance of the membrane. There were minimal fouling of the membranes in HF membrane setup as compared to CFC. Activated carbon is used as the filtering medium for treatment of PW.

Keywords: Evaluation, Characterization, Environment, Produced water, membrane treatment, membrane fouling.

References
[1] Y. Du, L. Guan, and H. Liang, "Advances of produced water management," Canadian International Petroleum Conference, 7 -9 June, Calgary, Alberta, 2005.
[2] K. Guerra, K. Dahm, and S. Dundorf, "Oil and gas produced water management and beneficial use in the Western United States," U.S. Department of the Interior Bureau of Reclamation, Science and Technology Program Report No. 157, Technical Service Center. Sep. 2011.
[3] Z. Khatib, and P. Verbeek, "Water to Value – Produced Water Management for Sustainable Field Development of Mature and Green Fields," J. of Petroleum Technology, pp. 26-28, Jan., 2003.
[4] S.B. Gogoi, and A.S. Tamuli, " Recent Advances in Treating Oil Field Produced Water: A Review," J. of Petroleum Engineering & Technology, vol. 4, no. 2, pp. 366-370, 2014.
[5] J.A. Veil, M.G. Pruder, D. Elcock, and R.J. Redweik, "A White Paper Describing Produced Water from Production of Crude Oi l, Natural Gas, and Coal Bed Methane prepared by Argonne National Laboratory for U.S. Department of Energy," National Energy Technology Laboratory, Jan., 2004.
[6] A.A. Al-Haleem, H.H. Abdulah, and E.A. Saeed, J, "Components and treatments of oilfield produced water," Al-Khwarizmi Engineering Journal, vol. 6, no. 1, pp. 24 – 30, 2010.
[7] H. Patel, D. Borgohain, and S. Jena, "Hydro geochemistry of Upper Assam Oil field," J. of Petroleum Technology, vol. 2, p p. 11 – 14, 2003.
[8] B. Stone, "Management of Produced water," Oxford publications, Washington, 37-41, 2003.
[9] O.F. Joel, C.A. Amajuoyi, and C.U. Nwokoye, "Characterization of formation water constituents and the effect of fresh water dilution from land rig location of the Niger Delta, Nigeria," J. Applied Sci. Environ. Management, vol.14, no. 2, pp. 37 – 41, 2010.
[10] R.P.W.M. Jacobs, E. Grant, J. Kwant, J. M. Marqueine and E. Mentzer, " The composition of produced water from shell operated oil and gas production in the North Sea," In: J.P. Ray and F.R. Englehart, Eds., Produced Water, Technological /Environmental Issues and Solutions, Plenum Press, New York, pp. 13-21, 1992.
[11] Konwar D., Gogoi SB, Barman J, Gogoi MP, "Correlation Analysis of Formation Water of Upper AssamBasin for a Greener
Ecosystem" International Journal of Engineering Technology Science and Research (IJETSR), ISSN 2394 – 3386, Volume 4, Issue
8, August 2017
[12] S.B. Gogoi, R.K. Sen, A. Rajbongshi, K. Hazarika, "Characterization of Oil field Produced waters of Upper Assam Basin,
India,"International Journal of New Technologies In Science And EngineeringVol. 2, Issue. 1, 2015, Issn 2349-0780.

Biodegradation study of rice straw using paper mill sludge

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Rice straw is abundant in the nature, which is lignocellulosic material. The complex structure of lignocellulosic material makes it hard to be biodegraded, resulting in poor digestion rate when it used as substrate for microorganism. In this study, Biodegradation rate of rice straw was investigated by using a paper mill sludge in terms of Soluble COD (sCOD) and Volatile Fatty Acids (VFA) production. Maximum sCOD and VFA production was found to be in the range of 152.2 mg/L, 292.6 mg/L, 286.6 mg/L and 235.8mg/L at 10th day in CN1, R1, R2 and R3 while the VFA production was observed as 18.75 mg/l, 56.25 mg/l, 50 mg/l, 53 mg/l. MLVSS concentration at day 39 was found to be 4384 mg/l, 6016 mg/l, 8832mg/l and 7152 mg/l in CN1, R1, R2 and R3 respectively which was higher than the initial concentration. FESEM and EDX spectra are confirming towards the degradation of rice straw which is done by cellulose degrading micro-organism which remains present in the paper mill sludge.

Resource recovery from solid waste employing earthworm gut isolated bacteria: A step towards in-situ waste degradation system

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The major goal of this work was to utilize earthworm gut isolated bacterial inoculums for rapid production of quality composts from biowastes. Inoculums of four efficient nutrient mobilizing strains of gutbacteria(Burkholderia vietnamensis, Burkholderia spp, Bacillus cereus, Serratia marscescens) were employed in presence and absence of Eisenia fetida in composting reactors prepared with vegetable waste(VW), Rice straw(RS) and cowdung(CD) in 2:2:1 ratio. Significant improvement in regard to nutrient availability (N, P, and K) and enzyme activity was recorded under EW+ inoculum treatment. Moreover, EW+I4 treatment was found to be superior than other treatments with respect to compost quality and time economy. However, among the four inoculums combination, I4 (Bacillus cereus and Serratia spp) was the best performer. In addition, strains of prolific cellulolytic bacteria and fungi were identified from the EW, EW+I4, EW+I3 and EW+I2 inoculated feed mixtures.

Keywords- Biowastes, earthworms, composting, gut-bacteria

Econanotoxicity and environmental impact of engineered nanomaterials: navigating possible strategies for nano-bio-eco interactions

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In recent years, a noteworthy progress has been noted in the area of nanotechnology as evident from its widespread use in textile, electronics, pharmaceuticals, cosmetics, etc. Despite of its tremendous benefits, the indiscriminate use of engineered nanomaterials in consumer and industrial products and their subsequent release into the ecosystems poses serious threat and has potential adverse environmental impacts. However, very little is known on risk assessments for nanomaterial emissions to the environment and little or no data exist on reliable measurements of nanomaterials at environmental concentrations. In this context, the present work aims to compile and present recent technological advances, potential health hazards and risks to the environment as well as regulatory background of engineered nanomaterials used especially, in nanopharmaceuticals. As many issues regarding the bioavailability, uptake, and the toxicity mechanisms remain to be elucidated, we herein summarize the current understanding of toxicity of engineered nanomaterials used in nanopharmaceuticals, highlighting the pressing need within the field of econanotoxicity. In addition, grey areas, challenges and tentative suggestions for future research will be outlined.

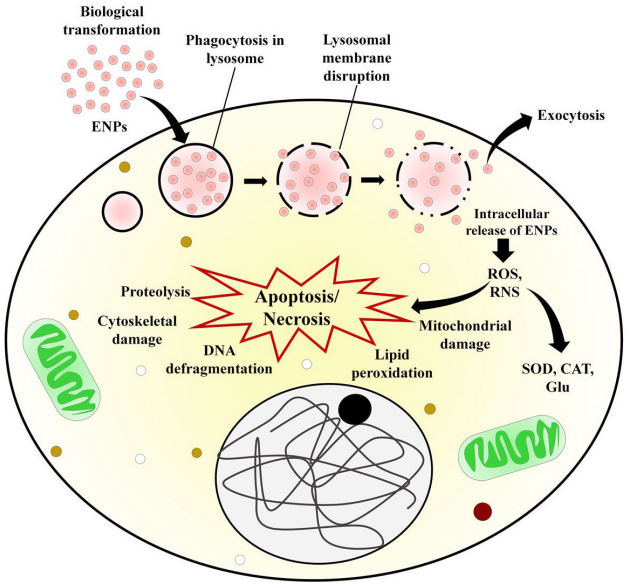

Figure: Schematic representation of cytotoxicity generated by engineered nanomaterials

Keywords: Engineered nanomaterials; Nanopharmaceuticals; Econanotoxicity; Risk assessment

Synthesis and characterization of geopolymeric materials fabricated using fly ash: An industrial solid waste

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The alkali activation of alumino-silicate industrial solid waste material has become an important area of research since last couple of decade. As million tons of these waste are polluting our environment every day, so there is need came to use this waste material to convert value added products. In this present study, fly ash was collected from National Thermal Power Corporation Limited, Bongaigaon, Assam and investigated as a precursor material for processing geopolymeric materials. The collected fly ash was characterized by means of various techniques and feasibility study of making geopolymeric specimens has been examined. Geopolymeric materials were synthesized by mixing fly ash, with different concentration of sodium hydroxide solution followed by room temperature curing, oven curing and hydrothermal curing as well. Effect of concentration of sodium hydroxide solution and curing condition on strength of geopolymeric specimens have been discussed with the help of the micro-structural feature, phase analysis, spectroscopy and fractography study as well.
Keywords: Fly ash, Geopolymer, alkaline liquid, microstructure, spectroscopy.

Mitigate the flood problem by increasing the hydraulic conductivity of soil

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Flood causes loss of life and great damage to buildings, bridges,railways, canals and man-made structures. In Assam flood repeats itself every year and leaves the economy in utter mayhem. The floods of last year displaced 1.83 lakh people in the state. Increasing the hydraulic conductivity of soil can be a solution in mitigating the flood problem and check the loss done by it. Hydraulic conductivity is a property of soil that describes the ease with which a fluid (usually water) can move through pore spaces or fractures. It is the ratio of velocity to hydraulic gradient indicating permeability of porous media. Increasing the temperature of the soil can increase the hydraulic conductivity of the soil. Flow of water through soils is governed by Darcy's law. According to this law, the velocity of flow of a liquid through soils is proportional to the hydraulic gradient that causes the flow. Now in our study, experiment is done by using conical flask, clay-soil, thermometer and filter paper. We have studied how hydraulic conductivity of soil increases by increasing the temperature. Hence, heating the soil will result in the increase of its permeability. Therefore, the flow of water also depends on the temperature of the soil. This can be of great help in mitigating the flood problem and check the havoc caused by it.
Keywords: flood, hydraulic conductivity, temperature , soil

References: Water temperature effect on hydraulic conductivity and infiltration rate of soils. G. J. Levy , H. J.C. Smith & M. Agassi. (1989)

Bioremediation of heavy metals from water with the help of plant resources and their equilibrium and kinetic studies

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In this work, Centella asiatica plant has been studied for its heavy metal removal potential. The fresh biomass was treated with the help of batch experiments. The heavy metal that was used for the study was lead. The result obtained from the study shows that this plant has the potential to remove heavy metal from water. The effect on the adsorption of various parameters, such as contact time, adsorbent dose, initial metal ion concentration, pH and shaking speed were also studied. To know their effect over rate and extent of adsorption, different isotherms like Langmuir, Freundlich and Temkin isothermic models and kinetic models like Pseudo First Order, Pseudo Second Order and Elovich kinetic models were used. The adsorbate was analysed in ICP – OES. The surface microstructures were studied with the help of SEM. The carbon, hydrogen and nitrogen percentage of the sample were also determined using CHN analyser.

Assessment of Phytoplankton diversity of River Kolong in Nagaon District

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Assessment of phytoplankton biodiversity was carried out in three selected stations of river Kolong, Nagaon district, Central Brahmaputra Valley Zone for a period of 6 months from February to July, 2017. A total number of 44 genera of phytoplankton were recorded from river during the study period. Of these, 38.64% belong to Bacillariophyceae (17 genera), 31.82% Chlorophyceae (14 genera) and 29.54 % Cyanophyceae (13 genera). Among the diatoms, Navicula sp., Nitzschia sp., Tabellaria sp., and Cyclotella sp. found to be most common and dominant in all the stations. Ulothrix sp., Volvox sp., Zygnema sp. and Chlorella sp. were found to be most dominant members of Chlorophyceae. Cyanophydeace was dominated by Anabaena sp., Chlroococcus sp., Nostoc sp. and Spirulina sp.

Keywords: Phytoplankton, Biodiversity, Kolong, Bacillariophyceae, Chlorophyceae, Cyanophyceae

Water diplomacy: Institutional mechanism for Brahmaputra river governance

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The Yarlung-Tsangpo- Brahmaputra-Jamuna river basin (hereafter referred to as the Brahmaputra river basin) spreads across China, India, Bhutan and Bangladesh. Being transboundary in nature, the hydrology of the river links the basin countries through an intricate network of interdependencies. The prevailing power asymmetry, lack of trust and confidence, historical contentions, zero-sum game attitude and absence of multilateral mechanisms has an effect on the management of the river basin. Water diplomacy can be used as a tool to enhance cooperation over shared river basins like the Brahmaputra. According to The Hague Institute for Global Justice, water diplomacy "includes all measures by state and non-state actors that can be undertaken to prevent or peacefully resolve (emerging) conflicts and facilitate cooperation related to water availability, allocation or use between and within states and public and private stakeholders".

Since the Brahmaputra cuts across national, political, social, economic, and sectoral boundaries, it is crucial to identify various actors (state and non-state) that have the potential to influence cooperation at these levels. Water diplomacy involves gaining an understanding of the multifarious dimensions and the stakeholders involved. It helps in increasing regional cooperation through the development of sustainable and peaceful solutions, and in turn trust and confidence among the riparian nations. In order for water diplomacy to work effectively and efficiently, it is first crucial to look into the prevailing institutional mechanisms within the basin. An analysis of the prevailing political settings in which the interactions over the Brahmaputra Basin take place within the region will give an insight into the existing river governance mechanisms. The overall effectiveness of the cooperative process depends upon the institutional capacity of the basin countries, the presence of dispute resolution mechanisms and frameworks.

Keywords: Water diplomacy, Brahmaputra River Basin, Institutional mechanisms

References:

Rees, G., 2010. The Role of Power and Institutions in Hydrodiplomacy.
Swain, A., Huntjens, P., Yasuda, Y., de Man, R., Magsig, B.O. and Islam, S., 2016. The Multi-track Water Diplomacy Framework: A Legal and Political Economy Analysis for Advancing Cooperation over Shared Waters.

Remediation of Chromium: An Overview of Chemical and Microbial Processes and Mechanisms

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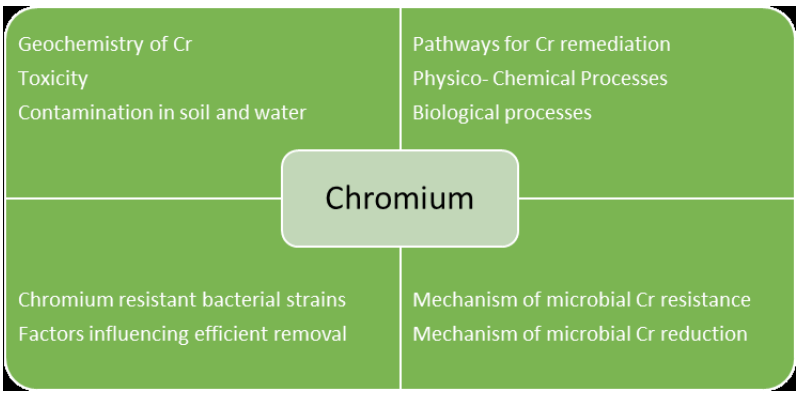
Chromium is one of the most extensively used metals in various industries. It has various oxidation states, out of which Cr(VI) is highly toxic as it is carcinogenic and mutagenic by nature. It is also a priority pollutant which affects the metabolism of different microorganisms, as well as plants. USEPA has classified Cr(VI) as one of the 17 chemicals causing the greatest threat to humans. The permissible limit for total chromium in potable water as set by WHO is 0.05 mg/L. Generally, the physico-chemical remediation techniques are widely used for Cr removal. However, microorganisms can also be very effective in Cr remediation as evident from the Cr-resistance mechanism displayed by some microbial species. Hence, bioremediation is gradually evolving as a potent technique to curb the problem of Cr(VI) pollution. This review focuses on chemistry of chromium, extent of chromium contamination in soil and water, toxicity of chromium and its remediation through chemical and biological pathways. The interaction of chromium with various isolated bacterial strains, factors influencing the efficient removal of Cr(VI), their resistance and reduction mechanism towards Cr(VI) remediation are also discussed in detail under the purview of the present study. This detailed understanding is necessary to enable any lab scale biotechnological technique to evolve into a large-scale reactor engineering, which can be a highly effective and proficient solution in this regard. A schematic representation for this review paper is provided below.

Keywords: Chromium, Bioremediation, Cr reduction, Mechanism.



Understanding the linkage between poverty, inequality, natural resources depletion and sustainable development in Asia: An ecological footprint perspective

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Although sustainable development is said to have three pillars - economy, society and environment, sustainable economic development is considered as the key concern to achieve social welfare. Economic growth is still being taken as the main instrument to eradicate the most fundamental challenge to civilization - poverty. But growth, in terms of gross domestic product (GDP) cannot be a complete measure of sustainable development. Because GDP never takes into account the cost of depletion of natural resources. Declining natural capital poses a direct threat to those people in developing nations who still depend on nature for their livelihood (Dasgupta, 2010). Both poor and rich countries understand the importance of natural capital, but the developing economies, faced with multidimensional realities, often degrade their natural capital while working for achieving economic development. These countries have a tendency to follow the growth path of developed countries in order to eliminate multidimensional poverty. Most of the developing countries, particularly in Asia, have to feed majority of the world population. Further, societies of these countries are vulnerable to many social evils as well as environmental catastrophes including medical backwardness, unemployment, inequalities among rich and poor, natural calamities etc. Hence to meet these multiple challenges, natural capital is under threat, due to growing demand for food, water, energy and materials, as well as the to fulfil the need for land for towns, cities and infrastructure (APFED, 2010; Dahiya, 2012; WWF and ADB, 2012). With the growing population and changing lifestyle, the pressure on the environment in the evolving Asian economies is likely to increase in the future. Strategies will be needed that will ensure sustainable use of resources as well as effective way to maintain the natural capital. Many of the developing Asian economies have developed remarkably over the last four decades. Industrialization and international trade were very rapid in the sub-regions of Northeast Asia, South Asia, and Central Asia since 1998. 4 to 8% growth rate has been recorded annually in these regions which is quite high. In Southeast Asia, though the annual GDP growth rate fell significantly in 1998 due to the Asian monetary catastrophe, it exceeded 4% in 2002 and recovered fruitfully from the economic downturn. According to Lee and Hong (2012), Asia's real GDP in purchasing power parity (PPP) experiences almost 7.5 times increase in 2009, compared to only 3 times increase in the global economy. Such magnificent economic growth has helped many Asian countries to reduce poverty and to increase their influence in the global economic platform. According to many projections (see APFED, 2005; Galli et al., 2012), current economic Asian trends are likely to last, or enhance even more swiftly in the next 10-12 years compared to other regions of the world. It could become the most dynamic region and a growth centre for the world by 2025. Asia's economic expansion, over the last 40 years, is not only because of economic policies, but also because of support received from natural resources (APFED, 2005). Human actions related with such extension have already placed too much pressure on the environment, resulting in serious environmental degradation, which now poses a grave risk to the region's growth projections, thus establishing a clear hindrance to achieving sustainable development. Therefore, it is critical to achieve sustainable development in this region so that sustainable development can be achieved globally. Hence the main objective of this study is to understand the linkage among poverty, inequality, natural resources and sustainable development. For this purpose this study has selected five low-middle income countries based on the World Bank classification2 (Bank, New Country Classifications, 2015). The selected countries are Bangladesh, India, Indonesia, Pakistan and Philippines. The variables under study are Gini Co-efficient, Multidimensional poverty index, GDP. To measure inequality in resource consumption, the indicator of ecological footprint has been adopted. The approach of ecological footprint offers an accounting system tool to measure the resource dimension of sustainable development. It is the demand of a population for natural capital which quantifies the biologically productive land and sea that a population needs to fulfil its materialistic as well as life-supporting needs. In this respect, a remarkable analysis would be to adoption of this indicator to compare the level of inequality in the resource use between countries, in a context of limitations on the planet's bio-capacity3 and the accelerated growth in consumption. Study period is taken from 1970 to 2015 for which secondary data are collected from various trustworthy sources. The study reveals that there is a close linkage among poverty, inequality, resource depletion and sustainable development of the countries under study. GDP acts as a measure to eradicate poverty in some countries, but has become a catalyst for resource depletion in some other. Ecological footprint has indicated that low-middle income countries have to raise their ecological footprint to achieve social sustainability. The results may be helpful in policy making processes of the countries under study.

An Environmental History of Tea Plantations in Colonial Assam: The Proliferation of Scientific Resources

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The tea plantations of Assam, since their very inception in the first half of the nineteenth century, have been contributing towards modifying Assam's landscape and environment. The story of Assam tea is an account of a British-contrived enterprise of altering a geographical terrain and topography, an aspect which most literature pertaining to the Assam tea plantations tend to overlook.

Alongside the distinctly visible changes in the landscape, like the clearance of the forested land to make way for the tea gardens, many other crucial changes were also inconspicuously creeping in, like the human-induced modifications of the wild tea plant to suit the needs of perpetual production and exhaustion, alteration, and erosion of the soil of the plantations owing to the perennial nature of the plantations. The consequence of this highly regularized and exploitative endeavour also paved the way for the creation of a problem that assumed a tremendous magnitude, i.e. the rapid propagation of pests, blights and insects in these gardens. The anxiety of the planters regarding the declining productivity of the soil as well as the invasion of destructive pests, insects, and blights translated into the intensification of botanical, entomological enquires and simultaneously, a market for manures, fertilizers, pesticides and insecticides began to proliferate.

The entire pursuit of discovering "good" tea within the British province of Assam and later the aforementioned environmental crises initiated an incessant inflow of resources in the form of agricultural expertise into Assam, through the initiation of various enquiry committees, tea research institutes along with collaborative efforts among planters, experts and local people. This inflow insidiously brought about a greater degree of control of the colonisers over nature, an idea originally articulated by historian Richard Drayton in one of his works1. An examination of prominent nineteenth and early twentieth century manuals, treatises and reports prepared by botanists, entomologists, chemist, geologists, planters as well as agricultural experts, such as Harold Mann, George Watt, P. H. Carpenter, G. D. Hope, M. K. Bamber and others, the then prevailing discussions and enquiries shed light on the priorities and the motivations behind such investigations on the tea plantations in Assam. Such research and experiments began as early as in the 1830s with the appointment of a scientific deputation to Assam in order to examine the indigenous tea plants. These endeavours also benefitted from institutions like the Agricultural and Horticultural Society Calcutta and Royal Botanical Society London. This paper would be an attempt to understand the historical processes as well the outcomes of the inflow of such scientific resources into the Assam tea plantations and also try to understand how such inflow of intellectual resources helped tighten their stranglehold over the Assam's natural resources in general and tea in particular.

1 Drayton, Richard. Nature's Government. Science, Imperial Britain, and the 'Improvement' of the World. New Delhi: Orient Longman, 2005.

Poverty and Income Inequality in Rural Longleng district, Nagaland

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Abstract: This paper investigates the poverty level among the households in rural areas of Longleng district using Head Count Ratio (HCR), Poverty Gap Ratio (PGR), Sen Index, Foster-Greer-Thorbecke (FGT) and Multidimensional Poverty Index. However, poverty still continues to be a major problem in the district, thereby, widening the gap between the rich and the poor as a results Gini-coefficient Model was used to presents the level of income inequality that exist in district. The paper then attempts to present the impact of education on employment, poverty and income using Linear-regression Model. Thus, this paper tries to analyze the existence of poverty and income inequality in rural region and the results shows higher level of poverty and income inequality exist in rural Longleng districts.

Keyword: Poverty, Multidimensional Poverty, Income inequality, Longleng

Introduction: Poverty has traditionally been understood as a lack of resources necessary to fulfill essential needs. Absolute poverty referred to the subsistence below a minimum needs. The concept of relative poverty is largely replacing the classical concept of absolute poverty in developing (Mack and Lansley 1985, Atkinson 1975).

Methods and Materials: Data collection for the study of this paper household survey was conducted in rural Longleng. For measuring the poverty level, Monthly Per capita Consumption Expenditure was used to analyse HCR, PGR, Sen Index, FGT, and MPI, for income inequality Gini-coefficient model was used.

Results:

Rural	HCR	PGR	Sen Index	FGT	MPI
Bura Namsang	0.2692	0.0828	0.1482	0.0399	0.293
Nian	0.6987	0.0779	0.3615	0.0376	0.494
Sakshi	0.7884	0.0793	0.5279	0.0455	0.459
Yachem	0.2331	0.0695	0.1132	0.0322	0.227

Table 1. Estimated Poverty for Rural Longleng

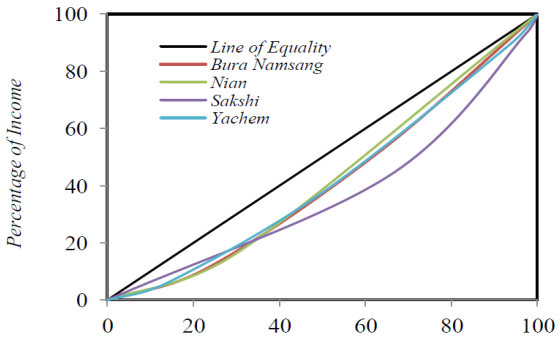

Fig.1. Population wise distribution of MPCE in rural Longleng

Social Sustainability of Water Supply: Examining Water Governance in Shillong

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The Khasi Hills in Meghalaya, India are governed by a dual system of governance – the traditional and the modern. In the city of Shillong, water governance is executed by the state government, the urban local body (municipality) and the village councils (called the dorbar shnongs).

As a common resource property, water is not fairly distributed. Urbanization poses a lot of challenges to water distribution in this hill city. The paper examines the working of the traditional local institutions in augmenting water supply. The research reveals an interesting finding. In the non-municipal areas, water equity is better when water is accordingly governed by the traditional institutions. Their degree of participation and efficiency depends on many factors.

These village councils are semi-democratic and their relevance is being examined. Some of these institutions are associated with clans which have control over water sources. Power in these village councils is thus controlled by clan members. These and many are the criticisms against these traditional rural institutions. These institutions of the people will have to 'modernize' for water sustainability in the city and for social sustainability of the people in general. The paper also examines possible solutions.

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This will be basically a descriptive oral presentation in which I will describe about one of the most highlighted crypto currency i-e Bitcoin. What is Bitcoin will be explained. Who developed this new things and what compel his/her/them to do so? Bitcoin is used in many places; one can purchases any thing using Bitcoin just like any paper currency. One can invest in Bitcoin also. How Bitcoin works and how are they generated will be explained. What is difference between this currency and paper currency? Price of Bitcoin is very volatile, it keeps on fluctuating day to day. Reasons behind this fluctuation will be examined. Bitcoin has been used in many criminal activities such as drug, porn video etc. Government can only warn people, financial institutions about using Bitcoin but cannot ban them why it is so? In fact some countries legalised this currency as a mode of payment. There is huge financial and security risk in dealing with Bitcoin, what are they will be carefully analysed. How one can make money i-e Capital gain using Bitcoin and whether this profit is taxable item, all these will be explained. What will be the condition of Bitcoin during that time (March) will be also discussed.

Market Signals and Farmers' Response: Evaluating Indian Agriculture after the Green Revolution

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Technology revolutions have the potential to usher in commercialization. In India, the Green Revolution (GR) led to large-scale technology adoption in agriculture in several regions. This study examines if such a technology revolution could increase the market-orientation of Indian agriculture. It adopts a Nerlovian framework to estimate responsiveness of the commercial crops (non-foodgrain sector) to changes in real relative prices faced for a period of 33 years from 1976-77 to 2009-10. The analysis does not find any conclusive evidence to suggest improved price elasticity of agricultural supply resulting from GR. To contrast the price-responsiveness of those regions where GR is seen to be relatively successful with that of the rest of the country, a panel regression with random effects specification was run separately on the four states-Punjab, Haryana, Kerala and Tamil Nadu. However, no clear evidence of price-responsiveness of agricultural output could be found here either. Instead, non-price factors (especially deficit rainfall) are found to be more important in determining agricultural output. Another important nonprice factor affecting agricultural supply, viz. fertilizer consumption, has increased exponentially after the GR. The study's findings raise important questions related to the possible existence of a non-linear relationship between the fertilizer consumption and yield, and about the effects of widespread deviations from the ideal N:P:K1 ratio on output. The study comes to the conclusion that the performance of agriculture in the years after the GR shows no direct evidence of increased market orientation of the 'commercial' non-food-grain sector. However, better insights can be obtained by conducting more in-depth and disaggregated analysis of the dynamics of agricultural supply.

Keywords: Supply response, Terms of Trade, Agricultural production, technology adoption, market orientation.
JEL codes: Q1, C1, C23.

Conversion Of Forests Into Shifting Cultivation And Its Impact On Soil Organic Carbon Budget Of Nagaland, India

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The North East Indian state of Nagaland is an important part of the Eastern Himalayan Biodiversity hotspot region and is endowed with a rich diversity. The traditional agriculture system of the state is shifting cultivation which is locally referred to as jhum. In recent years the jhum cycle has shortened from 10-15 years to a meager 4-5 years owing to demographic pressures. This has become one of the major drivers behind the conversion of primary forests to shifting cultivation. Land use changes in such a highly diverse region not only affect the overall biodiversity but also alters the soil organic carbon budget of the ecosystem. This study attempted to estimate the changes in carbon stock in two contrasting land uses viz. 'forest' and 'shifting cultivation' following standard protocols. 156 soil samples from both the land uses were collected from three depths 0-15, 15-30 and 30-45cm and SOC was estimated following the Walkley and Black method. The carbon stock in the forest has been recorded to be 61.66 t C ha-1 whereas in the shifting cultivation it was estimated to be 51.94 t C ha-1.This study reflects on dwindling natural resources owing to reduction in forest cover. Thus, this change in land use dynamics has serious implications in the overall carbon budget in Nagaland and needs to be addressed effectively to prevent further loss of this rich, immense natural resource.

Key words: Land use change, Sustainable management, Forest cover, Carbon stock, natural resource.

The Evolution of the Sculptural Art of Kamakhya Temple

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The archaeological site of the Kamakhya temple is situated on the Nilachala Hill on the western part of Guwahati in Assam, India. This paper is built on the thesis that the sculptural art of the Kamakhya temple belongs to the Kamarupa School of art named after the place of its origin, Kamarupa (ancient Assam). The Kamarupa School of art is divided into three phases, the ancient Kamarupa School of art; the early medieval Kamarupa School of art; and the late medieval Kamarupa School of art. Each phase of Kamarupa School of art has its own characteristic features but architectural and iconographical styles and designs from South and Southeast Asia have often been used and incorporated with the styles of the Kamarupa School of art. The ancient Kamarupa School of art comprises the influence of Gupta art, while the early medieval and late medieval comprises the influence of Pala-Sena and Ahom period art respectively. The amalgamation of the all these influences with the local and indigenous art resulted in the formation of this distinctive Kamarupa School of art.

The majority of the sculptures in the site belong to the early medieval and the late medieval period of the Kamarupa School of art. This is evident in the treatment of the sculptures especially the Bhairava sculptures on the exterior wall of the sanctum sanctorum of the main Kamakhya temple. The four-handed Bhairavas are depicted with a slender body with refined waist and broad shoulders, wearing different types of ornaments and headgears (kiritamukuta). Surprisingly none of the sculptures have any knee and ankle joints. The sculptures are standing in a tribhanga posture, slightly tilted to their right side. The oval face sculptures are depicted with wide open eyes and fuller parted lips (creating a weird smile). These sculpture are one of the examples of the early medieval Kamarupa School of art present on the site.

The primary aim of this paper is to understand the evolution of the sculptural art of the Kamakhya temple site and classify the sculptures on the basis of stylistic features of the specific phases of the Kamarupa School of art. This will also be an attempt to identify the main features of the Kamarupa School of Art in Northeast India. This critical study of art will help to cultivate knowledge of religious, aesthetic, social, theoretical, and economic principles prevailing in ancient Kamarupa

AGRIPRENEURSHIP IN ASSAM- POTENTIALITIES AND CHALLENGES

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Agribusiness marketing is the key issue for Indian economy and livelihood because more than 60% people live in rural areas and agriculture and its allied sectors contribute around 20% gross domestic product of the country. It generates employment to approximately 60 percent of the population. As the demand for traditional agricultural system is diminishing, there is a growing need of the entrepreneurship and management of the agribusiness sector and the entrepreneurship development for the rural communities in the state of Assam. Although Assam has a lots of potentiality for agripreneurship having its 86 percent of rural population out of 312.06 lakh (according to Assam Economic Survey, 2011 census), opportunities for various trending and global agribusiness sectors like agrotourism, farmtourism, floriculture, food processing, apiculture, etc are not being exploited. Agribusiness is nothing but the profitable marriage of Agriculture and Entrepreneurship. If this profession remain viable in the long run, it must continue to evolve, developing opportunities with agribusiness sector of Assam in order to meet the demands of a changing market. Hence, a study on agripreneurship in the state of Assam was carried out with the objective of studying the potential and challenges of Agripreneurship in the state. The study used both primary and secondary data. Primary data were collected through interviewing the respondents personally. Amongst, various agripreneurship the study mainly focused on agrotourism, farmtourism, floriculture, food processing, apiculture, etc. It was found that the selected agripreneurships were able to contribute to the income of the owners beside providing employment opportunity to the rural communities. Moreover, due to social media and growing need of awareness a term called "Agrotertainment", is evolving hand in hand with agripreneurship due to emphasis on meaningful resource utilization and maximum earning potential from the agro activities. Though the government is coming up with benevolent schemes and consideration of Agribusiness potential for the state like Act east policy, Advantage Assam etc. still due to lack of skilled labours, proper training, much needed awareness were found to challenge the sector in the state. However, with proper planning, appropriate training, along with government assistance would contribute to the growth and development of this sector in the state.
Key words: Agripreneurship, rural communities, employment, Assam.

References

1. Barooah B.K. (2007), Agribusiness and Food Security, in ICAR Sponsored Winter School Magazine, "Achieving Food Security and Nutritional Improvement in Agrarian Society".
2. Economic Survey, Assam, 2014-15.
3. Saikia J.N. in online article, Potentials and Challenges of Rural entrepreneurship in Assam: A study of two sectors in Tea and Natural silk.

Technology and the Reconfigurations of the Social in an Urban Space

Delhi in its endeavour to become a global city and seize on the opportunities offered since the liberalization of Indian economy has witnessed rapid infrastructural development. Metro construction and hosting commonwealth games of 2010 in the capital are two important steps taken in this direction. Infrastructural developments entailing the metro construction and commonwealth games made the city 'developed', 'beautiful', 'clean' and convenient for many of its citizens but this neo-liberal desire for development resulted in forced evictions, involuntary relocations and rendered homeless to many of its residents. This paper engages with displacement caused by the extension of the metro line into northeast Delhi and delineates the precarity of those bound for the involuntary displacement and rehabilitation.

A generation herded into a 'planned colony', Trilokpuri, officially categorised as JJC resettlement colony in 1976 during the national emergency, yet again is forced to experience the uncertainties of displacement and rehabilitation after over four decades of their resettlement. Trilokpuri, situated trans-Yamuna in east Delhi, is one of the fifty-five resettlement colony 'planned' to house those unsettled from their squatter settlements in the city. The colony was established during the second

wave of resettlement in the seventies, wherein poor's residing in jhuggis were dispossessed of their modest dwelling at the center of the city and were given land at its outskirts. The eviction and relocation of the socio-economically disprivileged class was aimed to enhance the aesthetics of the city through urban renewal and environmental improvement programmes. Thus requiring to distance ignominious presence of jhuggis and jhuggi dwellers to the periphery into these 'planned colonies'.

Unlike the past, impending demolition in the colony is driven to serve 'public interest' by extending an efficient and technologically advanced public transport, metro rail, in this part of the city. Further extension of the metro network to northeastern parts of the city has been retarded due to disagreements over rehabilitation of those leaving their houses involuntarily for the 'public interest'. The construction of the metro line through the colony is interrupted as houses standing on over hundred plots, housing over 300 families, obstructs the route on which metro viaduct is to be built. To create space for the metro viaduct through the colony buildings/houses has been marked for demolition and the occupants of the plots are promised with a newly constructed house within the colony. This spatial reorganization in the colony, induced by metro construction and promised rehabilitation, has resulted in the sharpening of communal identities, which in turn impinges upon the existing socio-political relations. As more than ninety percent of families bound for displacement are Muslims and confronted with resistance from 'Hindu' residents who are against their rehabilitation within the colony. The changing character of social relations in the colony and precarity of those marked for displacement is not due to the technology but the resource, land, acquired for the installation and operation of the metro rail. This paper aims to depict, firstly, the socio-political change brought in the colony with the extension of the metro line in the area, and Secondly, the life of those forced to submit to the protracted wait and uncertainties over their rehabilitation.

Characterization of resistance regular graph

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A connected graph is said to be resistance regular if all the row sums of its resistance matrix are equal. In this article, we establish several necessary and sufficient conditions for a connected graph to be resistance regular. Then we give a general expression for the entries of the Moore-Penrose inverse of the Laplacian matrix of a resistance regular graph. In addition to that, we provide necessary and sufficient conditions for a regular graph to be resistance regular and a resistance regular graph to be regular.

Keywords: Resistance matrix, Laplacian matrix, Moore-Penrose inverse of a matrix.
References:
[1] R. B. Bapat, Resistance distance in graphs, The mathematics Student, **68** (1999)
87-98.
[2] D. J. Klein and M. Randic, Resistance distance, Journal of Mathematical Chemistry, **12** (1993) 81-95
[3] J Zhou, L Sun and C Bu, Resistance characterizations of equiarboreal graphs, Discrete Mathematics, **340** (2017) 2864-2870.
[4] J. Zhou, Z. Wang and C. Bu, On the resistance matrix of a graph, The Electronic Journal of Combinatorics, **23** (2016) 1-10

Minimizing algebraic connectivity over graphs made with some given blocks

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This article describes the structure of the graph minimizing the algebraic connectivity among all connected graphs made with some given blocks with fixed number of pendant blocks, the blocks that has exactly one point of articulation. As an application we conclude that over all graphs made with given blocks, the algebraic connectivity is minimum for a graph whose block structure is a path.

KEYWORDS: Laplacian Matrix, Algebraic Connectivity, Fiedler Vector, Restricted Graph, Block.

On the convexity of Cesaro function spaces

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The Cesaro function spaces $Ces_p[0, \infty)$ for $1 \le p \le \infty$ were introduced by Shiue, Hassard and Hussein. The space $Ces_\infty[0,1]$ was already appeared in 1948, known as the Korenblyum, Krein and Levin space K. The Cesaro function spaces $Ces_p=Ces_p(I)$ are the class of Lebesgue measurable real valued function
f on I=[0,1] or $[0,\infty)$ such that for $1 \le p < \infty$

$$||f||_{C(p)} = \left[\int_I \left(\frac{1}{x}\int_0^x |f(t)|dt\right)^p dx\right]^{1/p} < \infty$$

and for $p = \infty$

$$||f||_{C(\infty)} = \sup_{x\in I, x>0} \frac{1}{x}\int_0^x |f(t)|dt < \infty$$

Like many other function spaces most of the geometrical properties of Cesaro function spaces has been studied in recent years. In this paper the convexity of this space is examined in a more generalised way via Hardy operator and convexity of $L_p(I)$ spaces, which results Cesaro function spaces $Ces_p(I)$ are strictly convex for all $1 < p < \infty$.
Keywords: Cesaro function space, Convex function, Hardy operator, L_p space.

On equality of connectivity and minimum degree of power graphs of nite groups

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The power graph of a group G is the graph whose vertex set is G and two distinct vertices are adjacent if one is a power of the other in G. In this talk, we ascertain that the edge-connectivity and minimum degree of power graphs (of nite groups) are equal and consequently, determine the minimum disconnecting sets of power graphs of certain cyclic groups, abelian p-groups, dihedral groups and dicyclic groups. In order to study the equality of vertex connectivity and minimum degree of power graphs, we rst obtain certain necessary conditions. Then for power graphs of nite cyclic groups, we obtain a necessary and sucient condition for the above equality, and discuss it for the power graphs of abelian p-groups, dihedral groups and dicyclic groups.
Keywords: Finite group, Power graph, Minimum degree, Edge-connectivity, Vertex connectivity
AMS subject classications. 05C25; 05C40; 05C07; 20K01
References
[1] I. Chakrabarty, S. Ghosh, and M. K. Sen. Undirected power graphs of semigroups. *Semigroup Forum,* 78(3):410{426, 2009.
[2] R. Halin. A theorem on n-connected graphs. *Journal of Combinatorial Theory*, 7:150{154, 1969.
[3] A. R. Moghaddamfar, S. Rahbariyan, and W. J. Shi. Certain properties of the power graph associated with a nite group. *Journal of Algebra and Its Applications,* 13(7):1450040, 18, 2014.
[4] R. P. Panda and K. V. Krishna. On connectedness of power graphs of nite groups. *Journal of Algebra and Its Applications,* 17(10):1850184, 20, 2018.
[5] R. P. Panda and K. V. Krishna. On minimum degree, edge-connectivit and connectivity of power graphs of nite groups. *Communications in Algebra,* 2018. DOI:10.1080/00927872.2017.1407424.

Superconvergence of NIPG method for a singularly perturbed reaction-diusion boundary-value problems

Gautam Singh Srinivasan Natesan

Here, we study the numerical solution of singularly perturbed two- point boundary-value problems of reaction-diusion type. The solution of these problems exhibit exponential boundary layers. To obtain the numerical solution of these problems, we apply the Non-symmetric Discontinuous Galerkin Finite Element Method with Interior Penalties (NIPG method). Also, we proved that the proposed method is uniformly convergent with order k +1 in "-weighted DG energy norm, where k is the degree of the piecewise polynomial in the nite element space, this is Superconvergence property of NIPG method. Numerical results are presented to support the theoretical results.

Key words: Singularly perturbed system of reaction-diusion boundary value problems, Shishkin mesh, discontinuous Galerkin nite element method, uniform convergence.
Subject Classication: 65L11, 65L20, 65L60, 65L70

Accidental Deaths in India: Forecasting with ARIMA Model

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Accident is one of the burning problems for pre-mature end to human lives. Road accident in India is an increasing trouble and has raised one of the country's major problems. This paper outlines development of a conventional time series model viz. autoregressive integrated moving average (ARIMA) model for the annual total number of deaths due to accident(natural & unnatural) in India covering the period 1967 to 2015 and to forecast the number of annual accidental deaths likely to occur in future. The analyzed data are secondary in nature and obtained from National Crime Record Bureau, Ministry of Home Affairs annual Report on Accidental Deaths and Suicides in India for the period of 1967 to 2015 with 49 data points. A significant upward trend is observed to the yearly total number of deaths due to accident in India from 1967-2015. We investigated and found that ARIMA (2, 2, 1) model is suitable for the given data set. The forecasted number of deaths from the model due to accidents in India for the upcoming 10 years also exhibits an upward trend.

Key Words: ARIMA, Forecasting, India, Accidental Death

Prediction of Surface Roughness in Milling Using Regression Analysis

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Achievement of high quality of the finished product in terms of dimensional accuracy and surface finish is a constant challenge faced by the modern machining industries. Milling is a widely used machining process and attaining the required surface finish in milling is of utmost importance. Proper selection of process parameters is crucial in milling operation to reduce surface roughness and extend tool life. Effect of process parameters on surface roughness in milling is widely investigated as evident from the literature [1, 2]. It is observed that important factors that influence surface roughness in milling are tool geometry, cutting speed, feed, depth of cut, material property, type of coolant, etc.
The main objective of this research is to investigate the effect of process parameters on surface roughness in milling and develop a mathematical model for surface roughness prediction from experimental data using multiple regression analysis. A series of experiments are performed and the effect of process parameters (feed rate, cutting speed and depth of cut) on surface roughness in milling is analysed. Feed rate, cutting speed and depth of cut are the parameters chosen to predict surface roughness in the regression model. Milling operations are performed on commercial grade mild steel workpieces of dimensions 80 mm × 45 mm × 12 mm in the vertical milling machine in the workshop of Assam Engineering College, Jalukbari, Guwahati. A high speed steel (HSS) milling cutter of 10 mm diameter is used for the milling operations. The experiments are performed with the following range of process parameters: feed rate 98–402 mm/min, spindle speed 380–850 rpm (cutting speed 12–26.70 m/min) and depth of cut 0.5–1 mm. Table 1 shows variation of surface roughness with feed rate at 850 rpm spindle speed and 1 mm depth of cut. It is evident from Table 1 that surface roughness increases with increase in feed rate which is a well established fact. In this study, it is observed that feed rate and cutting speed are the most influencing factors compared to depth of cut.

Actual experimental data is used for training the regression model developed for prediction of surface roughness in milling mild steel workpiece. To ensure the accuracy of the multiple regression prediction model, the average percentage deviation of actual surface roughness and predicted surface roughness (from regression model) is calculated and found to be in good agreement. The regression model is capable of predicting the surface roughness (Ra) with around 86 % accuracy which is quite reliable to be used in surface roughness prediction in milling.

Feed rate (mm/min)	Surface roughness R_a (μm)
98	4.603
132	5.002
170	5.601
230	5.894
402	6.012

Table 1: Experimental Ra values for varying feed rate at 850 rpm spindle speed and 1 mm depth of cut

References

1. Wang, W., Kweon, S.H., Yang, S.H. (2005),"A study on roughness of the micro-end-milled surface produced by a miniatured machine tool", Journal of Materials Processing Technology, 162, pp 702–708.
2. Yang, J.L., Chen, J.C. (2010), "A systematic approach for identifying optimum surface roughness performance in end-milling operations", Journal of Industrial Technology, 17 (2), pp 1–8.

Experimental study on improvement of the properties of biomass fuel through briquetting technique

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In this project work, briquettes are made from saw dust, husk and straw by using a compound lever press technology without heating device. The briquetting equipment, compound lever press is made of wood, which make it a very easy and cheap way of forming biomass briquettes. The process is economic as there is no need of extra electric energy for pressing. The proximate analysis is carried out to determine moisture content, volatility, ash content and fixed carbon. Calorific values and density of the briquettes are also determined. The briquettes produced are dense, easy to store as well as to handle. These briquettes can be used as fuels and can very well substitute coal in applications as fuel.

Magnetic pulse cladding of Al tube on Cu, Al and Brass bar using double solenoid coil

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Magnetic pulse crimping (MPC) is a high energy rate forming process. The crimping of the flyer aluminum tube on the aluminum, copper and brass bar was successfully achieved by using the pulse discharge energy of capacitor bank. The working tool used in this work was a double solenoid coil. Compression-shear test was carried out and it was found that the joint was strong and it was not failing for the discharge energy higher than a limiting value. Microstructure at the interface was also analyzed and it was found that there was a negligible gap was for the discharge energy more than a minimum value. The hardness at the interface was studied and it was found that because of high-velocity impact of the flyer tube on the base bar the hardness value gets increased. Finite element simulations were carried out to observe the deformation pattern, the maximum velocity obtained and also the magnitude of plastic strain developed in the experiment. This technique can be a reference for the joining of dissimilar materials.

Underwater robot: An enhanced tool for deep water exploration and retrieval of objects

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Autonomous underwater robots are gaining spotlight among the researchers for deep sea exploration, since their use can be effective in several applications. Underwater manipulation tasks are highly required for ocean development, freshwater preservation, rescue activities, and maintenance of infrastructures such as dams because these tasks are too severe for divers. We have developed a remotely operated underwater vehicle(ROV)also known as an underwater robot, whose key advantages are cost efficiency, simple construction and design, with the possibility of commercial production.This paper presents an exploratory study on the materials and components that we used for making our underwater robot and its designs. Underwater robotics is an emerging science, which has become more popular with evolving technology. Besides the capability of swimming, our robot also has a video camera, metal detection sensor and arms of various types to perform underwater tasks such as construction, salvage, rescue and repair. They are also helpful in collecting items that are deeply submerged inside the sea, used by the military and scientists mostly. The factors such as buoyancy, feasibility with depth

and weight balance which affect the movement of the robot in water have been discussed in this paper in detail along with the steps we have taken to overcome them. The prototype was finished within a low budget of just Rs.7,000 .The models which are available in the market costs nearly Rs.50000 making it unaffordable for normal people. ROV systems will not completely replace divers in the near future, but can replace putting a human in harm's way. This allows a safer and more cost-effective means of performing the mundane tasks of searching and monitoring. It takes less time, less effort, less risk, and (as a result) less money to drop a self-propelled camera into the water, go to the work site to look around and perform a task. By using an ROV system, the diver can be moved to a remote location that minimizes the risk to personnel (i.e. remote from the hazards of temperature, hyperbarics, moving machinery, and other underwater hazards). With the increased demand for underwater archaeological research activities and also for commercial purposes , robots with simple design and construction like ours are required, which can be brought even by normal people also. With its wide range of applications, our ROV has proved to be the best of its kind particularly in terms of its cost.

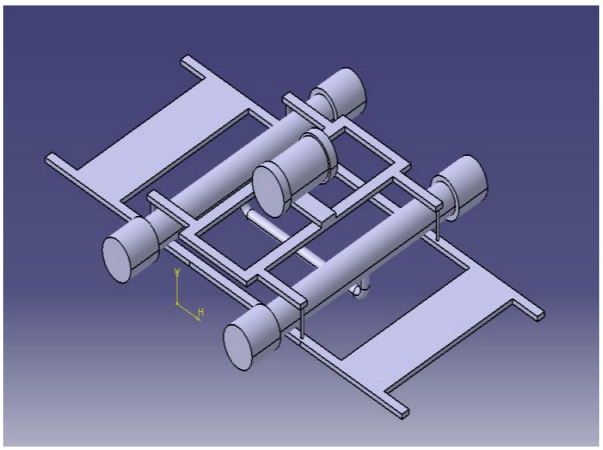

FIGURE 1 - Prototype design

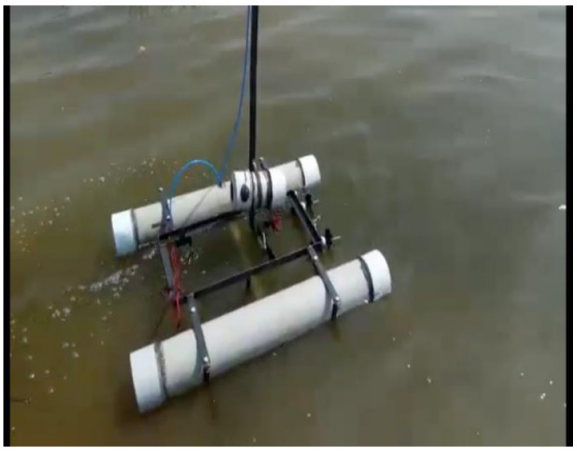

FIGURE 1 - Prototype

Molecular dynamics based simulations to study the symmetric tilt grain boundary structure and energies of bcc-Niobium

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Niobium is an important constituent of Zr-Nb alloys employed for fuel claddings and pressure tubes in nuclear reactors. In this article, molecular dynamics based simulations were employed to investigate the change in grain boundary structure and energies with misorientation angle in symmetrical tilt grain boundaries (STGBs) of Niobium bi-crystals along <110> tilt axis.

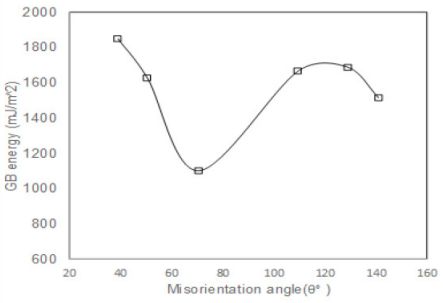

Fig. 1. Variation of GB energy with misorientation angle for <110> tilt axis for Nb bi-crystal

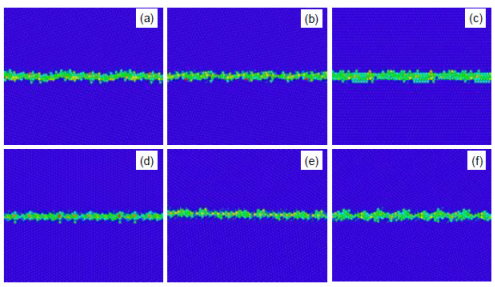

Fig. 2. GB structure for STGB with <110> tilt axis with (a) 38.94 (b) 50.48 (c) 70.53 (d) 109.47 (e) 129 (f) 141 misorientation angles

Results and discussion:
It can be deduced from Fig.1 that the energy is maximum at 38.94° and gradually decreases at 50.48°. Finally, a deep cusp occurs at 70.53° misorientation angle for Σ3 <111> grain boundary plane and then energy increases. More coherent boundaries have lesser energy. Energy is higher in disordered boundaries as can be deduced from figures 1 and 2 simultaneously. Thus there is a close relationship between STGB structures and their energies.

References:.
[1] Divya Singh, Avinash Parashar, 2017, Effect of symmetric and asymmetric tilt grain boundaries on the tensile behaviour of bcc Niobium, Computational Mat. Sci., 143, 126-132.
[2] M. A. Tschopp, Shawn P. Coleman, D.L. McDowell, 2015. Symmetric and asymmetric tilt GB structure in Copper and Aluminium (and transferability to other fcc metals). Integ. Mater. Manuf. Innov. 4:11
[3] D. Terentyev, X. He, A. Serra, J. Kuriplach, 2010. Structure and strength of <110> tilt grain boundaries in bcc fe: An atomistic study. Comp. Mater. Sci. 49, 419-429.
[4] Xuhang Tong, Hao Zhang, Dongyang Li, 2014, effects of mis-orientation and inclination on mechanical response of <110> tilt grain boundaries in α-Fe to external stresses. Modelling Simul. Mater. Sci. Eng. 22, 065016.
[5] Douglus E. Spearot, M.A. Tschopp, Karl I. Jacob, D.L. McDowell,2007. Tensile strength of <100> and <110> tilt bicrystal copper interface. Acta mater. 55, 705-714.
[6] Fatemeh Yazdandoost, Reza Mirzaeifar, 2017, Tilt grain boundaries energy and structure in Ni-Ti alloys. Computational materials science, 131, 108-119.
[7] Fellinger, M.R., Park, H., Wilkins, J.W.,2010. Force-matched embedded atom method potential for niobium. Phys.Rev.B:Condens. Matter 81, 144119.
[8] Plimpton, S., 1995. Fast parallel algorithms for short range molecular dynamics. J.Comput.Phys. 117, 1-19.[8] Stukowski,A., 2010. Visualization and analysis of atomistic simulation data with OVITO-the open visualization tool. Modelling Simul. Mater. Sci. Eng. 18, 015012.

Hybrid Multi-Objective Evolutionary Algorithm using Decom position Approach

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Introduction: Multi and Many objective optimization problems(MOOPs) have been constantly faced in solving many real life engineering problems. The inability of classical techniques to give satisfactory results to MOOPs led to the development of evolutionary strategies. Evolutionary strategies provide a way to obtain a diverse set of optimal solutions and then choose the required solution among the optimal set. We propose a new hybrid evolutionary strategy to solve multiobjective optimization problems.

Methods: We suggest a new normalization procedure on the existing NSGAIII framework based on Pareto- dominance and elite-preservation using predefined set of reference points. The new procedure takes care of degenerate cases in normalization when no intercepts are found by keeping track of intercepts in the previous generation. We also propose a hybrid evolutionary algorithm combining Differential Evolution operators with decomposition approach and the above suggested normalization strategy. All proposed strategies are implemented in JMetal and tested on standard benchmark problems like DTLZ. Inverse Generational Distance (IGD) and Hyper-Volume (HV) were used as indicators to compare algorithms.

Results: The proposed algorithms are applied to a number of many-objective test problems with 3,5,8,10 and 15 objectives and compared with two algorithms NSGA-III and θ- DEA. The proposed algorithms gave better results on DTLZ problems with objectives5,8,10,15. For 3 objectives case results of proposed algorithms were comparable. The solutions are found to be more diverse in the proposed strategies.

Conclusion: We conclude from our results that existing Pareto-dominance based evolutionary algorithms are sensitive to normalization and can be improved by developing more robust normalization technique to handle degenerate cases. We also conclude that introducing Differential Evolution operators is a good improvement over SBX crossover in many cases. We also validated that θ-dominance based algorithms give better IGD median values than Pareto-based algorithms.

A New Kinetic-Theory-Based Scheme for the 2D Euler and Navier-Stokes Equations of Gas Dynamics

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A new kinetic-theory-based high resolution scheme for the 2D Euler and Navier-Stokes equations of gas dynamics has been proposed. The scheme uses the well known connection between the Boltzmann equation of kinetic theory and the governing equations of macroscopic gas dynamics. In the Euler limit the collision term of the Boltzmann equation becomes zero. The equation can then be treated as a linear advection equation where the local Maxwellian distribution gets advected with the molecular velocity. A 2D collisionless Boltzmann equation is rst split into two 1D advection equations and then each of them is discretized using Sweby's flux limiting procedure. A moment of these discretized equations with molecular mass, momentum and energy gives a dimensional splitting scheme for the Euler equations. A central discretization of the x- and y-components of the viscous flux terms in the Navier-Stokes equations when combined with the Euler level scheme gives a hybrid solver for viscous flows. The Euler solver gives close to second order accuracy for low CFL numbers. The scheme is exible enough to be used with any conventional or sophisticated special purpose limiters. For an accurate Navier-Stokes solution the implicit numerical viscosity needs to be kept much lower than the actual physical viscosity. A new data dependent parameter based on kinetic theory has been introduced which checks the relative magnitudes of the physical and numerical viscosity coecients. Several standard inviscid and viscous flow tests show the accuracy and robustness of the present scheme.

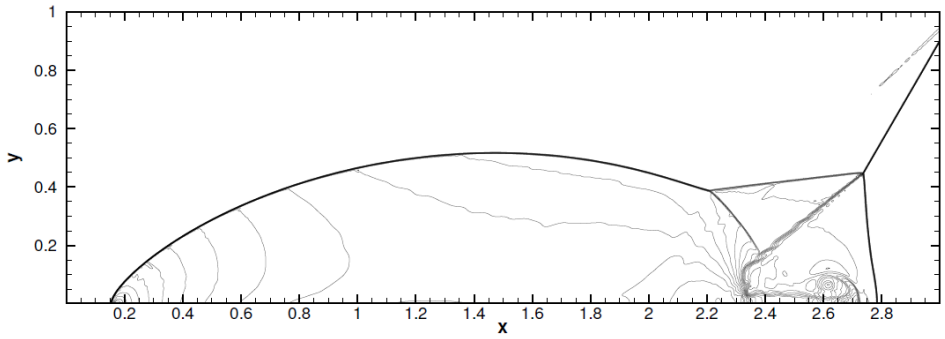

Fig. 1. Double mach reflection test case. Density contours obtained using the Euler solver with superbee limiter.

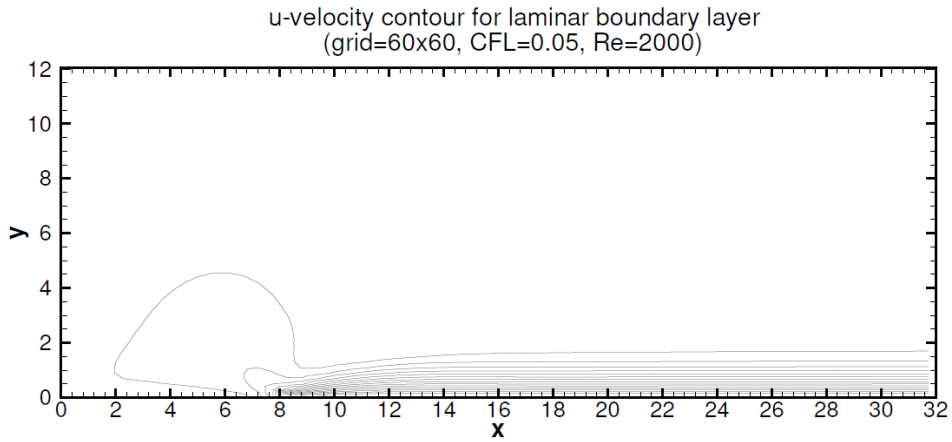

Fig. 2. Flat plate boundary layer test case. u-contours obtained using the Navier-Stokes solver with Van Leer limiter.

Manual Powered Mechanised Cultivator

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India being an agriculture based country, 56.6 % of the population is directly or indirectly associated with agriculture[1] contributing 17.9% of total GDP of India[2]. Yet the economic condition of Indian farmers are not so good. Also the yield of crop per acre of land is also not as high as the developed nations; which is primarily due to the age old farming methods utilized in cultivation. The majority of the agrarian workers have limited access to agricultural machinery and other farming equipment primarily due to economic constraints and low level of literacy among the farmers [ref 4].Also it is seen that with rapid urbanization of India, the migration of unskilled to semiskilled workers to cities and towns in search of a better livelihood is presenting a threat to the rural agriculture based economy by hampering with the manpower requirement during the peak time. The objective of the current work is to address the predicament, brought about mainly by financial limitations, of poor farmers by developing a low cost manually powered eco-friendly mechanized tiller. The design is made keeping only one person as the driver. The design employs Mantis Tiller mechanism to rotate the tiller blades while the power is provided by pedalling action by the driver. The torque generated from pedalling is then increased using torque multiplying mechanisms so that sufficient torque is generated for tilling action. A chain and sprocket arrangement is used for transmission of torque to the Mantis tiller as well as to the wheels. The initial design is made for application on loam and sandy soil types. Further design is planned for increasing the torque generation by use of flywheel for application on muddy terrain.

Reference:

[1] http://censusindia.gov.in/Census_And_You/economic_activity.aspx
[2] http://statisticstimes.com/economy/sectorwise-gdp-contribution-of-india.php

Development of core fundamental technology for membrane-less microfluidic microbial fuel cells

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Microbial fuel cells (MFCs) rely on metabolic activity of bacteria to generate electricity. The integration of microbial fuel cells with the micro-scale would result in more active bacteria per unit volume, thereby enhancing the power density significantly. In the present analysis, we have investigated the effects of flow conditions on the performance of a microfluidic MFC. The bacterial strain is stimulated the most in the presence of an optimal shear stress value thereby giving higher performance. Firstly, an experiment is performed which gives the target shear stress value for maximizing performance. Thereafter numerical simulations are carried out to obtain the optimal flow rates for varying channel aspect ratio. We report a favourable range of flow rate for the MFC to give maximum voltage output. When operated in the proposed conditions the power density of our MFC is found to increase 5 folds compared to conventional setup conditions

Production, Characterization, and Performance Evaluation of Methyl and Ethyl based Biodiesels

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Biodiesel is a promising green renewable alternative fuel. The fuel either has the ability to replace the petrodiesel or can be supplemented with the pure diesel fuel. As a result using of this fuel in diesel engine can reduce the dependency on imported diesel fuel; reduce greenhouse (GHG) gas emission and the capability to reduce the apprehension of the continuous depletion of the reserves of the fossil fuels [1]. There by it may help to improve the economic status of many developing countries. The raw materials to process the biodiesel can be edible or nonedible oils [2].
The present study has intended to produce the biodiesel from waste cooking oil by one- step transesteri fication process. In transesteri fication process potassium hydroxide (KOH) is used as the catalyst and
due the ability lower cost and faster reaction rate, methanol is used as the alcohol. In this investigation, Taguchi experimental design method is used to optimize the production parameters and to achieve the best quality biodiesel as the fuel. The optimum production parameters of biodiesel are estimated as (a) methanol to oil ratio is 6:1 (b) the concentration of catalyst is 1.0 wt% (c) reaction time is found 2hr and (d) the best reaction temperature is achieved as 60°C. The sample of waste cooking oil and the processed biodiesel oil fuel is analyzed using gas chromatography and yield of biodiesel fuel is 93%.

Peak	RT	FAME	GC-MS %yield	Compound Name	Formula
1	19.773	C_8:0	0.158	Octanoic acid, methyl ester	$C_9H_{18}O_2$
2	37.815	C_{14}:0	0.335	Methyl 12-methyl-tridecanoate	$C_{15}H_{30}O_2$
3	41.331	C_{21}:0	0.053	Methyl 9-eicosenoate	$C_{21}H_{40}O_2$
4	48.269	C_{18}:2	82.652	Methyl 9-cis,11-trans-octadecadienoate	$C_{19}H_{34}O_2$
5	49.059	C_{18}:1	8.646	Cyclopropanebutanoic acid 2-[[2-[[2-[(2-pentylcyclopropyl)methyl]cy	-
6	49.505	C_{18}:3	1.056	Cyclopropanebutanoic acid 2-[[2-[[2-[(2-pentylcyclopropyl)methyl]cy /	$C_{19}H_{34}O_2$
7	50.645	C_{20}:1	0.665	Methyl 9-eicosenoate	$C_{21}H_{40}O_2$

Table 1 List of compounds detected through GC-MS from biodiesel fuel sample

References:
1. Demi rbas, A., 2008. Biofuels sources, biofuel policy, biofuel economy and global biofuel projections. Energy conversion and management, 49(8), pp.2106-2116.
2. Haas, M.J. and Foglia, T.A., 2005. Alternate feedstocks and technologies for biodiesel production. The biodiesel handbook, pp.42-61.

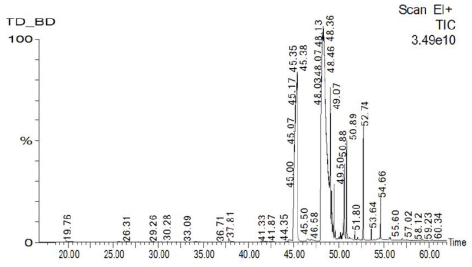

Figure 1 GC-MS of biodiesel FAMEs peaks

Fluid Structure Modelling of Tri-Leaflet Aortic Valve

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ABSTRACT: Although Heart Valve replacement surgery is among the most common cardiovascular surgical procedures, their outcomes are often difficult to predict. The main reason behind is the design and the selected material for the prosthesis. Although commercially available Mechanical Heart Valves (MHV) are good in working conditions but there are some disadvantages. This study describes the design and modelling of the polymer based prosthetic tri-leaflet heart valve which includes the simulation of the Tri-leaflet Aortic Valve during the blood flow. This study also aims to overcome all the possible problems that the patients are facing with the MHV's and to closely mimic the natural Tri-leaflet Aortic Valve. In this work, the tri-leaflet aortic has been modelled using fluid structure interaction using the properties of the prosthetic material required for fabricating the valve.

SUMMARY: There are mainly three types of aortic valves found in human beings – Mono-cuspid, Bi-cuspid with two leaflet and tricuspid or tri-leaflet with three leaflets. Seldom, Mono-cupid and Bi-Cuspid valves are found; mostly the aortic valve in humans have three leaflets. Heart valve diseases involves damage to one or more heart valves that can lead to certain problems including death. The major heart valve diseases are the Aortic Valve Stenosis and Aortic Valve Regurgitation. The former involves the valve becoming thick and stiff due to which the valve does not open properly whereas in the latter, the valve does not close properly leading to backflow of blood. One of the popular option is the replacement of the diseased valve with the Mechanical Heart Valve (MHV's). However, there were cases of backflow of blood [1]including sudden death due to the failure of MHV material under fatigue loading [2]. The present study aims to model and fabricate the Mechanical Aortic Valve and validate the results using Fluid Structure Interaction in ANSYS [3]. The geometry of the valve is based on the five independent parameters, which are sufficient for complete description [4]. Figure 1 shows the isometric view of the valve geometry made in SolidWorks. Figure 2 shows a prototype of the valve using 3D printing with the leaflets made with surgical glove Material (Latex) and Figure 3 shows the deformation of the mesh.

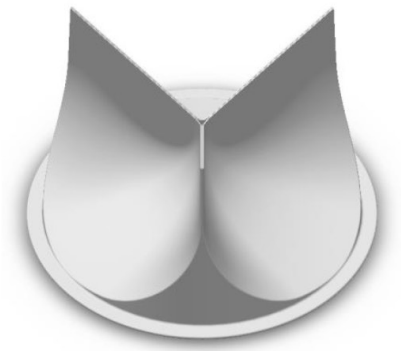

Figure 1: Geometry of Aortic Valve

Figure 2: 3D printed model with Leaflets

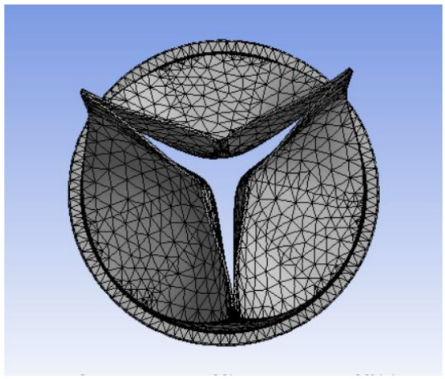

Figure3: Deformed mesh

References:
[1] C.V. Muraleedharan, G. B. (n.d.). Failure mode and effect analysis of Chitra heart valve prosthesis. 14th Conference of Biomedical Engineering Society of India (1995), 3.52-3.53.
[2] Thubrikar, M. (1990). The Aortic Valve. Mano Thubrikar.
[3] W. Klepetko, A. M. (1989). Leaflet fracture in Edwards-Duromedics bileaflet valves. Journal of Thoracic and Cardiovascular Surgery, 97, 90-94.
[4] J. De Hart, G. P. (2003). A three-dimensional computational analysis of fluid-structure interaction in the aortic valve. Journal of Biomechanics, 36 (1), 103-112.

Experimental investigation on the forming behaviour of sheet materials using shock tube

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The growing demand for fuel efficient vehicles which is having lesser energy consumption is a great challenge in automotive industry. It has been resulted in a renewed interest in aluminium alloy sheet as a replacement of conventionally used steel in automotive bodies due to its higher strength to weight ratio, higher formability, increased resistance to corrosion and better recycling potential. Generally the formability of aluminium sheet is lower than steel under normal processing conditions, but as it has been shown that the formability can be enhanced if the forming process is performed at higher strain rates instead of forming material at an elevated temperature [Rohatgi et al. 2014].

The strain rate has a significant effect on the material behaviour during the deformation process as well as on the final properties of the product. Almost all materials have significant strain rate dependence at rates above the threshold. Due to this reason, determining the mechanical properties accurately is one of great issues during analysing the deformation behaviour of materials at higher strain rates. Traditionally, for the case of materials, quasi-static tensile test and Split Hopkinson Pressure Bar (SHPB) are the two standard experiments have been widely used to extract the plastic behaviour of the materials at lower and higher strain rate, respectively, but limitations occur in these tests is due to obtaining the results only at a uniaxial direction. In order to understand the forming behaviour of a material in multi-axial direction, several studies have been performed in combination with SHPB to create a dynamic bulge test, but in a limitation several complexities have been observed in the experimental set up during experiment [Grolleau et al. 2008].

In last few years, blast or shock loading has been used in many cases to extract the material behaviour under a dynamic multi-axial loading, but the use of explosives create a high strain rate loading environment generates deficiencies such as complexity in instrumentation and difficulties in handling. To recover from these limitations, shock tube has been introduced in various studies to study the dynamic response of thin metallic plates subjected to varying levels of shock loading. In this study it has been used to extract rate dependent multi-axial material properties.

The present work involves a comparative study of the forming response of 304L stainless steel and AA5052 at different strain rates using a shock tube to understand the influence of rate dependent properties on the forming response of both the sheet metals. In order to obtain higher strain rate loading, a nylon rod having hemispherical end has been considered during the study as shown in figure 1. A scale of higher strain rate loading over the surface of the material can be generated by applying different magnitude of shock wave to the projectile which travels at different velocities and hits the material surface. It is decided by the thickness of the diaphragm material that ruptures and creates different scale of pressure change. The shock tube is equipped with pressure transducers along the driven tube to capture the pressure-time history of the shock wave which impacts the plate specimen. The forming responses like dome height, strain evolution, strain-rate evolution, hardness after forming and mode of failure has been monitored and understood. From the results it is clearly obtained that the forming limits are enhanced for both the materials when it is deformed at higher magnitude of strain rate. The effect of inertial force because of high strain rate deformation results in to increase in elongation. AA5052 has shown almost 80-90 % increase in limiting strain relative to quasi-static forming which is clearly depicted in figure 2. Under the same experimental conditions, AA5052 has shown better forming behaviour comparing to 304L stainless steel.

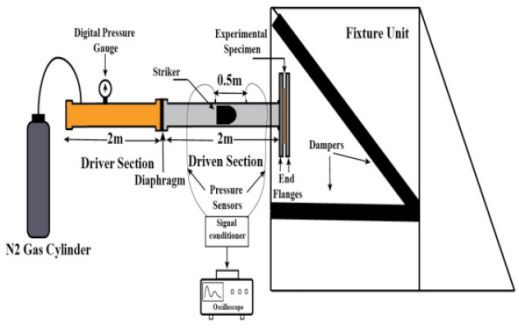

Figure.1. Schematic of Shock tube with instrumentation

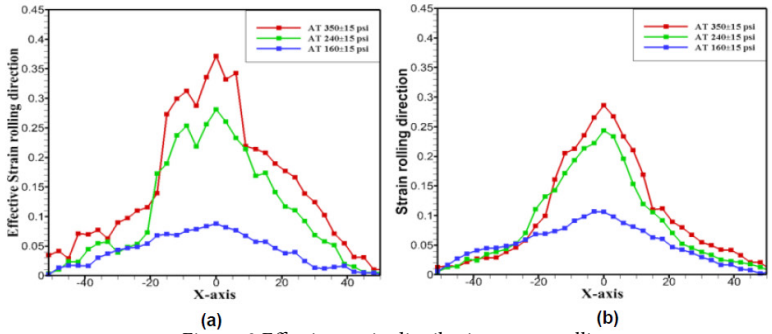

Figure. 2 Effective strain distribution across rolling direction for (a) AA5052 & (b) SS 304L

References::
1. Grolleau V., Gary G., Mohr D., "Biaxial Testing of Sheet Materials at high strain rates using Viscoelastic Bars", Experimental Mechanics, 48(3),293–306(2008).
2. Rohatgi A., Soulami A., Stephens E. V., Davies R. W., and Smith M. T.: "An investigation of enhanced formability in AA5182-O Al during highrate free-forming at room-temperature: Quantification of deformation history", Journal of Materials Processing Technology, 214(3), 722 732(2014).

Coupled Regenerative Braking and Suspension System

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In order to improve the vehicle fuel economy of off-road vehicles, this paper presents the design, modeling, and performance study of a coupled regenerative suspension and braking based on an energy recovery unit. This regenerative suspension and braking can transform the kinetic energy of suspension vibration and braking into unidirectional generator rotation which will generate electrical energy. A prototype of the system has been designed in CATIA V5R19, assembly and a series of experimental tests will be conducted to demonstrate its effectiveness to generate the damping characteristic, energy harvesting capability and the feasibility of the proposed approach. In this implementation scheme, operating electric circuits will be designed based on different working status and it is realizable to accumulate energy from road vibration and braking.

Development of diagnostic device employing nanoparticle based sensor

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Nanoscience and nanotechnology have given immense opportunity to develop specific and sensitive sensors for biomedical applications. A major portion of recent day's research is directed towards the development of nanoenabled point -ofcare diagnostic devices to detect different diseases at their early stages. Among many other diseases, chronic obstruction pulmonary diseases (COPDs) are also one of the common diseases that have influenced the health condition of the society by and large. Increasing rate of air pollution in urban as well as sub-urban areas, is effecting the lung health of the inhabitants at an alarming rate. Many of the city-dwellers now a days suffer from lung congestion which leads to asthma attack in frequent intervals. Moreover, in a country like India, the lung problem is very highly prevalent among children and is a major cause of childdeath. In this direction, a humidity sensor based POCT device has been developed to detect lung diseases at its early stage. [1, 2] The sensor has been fabricated using CdS nanoparticle on paper substrate. The proposed system shows a change in resistance across the sensor in presence of humid air. A significant change in resistance ($\Delta R \sim 80\%$) has been observed in presence of 96% of humid air. It has been reported that the human exhaled air is highly humid and thus a forced exhalation on the sensor could detect the peak flowrate of the lungs, which is an important parameter to diagnose lung health. The sensor h as also been integrated with a Cu-wire based heater to improve the recovery time. Hence, the proposed device is capable of detecting lung diseases at its early stages.

References:

1. Mitradip Bhattacharjee, Harshal Nemade and Dipankar Bandyopadhyay, "Nano-Enabled Paper Humidity Sensor for Mobile Based Point-of-Care Lung Function Monitoring", Biosens. Bioelectron., 2017, 94: p. 544-551.
2. Mitradip Bhattacharjee, Dipankar Bandyopadhyay, and Harshal B. Nemade, "A lung condition monitoring device.", Indian patent application number: 201631033190A dated 28-09-2016. [PCT Appl.No. PCT/IN2017/050363 dated 29-08-2017]

The use of Taguchi optimization in determining optimum parameters to produce minimum diameter and porous nanofibers for use in composite

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Polycaprolactone (PCL) porous nanofibers are produced through a non-solvent induced phase separation mechanism. For nanofibers, solvent of Chloroform-DMSO and electrospinning technique is used. Based on a Taguchi design of experiment (DoE) method, the effects of CF-DMSO and electrospinning on the PCL nanofibers diameter, including flow rate, Collector Speed, and applied voltage is evaluated. An optimum combination to obtain smallest diameter and porous membrane is also determined with a minimum variation for electrospun PCL nanofibers. An orthogonal array of L9 is created in the statistical design of experiments. Using Taguchi design of experiment parameters are optimized to produce minimum diameter and porous membrane.

Keywords: Electrospinning, Porous nanofiber, Taguchi method

Development of docetaxel loaded nanoliposomes for the treatment of brain tumor

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Docetaxel (DTX) delivery to brain to treat solid tumor of brain (glioma) is very difficult and challenging due to the physicochemical and pharmacological characteristics of the drug. To overcome this challenge and having effectiveness in glioma cell line in vitro, nanoliposomes of docetaxel have been developed by lipid layer hydration technique to attain ability to cross blood brain barrier and were characterized in vitro. Cellular uptake by C6 glioma cells was also investigated. The vesicles were unilamellar with around 50 nm size with smooth surface. Drug released slowly and in a sustained manner from the liposomal formulation. The pharmacokinetic data shows more extended action of DTX from liposomes in experimental rats than the free drug and marketed product. Thus, nanoliposomes (as vehicle for DTX) may be a promising approach to treat glioma with DTX.

Bacteria driven heat engines-Unconventional yet highly efficient

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The stochastic thermodynamics provide a precise framework for quantifying the performance of heat engines that operate between thermal reservoirs. Artificial microscale heat engines are prototypical models to explore the mechanisms of energy transduction in a fluctuation-dominated regime. However, it has to be looked at critically whether the same mechanisms are applicable to the functioning of nonequilibrium operated unconventional heat engines of synthetic and biological type. To realize this, experimental studies have been conducted through periodically cycling a colloidal particle in a time varying optical potential across bacterial baths of different degrees of activity. The outcomes of these experiments revealed that the studies on particle kinetics of these engines would contribute to the enhancement of overall efficiency. The present paper discusses the significance of bacteria driven heat engines, fundamental insights in to the functioning of micromotors and engines. Suggestive measures to be taken up to increase the temperature window of hot and cold reservoirs for enhancement of efficiency of these engines are also thrown light.

Keywords: Stochastic process, heat engine, micromotors

References:

1. http://iisc.researchmedia.center/article/putting-bacteria-work-scientists-design-micro-heat-engine-usingbacterial-reservoirs -content published on IISC research website
2. http://www.thehindu.com/sci-tech/science/Scientists-use-bacteria-to-power-a-tinyengine/article14630863.ece -Extracted from an article in The Hindu
3. http://www.ableindia.in/frontend/briefnews/109-A blog from ABLE, Association of Biotechnology Led Enterprises.

One-Step Liquid Crystal Nanodroplets by Solvent Evaporation Method

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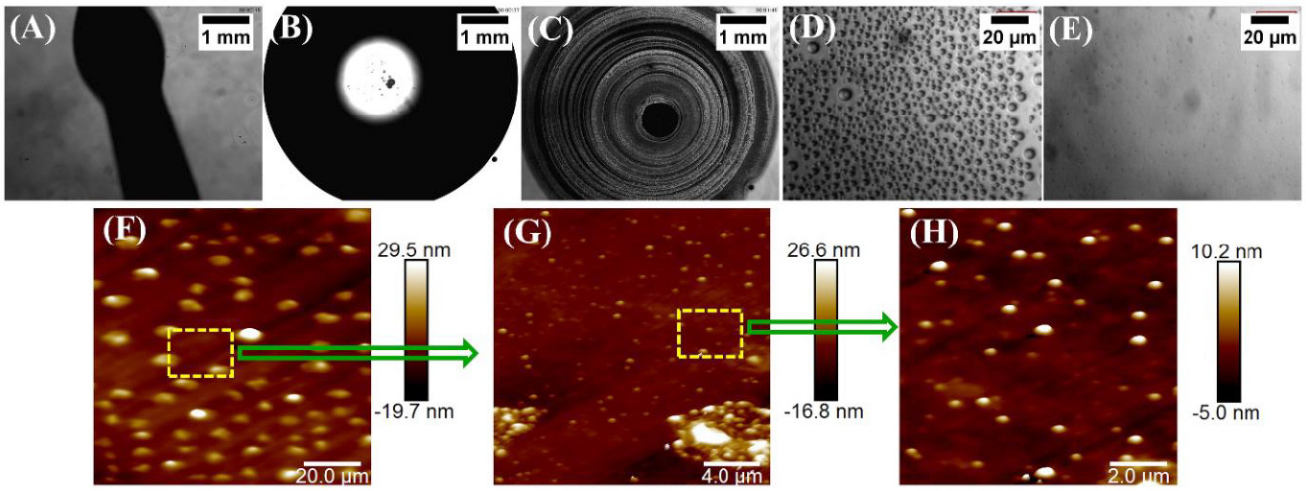

Figure 1. One step 5CB liquid crystal nano droplets generation mediated through solvent evaporation by drop cast method.

Generation of high surface to volume ration of micro or nano structures of smart materials is fore vision in many futuristic applications. However, complexity of special material structure it is a challenging task. Here we showed a top-down approach for generation of nano structure of special material like liquid crystal by simple drop cast method. The 5CB (4'-pentyl-4-bipenylcarbonitrile) liquid crystal was diluted in solvent and then a small drop (10 µl) was casted on hydrophobic PDMS (polydimethylsiloxane) substrate, as shown in the Figure 1. The drop formed a convex meniscus on the substrate due to wettability characteristics. The convex meniscus changed into a thin film when the volatile vapor evaporated continuously from the drop surface. Following this, the film dewetted due to the capillary forces and the van der Waals interaction to generate submicron size LC droplets. The drop formation process started from the peripheral contact line to center of the drop. Removing excess solvent from the drop by vacuum drying, the droplets size further shrank to the nanoscale. We showed the variation in the size of the LC droplets with concentration (0.01 – 1% (v/v)) of LC, solvent (toluene and chloroform), and substrate (hydrophobic and hydrophilic PDMS). Also showed a simple theoretical model for separation of generated of micro/nano LC droplets mediated through solvent evaporation. Finally, showed some simple applications by this generated micro/nano LC droplets such as digitized light reflect

Different Emission Mechanism of EM Radiations from different condensed layers of Sun during Solar Flares and CMEs

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Sun is a large source of electromagnetic radiation and heat. It has seven main layers viz. core, radiative zone, tachocline , convection zone, photosphere, chromosphere and corona. Core has the highest gravity. Actually atoms in the core have their own rotations. The rotation as well as huge amount of pressure and temperature due to gravity, forms a huge electromagnetic field and a plasma state. Solar flare is a resultant effect of outer zone of sun like photosphere, chromosphere etc. The outermost part is the corona. We have analyzed number of solar flares and CMEs with different space based and ground based observed data such as SOHO/LASCO, EIT, EUV, X rays, H-alpha line, microwave and radio emission from WIND/WAVES, NRH etc. The analysis reveals that during the solar flares and CMEs different mechanism of EM radiation are involved in different layers of the sun as well as in the interplanetary medium. We have found during solar flares, very high kinetic energy related particles are generated from the sheath regions which hits the ambient plasma in the solar atmosphere and losses energy in the form of X-ray, H-alpha line from chromospheric layer of sun. Again the charged particle gyrates the magnetic field line as a result of which it produces EM waves in the range of microwave. The study reveals that the particles moving from the reconnection region towards the upper corona and interplanetary medium produces radio waves as well as radio burst of different types. The observation reveals that during the onset of solar flares and CMEs type III, type II radio burst are emitted which can be used as a precursor of these energetic events. The detail study is presented herewith from the observed solar flares and CMEs.

Laser Induced Breakdown Spectroscopy for Quantitative analysis of Brass

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Laser-Induced Breakdown Spectroscopy (LIBS) is an optical emission spectroscopic technique which can be used for qualitative and quantitative analysis of any kind of sample. In (LIBS), a high power pulsed laser is focused on to the surface of a material that furnishes the ablation of the small amount of material from the focal volume and produces its transient inhomogeneous high density and high temperature laser induced plasma (LIP). The LIP expands in the surrounding medium, cools down and emit characteristic radiations of atomic and ionic lines of the element present in the LIP. By analyzing this spectrum, it is possible to identify the constituent elements of the target sample. LIBS technique has potential application for qualitative and quantitative analysis of elemental composition of sample. In comparison with other spectrochemical analytical technique, the LIBS has many advantages. i.e. it is applicable to any kind of sample irrespective of its physical state (i.e. solid, liquid and gases), free from sample preparation and thus contamination free, nearly nondestructive, simultaneous detection of multi-element sample, applicable over wide spectral range, simple, inexpensive, compact, portable and single shot measurement allow for quick and rapid analysis. In the present study, a second harmonic of a Q-switched Nd:YAG laser of pulse width 7ns and repetition of one hertz was focused on to brass sample to generate the plasma. The radiation spectra from the laser induced brass plasma were recorded using a spectrometer attached to an ICCD detector. The recorded spectra were analyze to identify all the elements in the brass and concentration of the individual elements by applying LIBS. By studying the LIBS emission spectra presence of major elements Cu and Zn were identified along with the trace elements Al, Fe, Pb, Ni and Sn. The plasma temperature was estimated using Boltzmann plot method. Electron densities were estimated applying Stark-Broadened profile of CuI (510.55 nm) line. The conditions of LTE (Local Thermodynamic Equilibrium) and optical thin condition plasma were validated in the present case for correct estimation of plasma parameters. The estimated plasma parameters were used in CF-LIBS (Calibration Free-LIBS) algorithm to estimate the concentration of the identified elements in the brass sample. The estimated concentrations of all the elements in the brass sample were compared with the EDX results.

References:
1. Ciucci, M. Corsi, V. Palleschi, S. Rastelli, A. Salvetti, E. Tognoni, New procedure for quantitative elemental analysis by laser-induced plasma spectroscopy, Applied spectroscopy, 53 (1999) 960-964
2. S. Zhang, X. Wang, M. He, Y. Jiang, B. Zhang, W. Hang, B. Huang, Laser-induced plasma temperature, Spectrochimica Acta Part B: Atomic Spectroscopy, 97 (2014) 13-33
3. S. Harilal, C. Bindhu, R.C. Issac, V. Nampoori, C. Vallabhan, Electron density and temperature measurements in a laser produced carbon plasma, Journal of applied physics, 82 (1997) 2140-2146.
4. http://physics.nist.gov

Holographic Fermi surfaces

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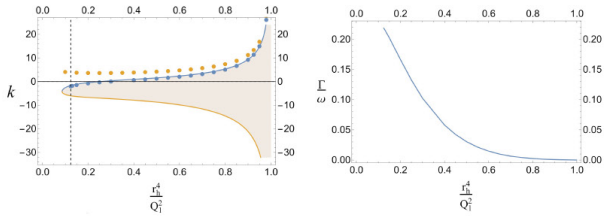
We study behaviour of fermions in a strongly coupled system using holographic dulity and nd quasi paticles both in the Fermi and non Fermi regime as well as marginal Fermi liquid. At nite temperature spectral functions of the excitations show sharp peaks at specic values of Fermi momenta.

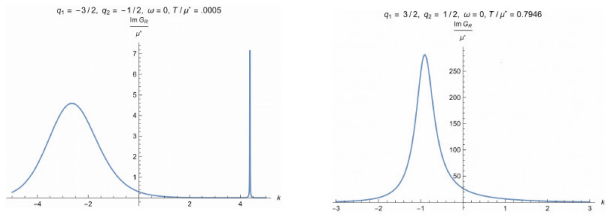
Introduction: Metals and other strongly correlated electron systems are successfully described by Fermi liquid theory, where excitations are assumed to be long-lived, weakly coupled quasi particles near Fermi surface. Due to weak coupling they are ameanable to analysis of perturbative techniques and are called Fermi liquid. However, cuprate superconductors and heavy fermions have evidences of uctuations which are short-lived, dubbed as non-Fermi liquid and cannot be explained by Fermi liquid theory. An understanding of their behaviour requires techniques for strongly coupled systems. It was proposed [1] that strongly coupled theories are dual to gravity theories in one more dimension, in particular in the background of charged black hole. This technique has been successfully used for various models. We have considered a black hole geometry with two charges and nd Fermi surfaces whenever the charge is large enough.

Model: We consider a supergravity theory consisting of scalar elds and two electromagnetic elds. This theory has a black hole solution which is charged with respect to both the electromagnetic eld. The black hole solution is characterised by a temperature, which depends on the charges of the black hole. It also consists of fermions in the gravity theory, which are charged with respect to the electromagnetic elds. Dual eld theory involves strongly coupled scalar elds and fermions. The asymptotic behaviour of the scalars in the gravity theory determines the source term and expectation values of the operator in the dual eld theory. In a similar way, fermions in the gravity theory corresponds to composite fermionic operators in the dual eld theory and its asymptotic behaviour determines spectrum of the fermionic operators.

Result: We have studied [2] fermions with charges 3=2 and 1=2 with the black hole solution in the background at zero temperature. For fermionic charge (3=2; 1=2) Fermi momenta are given in the left subgure of Fig.1. There is a region called oscillatory region within which no Fermi surface exists. We nd two branches of Fermi momenta appearing along the boundary of this regionwith the closer one being non Fermi liquid and approaches marginal Fermi liquid. The decay width of the exitations in the non Fermi regime are given in the right subgure of Fig. (a). At nite temperature, it shows two peaks indicating there are Fermi surface at two dierent Fermi momenta. In right subgure of Fig.(b) we have plotted spectral function for the case where there is only a single electromagnetic eld. The number of the peaks has now reduced to one and so it admits only one Fermi surface.



(a) Fermionic charge (3=2; 1=2): Fermi momenta (left) and decay width of excitation (right) for dual quasi-particles



(b) Spectral function vs. momentum for quasi- particle dual to fermions with charges (-3/2, -1/2): for two EM elds [left]; for one EM eld [right]

References:
[1] J. M. Maldacena, Int. J. Theor. Phys. 38, 1113 (1999). T. Faulkner, H. Liu, J. McGreevy and D. Vegh, Phys. Rev. D 83, 125002 (2011).
[2] S. Mukhopadhyay and N. Rai, Phys. Rev. D 96, n o. 2, 026005 (2017); no. 6, 066001 (2017).

Inter-atmospheric consequences of a Large CME associated with a flare on 4th Nov, 2003

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Amongst the solar phenomenons, Coronal Mass Ejection (CME) is a result of the release of matter and energy from the surface of the sun which is usually associated with an intense solar flare. This is a case study on the CME which occurred on 4th November, 2003 during 19:50 to 20:10 UT in active region AR486 of the sun. This CME was observed in the SOHO/ LASCO C2 field of view at 19:54 UT. The CME propagated with a linear speed of about 2650 kms^{-1} and had a mass of about 1.5x10^{13} kg. This CME interacted with another CME having a linear speed of 600 kms^{-1} and caused a complex and intense radio emission as observed from the LASCO images. It is the largest solar flare and CME that was ever recorded and it saturated the GOES XRay detector yielding peak X-Ray flux of 2.8x10^{-3} Wbm^{-2}. The effect of the storms caused by these flares were serious enough to reroute aircrafts, affecting satellite systems and communications, and causing power outrages in some places for about an hour. On the surface of the Earth, most of the time the noticeable part of a CME is the aurora and most of the other consequences of a CME just don't make it to the surface. The dramatic events on 4th November, 2003 demonstrated that our ability to observe and predict our solar activity and its impact on the technological systems as well as Geomagnetic Disturbances in space have measured effectively with high spatial and temporal data.

The Accelerated Expansion of the Universe (A Rudimentary study of the 2011 Noble Prize winning discovery)

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S. Perlmutter, A. Riess and B.Schmidt are profoundly known for their path breaking discovery of the Accelerated expansion of the universe. Being one of the towering achievement of the 21st-century standard Cosmology it led them to the 2011 Noble Prize in Physics. 7 years after its discovery it has set a bench mark as one of the leading advancement in the field of Cosmology. They used a Type Ia Supernovae (SNe Ia) as standard candles to measure their luminosity distances and finally put forwarded that the rate of expansion of the universe is increasing with time.

Investigating the implications of their work and the far reaching consequences, we are trying to provide the ideas behind the Accelerated Expansion of the Universe in a rudimentary level discussing the basics of it- General Theory of Relativity, FRW Cosmology, luminosity distance, cosmological constant and its problem. Within the framework of the General Theory of Relativity we shall describe the possible explanation assuming Dark Energy is used in the current standard model of Cosmology.

CME and Associated Interplanetary Consequence

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A study has been made on observed CMEs those occurred on several dates. All the CMEs are moving very fast in the IP medium more than 1500 Km/h speed which produces intense D_{ST} as well as radio waves. All these CMEs are associated with intense solar flares. We studied the evolution mechanism of all the CMEs. When ejections are directed toward the earth and reaches the interplanetary medium as ICME, the shock waves of travelling mass causes a geomagnetic storm that disrupt earth magnetosphere, compressing it on day side and extending night side magnetic tail. Energetic protons released by a CME can cause on increase in the number of free electrons in the ionosphere, especially in high latitude polar region. It reaches velocity from 20-3200 Km/sec (12 to 1988 m/sec) with an average speed of 489 Km/sec (304 m/sec) based on SOHO/LASCO measurement between 1996 and 2003. The frequency of ejection depends on the phase of the solar cycle. The CME Geoeffectiveness characterized by $D_{ST} \leq$-80 nT according to field orientation (N or S) in a CME source region and its dependence on interplanetary CME classification (magnetic cloud or ejecta). We first considered 133 CME-ICME pairs (1996-2001) whose CME source locations are identified by SOHO/LASCO and extreme ultra violet imaging telescope data. Then we identified the shapes of the X-ray sigmoid associated with 63 of these CME using soft Xray telescope data. The IP shock is a disturbance propagating into and through the expanding solar wind. The arrival of CME at the earth can be potentially Geo-effective depending on their dynamical and magnetic properties.

High open circuit voltage c-Si/a-Si:H heterojunction solar cells with hydrogen plasma treatment

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c-Si/a-Si:H heterojunction solar cells were fabricated by rf-PECVD in multichamber system. The n-type crystalline silicon wafer thickness of 275-325 µm, resistivity of 5-10 Ω cm, double side polished substrate were used for fabricating heterojunction solar cells. The cells were deposited with hydrogen plasma treatment of a-Si:H(i) layer prior to the deposition of top a-Si:H (p) layer. Four different i-layer thickness of 35, 40, 45 and 50 nm a-Si:H(i) layer was subjected to 2 min H2 plasma treatment. We achieved high open circuit voltage of 703mV and 711 mV and improved efficiency 9.97% with one side heterojunction solar cell Ag/Al/c-Si(n)/a-Si:H(i)/a- Si:H(p)/ ITO/Ag structure. This improvement in Voc due to reduction of interface recombination sites, passivation of surface dangling bonds and decrease of series resistance with 2 min H2 plasma treatment on a-Si:H(i) layer before deposition of a-Si:H layer(p), which also improved the short circuit current and fill factor.

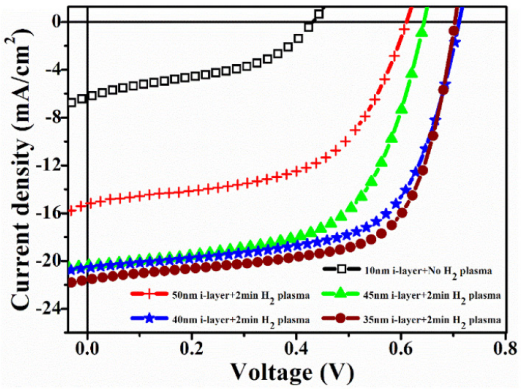

Fig. J-V characteristics of c-Si/a-Si:H heterojunction solar cells

Table: The solar cell parameters for c-Si/a-Si:H heterojunction solar cells as a function of i-layer thickness.

	Condition	J_{sc} (mA/cm^2)	V_{oc} (V)	J_{max} (mA/cm^2)	V_{max} (V)	FF	η (%)
1	35nm+2min H_2 plasma	21.53	0.703	17.71	0.563	0.66	9.97
2	40 nm +2min H_2 plasma	20.64	0.711	16.72	0.456	0.63	9.25
3	45 nm +2min H_2 plasma	20.0	0.645	15.20	0.504	0.59	7.66
4	50 nm +2min H_2 plasma	15.15	0.613	11.33	0.456	0.57	5.17
5	10nm+No H_2 plasma	6.27	0.436	3.70	0.305	0.41	1.13

High Temperature Dielectric Behavior of Spin-1/2 Frustrated Kagome Magnet $Co_3V_2O_8$

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Spin-1/2 frustrated Kagome Magnets have attracted immense attention due to their potential applications in the memory and logic devices [1,2]. In particular, the family of transition-metal vanadates $Co_3V_2O_8$, $Fe_3V_2O_8$ and $BaCu_3V_2O(OD)2$ has been extensively studied in the context of frustrated magnetism, since the magnetic coupling in these materials form a network identical to Kagome lattice [2]. Among these frustrated magnets, $Co_3V_2O_8$ exhibits excellent electrochemical performance in energy storage applications such as Li-ion batteries and oxygen evolution reactions [2]. The present work aims to investigate the detailed temperature dependent dielectric behaviour and acelectrical conductivity of polycrystalline form of $Co_3V_2O_8$. The polycrystalline $Co_3V_2O_8$ has been successfully synthesized by solid-state reaction technique and vacuum sintering the sample at 800- 1000°C for 12 h followed by quenching to 0°C using Ice-bath. The X-ray diffraction analysis reveals the Orthorhombic crystal structure of $Co_3V_2O_8$ having space group Cmca with lattice parameters a =6.03 Å, b = 11.48 Å and c = 8.31 Å. The temperature dependence of dielectric spectroscopy reveals a giant dielectric transition 454°C together with the anomalies at 362°C and 134°C. The temperature variation of the ac-resistivity ρac(T) data provides the evidence for variable-range-hopping of charge carriers following the Mott's equation $\rho ac = \rho o \exp (To/T)^{1/4}$. The origin of new dielectric anomalies observed in $Co_3V_2O_8$ system will be discussed.

References:

[1]. M. Pereiro et al., Nature Communications **5**, 4815 (2014).
[2]. Luo et al., J. Mater. Chem. A **4**, 5075 (2016).

Evaluation of Ni-Mn-X-Sb (X=Si/Fe) alloys for magnetic refrigeration application

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Magnetic refrigeration based on near room temperature magneto-caloric effect (MCE) offers an alternative refrigeration method using a magnetic field, with the promise of being eco-friendly and more efficient than conventional refrigerators working on vapour compression cycle [1,2]. MCE is measured in terms of isothermal magnetic entropy change (ΔS_M) and/or adiabatic temperature change (ΔT_{ad}). Refrigeration capacity (RC) defines the operating range of the refrigerant. In recent years, off stoichiometric $Ni_{50}Mn_{25}+xZ_{25-x}$ (Z = Ga, In, Sn, Sb) alloys have gained enormous attention due to their giant magnetic field induced strains and giant MCE [3–5] close to the martensitic transformation. Several studies have been done on these alloys to optimize them for these applications. After a thorough investigation of the available literature in these systems, it is found that $Ni_{49}Mn_{39}Sb_{12}$ may be one of the potential candidates for use as room temperature refrigerant. We have prepared $Ni_{49}Mn_{39}Sb_{12}$ alloy and substituted it with magnetic (Fe) and nonmagnetic (Si) elements at the Mn sites with the aim to improve the magneto-caloric properties of the alloy. The alloy ingots were prepared from high purity Ni (99.9%), Mn (99.9%), Sb (99.8%), Si (99.9%), Fe (99.9%) pieces using arc melting method. The ingots were annealed in evacuated and flame sealed fused silica ampoules at 1123 K for 2 days and then quenched in ice water. The crystal structure of the alloys was determined by using a powder X-ray diffractometer (Rigaku TTRAX III) with Cu Kα radiation (λ = 0.15406 nm) and the magnetic properties were measured using a vibrating sample magnetometer (VSM, Lakeshore 7410). It is evident from the XRD patterns that both $Ni_{49}Mn_{39}Sb_{12}$ and $Ni_{49}Mn_{38}Fe_1Sb_{12}$ alloys exhibit tetragonal martensite phase while $Ni_{49}Mn_{38}Si_1Sb_{12}$ exhibits cubic austenite phase (see Fig. 1(a)) at room temperature. A positive magnetic entropy change (SM) of 0.71 J/kg.K was obtained at 316 K for a field change of 10 kOe in the vicinity of the martensitic transition in $Ni_{49}Mn_{39}Sb_{12}$ alloy with RC of 11.4 J/Kg. Substitution of Si and Fe in Mn position in the ternary alloy resulted in a large increase in SM (see Fig.1(b)) and RC. Ni49Mn38Fe1Sb12 exhibited ΔS_M of 2.53 J/kg.K at 303 K and RC of 31.9 J/Kg, whereas $Ni_{49}Mn_{38}Si_1Sb_{12}$ showed ΔS_M of 1.58 J/kg.K at 267 K and RC of 5.8 J/Kg for a field change of 0-10 kOe. Thus, we could achieve the highest MCE in Ni-Mn-Sb alloy near room temperature with Fe substitution. Therefore, $Ni_{49}Mn_{38}Fe_1Sb_{12}$ alloy has best potential as magnetic refrigerant among Ni-Mn-Sb based alloy

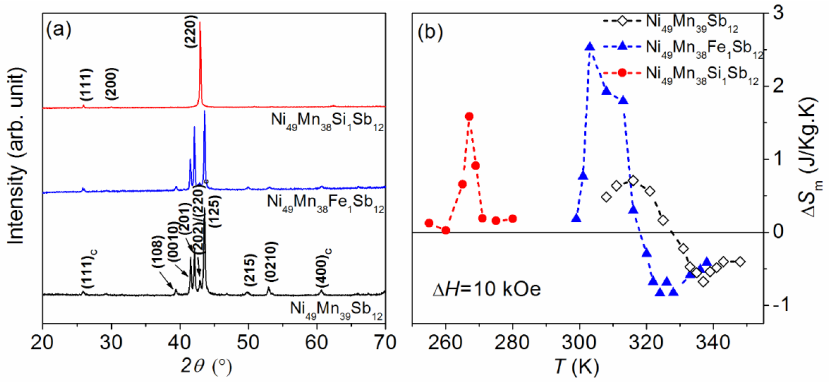

Fig.1.(a) Room temperature XRD patterns of annealed Ni49Mn39Sb12, Ni49Mn38Fe1Sb12 and Ni49Mn38Si1Sb12 alloys.(b) Change in magnetic entropy with temperature for the alloys.

References:

1. O. Tegus, E. Brück, K. H. J. Buschow, and F. R. de Boer, Nature 415, 150 (2002).
2. J. Liu, T. Gottschall, K. P. Skokov, J. D. Moore, and O. Gutfleisch, Nat. Mater. 11, 620 (2012).
3. X. Zhang, B. Zhang, S. Yu, Z. Liu, W. Xu, G. Liu, J. Chen, Z. Cao, and G. Wu, Phys. Rev. B 76, 132403 (2007).
4. B. Hernando, J. L. Sánchez Llamazares, V. M. Prida, D. Baldomir, D. Serantes, M. Ilyn, and J. González, Appl. Phys. Lett. 94, 222502 (2009).
5. R. Kainuma, Y. Imano, W. Ito, Y. Sutou, H. Morito, S. Okamoto, O. Kitakami, K. Oikawa, A. Fujita, T. Kanomata, and K. Ishida, Nature 439, 957 (2006).

Two-temperature accretion flow around black holes

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In the vicinity of a black hole, the electron–ion collision timescale is larger than that of their in-fall timescale. So, they cannot maintain a single temperature throughout, the possibility of two-temperature flow become unavoidable in an accretion flow. Where, ions gain energy due to viscous dissipation and transfer a part of its energy to the electrons, finally, electrons radiate these energies via different channels of radiative mechanisms. We study the properties of such flow in the steady state around a black hole where a pseudo-Newtonian potential is adapted to mimic the effect of general relativity. We assumed that the flow is exposed to the stochastic magnetic fields which lead to synchrotron emission of electrons and these emissions are further strengthen by Compton scattering. The presence of centrifugal repulsion triggers shock waves in the flow, in its journey towards the black holes. We extensively study the possibilities and implantation of such formalism in the investigation of spectral and timing properties of black holes sources.

References:

1. Dihingia I. K., Das S., Mandal S., 2015, in Astron. Soc. India Conf. Ser., 12, 139
2. Dihingia I. K., Das S., Mandal S., 2018, MNRAS, in press

Phenomenology of two or more mass-degenerate Higgs bosons in the NMSSM

The two singlet like Higgs bosons (a scalar-pseudoscalar pair) in the Next-to-Minimal Supersymmetric Standard Model (NMSSM), can result in important phenomenological aspects at the Large Hadron Collider (LHC), which may help to probe the non-minimal features of supersymmetry. There exists possibilities that anyone of the scalar-pseudoscalar pair could be almost mass-degenerate with the 125 GeV SM-like Higgs boson. In the real NMSSM, when the mass difference between two Higgs states is comparable to their individual total decay widths, the quantum mechanical interference due to the relevant diagonal as well as off-diagonal terms in the propagator matrix between them can become sizeable. This possibility invalidates the usage of both the narrow width approximation (NWA) and the single Breit-Wigner (BW) approach to compute the cross section for the production of a di-photon pair with a given invariant mass via resonant Higgs bosons in the gluon-gluon fusion. Motivated by the baryon asymmetry of the universe, we explicitly invoke CP-violating phases in the Higgs sector of the NMSSM. As a consequence, all the Higgs interaction eigenstates mix to give five neutral CP-indefinite physical mass eigenstates. In this scenario, the interference effects due to the off-diagonal terms in the Higgs mass matrix that mix the pseudoscalar states with the scalar ones can also become significant, when these two are sufficiently mass-degenerate, challenging both the NWA and the approach based on the tree-level interference, and eventually considerably modifying the phenomenology of the observed Higgs boson at the LHC. We perform a detailed analysis, in both the real and complex NMSSM, of these interference effects, when the full propagator matrix is taken into account, in the production of a photon pair with an invariant mass near 125 GeV through gluon-gluon fusion. It is observed that these effects can account for up to ~ 40% of the total cross section for certain region of model parameter space. We also investigate how such mutually interfering states contributing to the 125 GeV signal observed at the LHC can be distinguished from a single BW resonance. We have also studied the possibility and effects of two or more mass degenerate Higgs states in the heavier side of the NMSSM Higgs mass spectrum. We have inestigated the scope of distinguishing these heavy Higgs bosons at the current and future experimental facilities at the LHC in few prominent channels like the di-photon, di-tau and bbar, produced through the decay of resonant heavy Higgs bosons in the gluon-gluon fusion. We have investigated the interference effects between two or more nearly mass-degenerate heavier Higgs states to explore the possibility of identifying them from what might appear as a single BW resonance produced in gluon-gluon fusion and decaying in the di-photon, dit-au and bbar channels, at the current and future experimental setups at the LHC.

An Analysis of a Visible Light Communication System for efficient Data Acquisition and Transfer

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Visible Light Communication refers to illumination as well as communication using the same light source. It uses visible light (390- 750nm) portion of the electromagnetic spectrum and is a part of the Optical Wireless Communication. The rapid development of solid state lighting devices such as Light Emitting diodes, made it possible for this sort of communication. Visible light can be used to transfer high speed data in critical scenarios like hospitals, airplane or petrochemical plant where Radio frequency based system is unsuitable. The paper gives an experimental setup for temperature sensor data monitoring as well as data transfer between two Personal Computers. The efficiency of the whole setup is analyzed in terms of bit rate by varying the distance between transmitter and receiver module, different types of receiver (Solar Cell and Photodiode), different LED drivers. From the experimental analysis, it is seen that, using 1 Watt LED data rate of 1.1 Mbps is achieved at a distance of 30 cm between the transceiver. The maximum distance up to which data can be received is 600 cm. The use of convex lens just after the transmitter and before the photo detector further improves the successful reception of data. Also, the data rate can be further improved by using high watt LED on the transmitter side. The results of this study can be used to make an efficient indoor visible light communication system.

Properties of stars from Spectral Analysis

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Spectroscopy is an inevitable tool in astronomy to explore the universe. Its contribution in stellar astronomy is to discover the properties of stars and to identify them into different types. Identification of stars is important as it is useful in the study of the structure and kinematics of the galaxies. The purpose of this analysis is to understand how to examine the spectrum of a star and reveal detail knowledge about its properties using Astronomical Spectroscopy involving the three major bands of radiation- visible, radio and x-ray. Basic data of the stars for analysing spectral properties as well as composition of stars have been taken from the SIMBAD astronomical database. The spectra of the stars obtained with the telescopes are then reduced using IRAF reduction package. Analysing this reduced data a lot of information regarding the physical properties and chemical composition have been found out. From the spectral lines the elements present in the stars have been determined along with the temperature and density of the elements in the star. Magnetic field and relative motion of the stars are also found from the spectrum. From the width of the spectral lines how fast the materials (stellar winds) are moving can be estimated. The mass and size of a star is also determined from its spectrum. Spectral analysis also determines the materials around the stars.

High Temperature Dielectric Behavior of Spin-1/2 Frustrated Kagome Magnet $Co_3V_2O_8$

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Spin-1/2 frustrated Kagome Magnets have attracted immense attention due to their potential applications in the memory and logic devices [1,2]. In particular, the family of transition-metal vanadates $Co_3V_2O_8$, $Fe_3V_2O_8$ and $BaCu_3V_2O(OD)_2$ has been extensively studied in the context of frustrated magnetism, since the magnetic coupling in these materials form a network identical to Kagome lattice [2]. Among these frustrated magnets, Co3V2O8 exhibits excellent electrochemical performance in energy storage applications such as Li-ion batteries and oxygen evolution reactions [2]. The present work aims to investigate the detailed temperature dependent dielectric behaviour and ac- electrical conductivity of polycrystalline form of $Co_3V_2O_8$. The polycrystalline $Co_3V_2O_8$ has been successfully synthesized by solid-state reaction technique and vacuum sintering the sample at 800- 1000°C for 12 h followed by quenching to 0°C using Ice-bath. The X-ray diffraction analysis reveals the Orthorhombic crystal structure of $Co_3V_2O_8$ having space group C*mca* with lattice parameters a = 6.03 Å, b = 11.48 Å and c = 8.31 Å. The temperature dependence of dielectric spectroscopy reveals a giant dielectric transition 454°C together with the anomalies at 362°C and 134°C. The temperature variation of the ac-resistivity $\rho_{ac}(T)$ data provides the evidence for variable-range-hopping of charge carriers following the Mott's equation $\rho_{ac} = \rho_o \exp$ (To/T)1/4. The origin of new dielectric anomalies observed in $Co_3V_2O_8$ system will be discussed.

References:

[1]. M. Pereiro et al., Nature Communications 5, 4815 (2014). [2]. Luo et al., J. Mater. Chem. A 4, 5075 (2016).

Two-temperature accretion flow around black holes

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In the vicinity of a black hole, the electron–ion collision timescale is larger than that of their in-fall time-scale. So, they cannot maintain a single temperature throughout, the possibility of two-temperature flow become unavoidable in an accretion flow. Where, ions gain energy due to viscous dissipation and transfer a part of its energy to the electrons, finally, electrons radiate these energies via different channels of radiative mechanisms. We study the properties of such flow in the steady state around a black hole where a pseudo-Newtonian potential is adapted to mimic the effect of general relativity. We assumed that the flow is exposed to the stochastic magnetic fields which lead to synchrotron emission of electrons and these emissions are further strengthen by Compton scattering. The presence of centrifugal repulsion triggers shock waves in the flow, in its journey towards the black holes. We extensively study the possibilities and implantation of such formalism in the investigation of spectral and timing properties of black holes sources.

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High open circuit voltage c-Si/a-Si:H heterojunction solar cells with hydrogen plasma treatment

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c-Si/a-Si:H heterojunction solar cells were fabricated by rf-PECVD in multichamber system. The n-type crystalline silicon wafer thickness of 275-325 μm, resistivity of 5-10 Ω cm, double side polished substrate were used for fabricating heterojunction solar cells. The cells were deposited with hydrogen plasma treatment of a-Si:H(i) layer prior to the deposition of top a-Si:H (p) layer. Four different i-layer thickness of 35, 40, 45 and 50 nm a-Si:H(i) layer was subjected to 2 min H2 plasma treatment. We achieved high open circuit voltage of 703mV and 711 mV and improved efficiency 9.97% with one side heterojunction solar cell Ag/Al/c-Si(n)/a-Si:H(i)/a- Si:H(p)/ITO/Ag structure. This improvement in Voc due to reduction of interface recombination sites, passivation of surface dangling bonds and decrease of series resistance with 2 min H2 plasma treatment on a-Si:H(i) layer before deposition of a-Si:H layer(p), which also improved the short circuit current and fill factor.

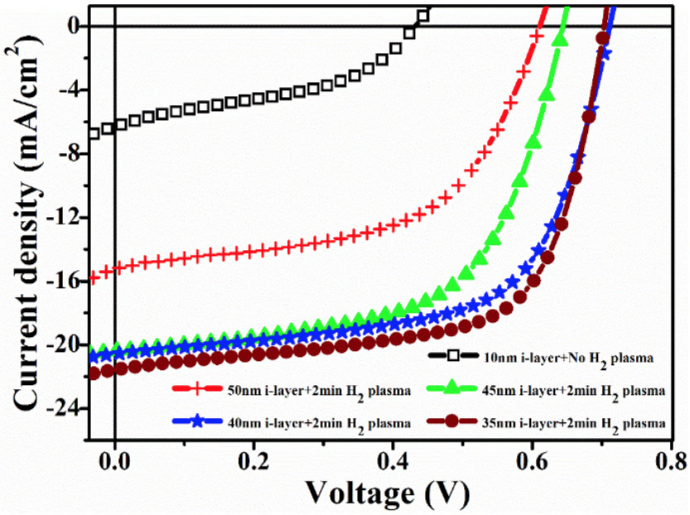

Fig. J-V characteristics of c-Si/a-Si:H heterojunction solar cells.

Table: The solar cell parameters for c-Si/a-Si:H heterojunction solar cells as a function of i-layer thickness.

	Condition	J_{sc} (mA/cm^2)	V_{oc} (V)	J_{max} (mA/cm^2)	V_{max} (V)	FF	η (%)
1	35nm+2min H_2 plasma	21.53	0.703	17.71	0.563	0.66	9.97
2	40 nm +2min H_2 plasma	20.64	0.711	16.72	0.456	0.63	9.25
3	45 nm +2min H_2 plasma	20.0	0.645	15.20	0.504	0.59	7.66
4	50 nm +2min H_2 plasma	15.15	0.613	11.33	0.456	0.57	5.17
5	10nm+No H_2 plasma	6.27	0.436	3.70	0.305	0.41	1.13

PHYTO-DIVERSITY CHARACTERIZATION AND ASSESSMENT OF SOIL ORGANIC CARBON IN HOME GARDENS OF UPPER ASSAM, INDIA

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Home Gardens are a unique natural resources and an integral part of the indigenous village ecosystem of Assam that have stemmed out of the indigenous knowledge and species selection of plants with social and cultural significance. These agroforestry systems with a dynamic structure provide subsistence to the dependents and harbor exclusive and at times rare species of crop plants and are also of significance from the parlance of carbon sequestration. There has been an increasing interest in home gardens as sustainable repositories of biodiversity conservation in the tropics. This interest has been piqued owing to the multi strata vegetation composition of these dynamic agro forestry systems which aredeliberately planned to mimic a natural forest. In this study we aimed at studying the home gardens of the seven districts of Upper Assam documenting the phytodiversity and the status of Soil Organic Carbon (SOC). Phyto-sociological analysis was done following standard ecological protocol whereas soil samples were collected and analyzed from three depths (0-15, 15-30, 30-45 cm). 101 numbers of tree species, 28 numbers of shrub species and 38 numbers of herb species were recorded in the home gardens of upper Assam. The Soil organic carbon (SOC) was found to be 29.58 tC ha-1. A shift of the home gardens structure from a multi species biodiverse system to a single species, market oriented system is also evident from this study. This shift has lead to shrinking home gardens, affecting the biodiversity of the system as a whole which is a matter of great concern that needs to be addressed and remedied effectively and immediately for sustainable management of this important recourse.

Key words: Natural Resource management, Agro forestry, Sustainable Management, Natural Forest.

CROP DIVERSIFICATION: A KEY TO FARMERS' ASSURED INCOME

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Crop diversification refers to the addition of new crops or cropping system to agricultural production on a particular farm taking into account the different returns from value added crops with complementary marketing opportunities. Crop diversification is regarded as an important strategy to mitigate risk and enhance income of farmers. The concept of crop diversification implies reallocation of resources in a large mix of diverse and complementary activities within agriculture. Diversification has become a significant component for realizing higher output growth, higher farm income, employment generation, sustainability of natural resources and poverty alleviation. Crop rotation can break pest cycles, including plant diseases, insects and weed infestations as well as reduces erosion and conserve soil moisture. Major driving forces include increasing income on small farm holdings, withstanding price fluctuations, balancing food demand with increasing population, mitigating effects of increasing climate variability. One of the reasons to diversify is to spread risk. It increases economic stability by reducing financial risk, stabilizing farm income, maximize the utilization of scarce land resources and increasing choice of farm practices. However even though cropping diversity can reduce several limitations and risks involved in traditional methods of agriculture, it cannot eliminate the risk element completely. Changes in cropping pattern intensify the need for stronger financial institutions. Owing to the prevalence of small and marginal farmers in most of the parts of country, over dependence on credit has become a problem for the farmers as well as the agricultural insurance is less explored in most of the farming areas and rural areas. Poor basic infrastructure, weak research extension farmer linkages, pest and disease infestation, poor marketing facilities, agro based industries are some of the obstacles and major challenges in crop diversification leading to low income of farmers.

Though agriculture continues to be a major sector in Assam, it is still predominantly traditional in nature. Only a few proportions of farmers have adopted the changing modern technology. The farm household income in the state per year is only Rs. 80328 as against Rs. 217450 in Punjab per farm household. Amongst several other options, it is expected that crop diversification would be able to contribute significantly to increased farm household income in Assam. Inclusion of high value crops such as Bhut Jalakia, Safed Musli, Stavia etc can boost farmers income to considerable extent. However, farmers awareness and government initiatives must be there for encouraging crop diversification.

Key words: Crop diversification, high value crop, farmers' income, Assam

A Comparative Study of Farm Mechanisation in Different Parts of India

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Farm mechanization is a critical aspect in determining the overall agricultural productivity of a piece of land. With the rapidly escalating population, the food demand is also increasing day by day thus leading to a huge pressure being created on the existing agricultural land, which expresses a pressing need for sustainable mechanization of farming practices. The development and expansion of farm mechanization in India has occu rred in a highly nonuniform manner as diverse farming practices are followed in different regions of India. The gap is especially wide between Northern and Eastern India- the food bowl states (Punjab, Haryana and western Uttar Pradesh) exhibit extensive farm mechanization while in comparison much lesser mechanization can be observed in the other region. The reasons for such a difference range from pattern of land holdings to cost of machineries. In this paper, an investigative study into the current scenar io of farm mechanization in different parts of India and their plausible reasons has been presented.

Nglove: A Smart Vein Viewer

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Cannulation is a very important step in the Intensive Care Units, this becomes more critical in the paediatric intensive care units where Cannulation is done for the infants. Most of the times Cannulation is a lifesaving measure and need of the hour to introduce fluids in the infants subjects. There exists a great difficulty in practicing this procedure especially in the golden hour in the paediatric subjects because of the inability to spot the veins in babies, so there is great need to introduce a visual aid to assist the doctor:/nurse to successfully handle this procedure.
This is very crucial especially in rural India where there is a lack skilled man power. We have taken this as a challenge and found a smart solution to tackle this problem by developing Nglove™ a smart visual aid that can help a doctor / Nurse in spotting the veins. We developed this by making use of Physical optics and virtual reality

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Appropite Technology for Rural Community – Fostering Sustainibility at the Bootm of the Pyramid

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In this article it will be demonstrated how RuTAG is supporting sustainable development of the society through need based intervention of technology for rural community. Since inception in 2004, the mission has been involved in design, development and generation of appropriate technology/ tools to improve rural community through improving quality of product, enhancing productivity, efficiency and reducing drudgery of the traditional earning methods/ process of the rural community. One of the basic objective of the mission is to consider the end users, i.e., the rural community for whom technology is being designed is to consider as subject in the process of design and development of technology. Such efforts extend the scope of the mission to consider the need as well constraints of the resource constraint society in the process of design and development of technology. In doing so, it has successfully addressed intervention of a holistic approach for transfer of need based appropriate technology in the rural community where technical institute, Government Organization, Non-Government Organization (NGO) and rural artisans have been working in a common platform for design/ redesign of some of the traditional tools/ technology which have been in use among the rural people for hundreds of years.
People centric approach and involvement of community in each step from idea generation to transfer of technology has widened the scope of affordability and acceptability in the society. To make it sure that the technology is available in villages of the region, RuTAG has been working for drawing a technology transfer program in collaboration with the Ministry of Development of North East. Such effort would be helpful for fostering the rural entrepreneurship in the region as special emphasis has been given to draw up a marketing strategy of items produced by artisans. Steps have been initiated to strengthen the village based institutions to develop their capabilities to participate in the development initiatives because inclusion of such organizations plays an important role in the success of attaining sustainability in the society.
The article is review based where case study of two special cases of RuTAG is draw to present here. They are: i) Women empowerment by technology supported manufacturing of beads from Holy Basil ii) Design and development of Potter's wheel for pottery artisans. The two cases are drawn here to explain how RuTAG is working for improving the rural economy of the nation through developing need based technology for rural artisans of the country. Such efforts will help in creating more employment opportunities in the rural areas through rejuvenation of rural industry of the nation.

Recently, issues related to sustainable development received very high attention among the policy planer as well as technology developer or research group. In this article, RUTAG's effort to foster social sustainability through addressing issues related to economic, social and environmental sustainability of rural people will be discussed in the final section.

Agripreneurship: A new horizon for the emerging youth

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Post independent Indian agriculture has witnessed unprecedented paradigm expansion, growth and development in order to feed the ever increasing population of the country and also due to increasing demand for new technologies. Entrepreneurship has been considered as one of the major factor for economic development. During an economic crisis, when development tends to be negative, the importance of entrepreneurship development increases. There are two parts to entrepreneurship. The first is the managerial skills needed to start and run a profitable farm business. The second is 'entrepreneurial spirit'. Both are important. Managerial skills can be taught, but an entrepreneurial spirit cannot be taught. The World Trade Organization (WTO) agreements have started new vistas for agricultural development and diversification and, in turn, agri-business in the member countries including India. As such, opportunities have increasingly emerged for developing entrepreneurship in agri-business sector especially agriculture, horticulture, floriculture, sericulture, animal husbandry and veterinary, fishery, etc. Agriculture has always been the backbone of the Indian economy and despite concerted industrialization, in the last six decades; agriculture still occupies a place of pride. Entrepreneurship development in rural industries appears to be the best potential alternative to find employment avenues for the rural population. The importance of entrepreneurship development in agricultural sector and business planning for agricultural firms requires a thorough business plan. Successful farmer-entrepreneurs need to be technically competent, innovative and plan ahead so that they can steer their farm businesses through the stages of enterprise development – from establishment and survival to rapid growth and maturity. Nonetheless, there are many challenges that these agripreneurs have to face: social barriers, economic barriers, regulations, access to finance and information, and their own managerial capacity to cope with risks and changes and to seize opportunities.

Key words: Entrepreneur, Agriculture, Innovation, Planning, Horticulture

EFEECT OF POST SHOOTING BUNCH SPRAY OF PGRS AND SLEEVING ON YIELD AND ECONOMICS OF A TISSUE CULTURED BANANA (*Musa paradisiaca* L.) cv. GRAND NAINE

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An experiment entitled "Effect of post shooting bunch spray of chemicals on bunch characters and yield of banana (*Musa paradisiaca* L.) cv. Grand Naine" was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari (Gujarat) during the year 2015-2016. The experiment was laid out in Randomized Block Design (RBD) with twelve treatments and three replications. The treatments included GA3 @ 50 mg l-1 (T_1), GA3 @ 100 mg l^{-1} (T_2), NAA @ 50 mg l^{-1} (T_3), NAA @ 100 mg l^{-1} (T_4), Ethephon @ 0.1 mg l^{-1} (T_5), Ethephon @ 0.2 mg l^{-1} (T_6), CPPU @ 1 mg l^{-1} (T_7), CPPU @ 2 mg l^{-1} (T_8), Brassinosteroid @ 1 mg l^{-1} (T_9), Brassinosteroid @ 2 mg l^{-1} (T_{10}), SOP @ 1.5% (T_{11}) and Control (T_{12}). The first spray was given immediately after complete opening of the bunch and second spray was given at 20 days after first spray.
The results of present investigation revealed that the banana bunches when sprayed withEthephon @ 2 ml l^{-1} shortened the maturity period of cv. Grand Naine banana. Whereas, bunches sprayed with Brassinosteroid @ 2 mg l^{-1} found effective in higher bunch size (length and girth), finger size (length and girth), finger weight, weight of third hand, bunch weight and fruit yield.

The minimum physiological loss in weight and maximum shelf life and pulp: peel ratio of banana fruit was observed when bunches were sprayed with CPPU @ 2 mg l^{-1}.
From the economic point of view the highest net return was obtained in the bunches sprayed with Brassinosteroid @ 2 mg l^{-1} while the maximum BCR was noted in the bunches sprayed with GA3 @ 100 mg l^{-1}.

Effect of Farmyard Manure/Compost on Heavy Metal Availability in different Agricultural Soils

Heavy metal contamination of soils has become a severe issue in agricultural production in the past few decades because of various anthropogenic activities and improper use of heavy metal-enriched materials in agriculture. Farmyard manure or compost can be applied to soil to supply nutrients required for crops and improve soil physical properties. The presence of non-biodegradable and toxic heavy metals in composts impedes agricultural land application resulting in increasing concern among farmers about heavy metal accumulation in agricultural soils. A pot study has been carried out on two types of agricultural soils (alluvial and laterite) amended by compost to study various physico-chemical properties like pH, electrical conductivity and cation exchange capacity. Periodic experiments have been carried out on bioavailability and leachability of heavy metals (Pb, Cd, Ni, Hg, Fe, Cu, Mn and Zn) on soil samples collected at specific depths from the top surface of soils in the pots. The bioavailability has been investigated in the form of water soluble and diethylenetriamine penta-acetic acid (DTPA) extractable. The Tessier sequential extraction method has been used to investigate the changes in heavy metals speciation (Pb, Cd, Ni, Hg, Fe, Cu, Mn and Zn) during the pot study in the similar manner. Results have shown some heavy metal accumulation in (0-20) cm of soil depth in the potted experiment.
Keywords: Compost, soil, heavy metal, bioavailability, leachability, speciation

Research Conclave'18

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Abstracts (Poster)

Abstracts (Poster)

Biosciences and Bioengineering

Metagenomic approach for mining Industrially Relevant Thermophilic Enzymes

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Extremophiles such as thermophiles are a potential source of enzymes like lipases, proteases amylases, etc. which have immense industrial application in detergent, textile, food, cosmetics and pharmaceutical industries. They offer an excellent source of replacement in lieu of mesophilic ones currently used in these processes. Many extremophiles are non-culturable due to practical limitations. Among various approaches to obtain these enzymes from non-culturable organsims, metagenomics offers an attractive approach to mine novel genetic resources in the natural environment. Metagenome from compost soil was extracted and purified by both direct and indirect method. A method was devised modifying existing protocols of DNA extraction to overcome problems associated with humic acid PCR interference and optimized for purity and yield. Activated charcoal was used to absorb humic acids and other phenolic compounds. DNA was further purified by electro dialysis gel extraction method and was concentrated with Amplicon centrifugal concentrator. The DNA was then directly used as a template for amplification of thermostable lipase gene fragments using multiple degenerate primers and gene fractions obtained by PCR amplification. CODEHOP (COnsensus DEgenerate Hybrid Oligonucleotide Primers) were designed as gene specific primer for thermostable lipase gene. CODEHOP primers were designed based on conserved motifs (like GXSXG and AXXXA motifs), conferring thermostability to the expressed gene. Further, primers were designed for full length amplification of gene by genome walking and obtaining clones of thermostable lipase genes. This method reduces the task of library creation of the whole metagenome to fish out targeted thermostable genes using gene specific CODEHOP primers.

Keywords: Extremophiles; Metagenome; thermostable; CODEHOP

Advanced Gene Therapy: Future of Cancer Therapeutics

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With the escalating numbers of cancer deaths worldwide, it has become crucial to explore efficient alternatives to conventional chemo and/or radiotherapy, which show poor prognosis and high mortality rates. The advent of gene therapy has paved a way to combat various diseases, including cancer. We have designed multiplex systems targeting specific signalling pathways in cancer. Genes of different origins, viz., human, bacterial and plant were inserted into mammalian cancer cells to determine their potential effect on proliferation and signal transduction. In particular, novel approaches were designed to treat multidrug resistant glioblastoma, where conventional anticancer drugs cease to work alone or in combination. Overexpression of the IkBα gene, which is a cellular inhibitor of NFkB signalling pathways, resulted in chemosensitization of the glioblastoma cells. Antitumor property of the gap junction (GJ) protein, connexin-43 (Cx43) in conjunction with the artesunate (ART), a plant-based active anti-malarial compound was also exploited by our group. GJ deficient MCF-7 cells transfected with Cx43 gene showed an increased sensitivity towards ART treatment and required a significantly lower dose of ART to attain its IC50, as compared to parental cells. The expression of Cx43 helped in reducing the dose dependent cytotoxicity of ART as well as enhanced the bystander apoptosis of the neighbouring cells. One essential aspect of gene therapy is its successful delivery to tumour cells. Development of gene delivery vehicles for preferential delivery of the therapeutic agents to the tumour cells and avoiding undesired accumulation at other sites is of utmost importance. Nanocarriers exhibit certain advantages like small size and fluorescence properties, which enable bio imaging, monitoring of controlled release, and specific targeting of cancer cells, ushering the evolution of the novel field of

cancer theranostics. In this regard, a nanocomposite, consisting of highly fluorescent gold nanoclusters and the biopolymer chitosan, has been developed, to form a stable polyplex with suicide gene for induction of apoptosis. Thus, simple strategies offering the scope of using combination module for cancer therapy were designed.

Emergence of Protein Therapeutics in Cancer Medicine

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The current scenario in cancer therapy demands the development of drugs with minimal side-effects and maximal therapeutic efficacy. Conventional treatment methods such as, chemotherapy, radiation and surgery are crippled with adverse effects, high recurrence and poor prognosis. With substantial research focusing on cancer, a number of advanced therapeutic strategies have been designed that show promising outcome. One such venture is protein therapy, which is gaining considerable attention in cancer treatment after its success in treating different disease conditions such as diabetes and hormonal disorders.
Herein, we report the expression, purification, characterization, and anti-cell proliferative activity of novel recombinant proteins INF-γ, IkBa, sFRP1 and PTEN. Gene sequences of INF-γ, IkBα, sFRP1 and PTEN were amplified and cloned into bacterial expression vectors. GST tagged bacterially expressed proteins were further purified by using the glutathione agarose column. Characterization of purified proteins was performed with the Western blotting, MALDI and circular dichroism. To attain stability and intracellular delivery of these proteins to cancer cells, different nanocarriers based on the affinity and stability of proteins were designed. INF-γ and silver nanoparticles were loaded in PLGA composite nanoparticles (INF-γ-Ag PLGA NPs). GST-IkBα recombinant protein was encapsulated within polyvinyl alcohol (PVA)/ polyvinyl pyrrolidone (PVP) hydrogel nanocarrier (NC). Nanocarriers were characterized by UV-spectroscopy, Dynamic Light Scattering (DLS), Transmission Electron Microscopy (TEM) and Field Emission Scanning Electron Microscopy (FESEM). Subsequently, potential anti-proliferative effect of the protein loaded nanocarriers was studied. INF-γ-Ag PLGA NPs caused arrest of the cell cycle at G1 phase which further caused apoptosis of the HeLa cells and MCF7 cells. The therapeutic efficacy of GST-IkBα loaded hydrogel NCs was evaluated on HeLa cells and drug resistant U8-7 MG cells cells by cytotoxicity assay, cell cycle analysis and TUNEL assay. IkBα hydrogel NCs showed growth inhibition of drug resistant U-87 MG cells in combination with 5- Flurouracil. sFRP1-loaded gold nanocluster nanoparticles along with cisplatin targeted wnt pathway to achieve synergistic anti-proliferative effect on HeLa cells. Similarly, GST-PTEN was immobilized onto silica nanoparticles. The effect of GST–PTEN–silica nanoconjugate was evaluated on a PTEN null cell line U-87 MG, which revealed significant S phase arrest culminating into dose dependent reduction in cell proliferation. Thus, the promising effects of these proteins paves the way for their potential application for cancer therapy.

Studies on Leishmania donovani theranostic

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Visceral leishmaniasis (VL) is a severely neglected tropical disease in spite of being responsible for causing almost 40,000 annual deaths globally. This vector-borne parasitic disease is caused by Leishmania donovani and is endemic to the Indian Subcontinent, East Africa and Latin America, thus affecting some of the poorest people in the world. Current diagnostic techniques for VL rely mainly on parasitological and serological tests. Serodiagnosis of VL exploits the presence of disease-specific antigens or antibodies in the patients' sera and detects them using immunochemical or agglutination assays. This study was aimed at identifying and validating parasitic antigens that could be used to fabricate a theranostic device for VL. Trypanothione reductase (TryR) and trypanothione synthetase (TryS) are the key enzymes

involved in the trypanothione metabolism that is unique to kinetoplastid parasites (such as Leishmania donovani) and essential for their survival. As such, the presence of these proteins or the antibodies against them in an individual's serum could potentially serve as an indicator of VL. In this research, enzyme-linked immunosorbent assay (ELISA) was used for the colorimetric detection of TryR and TryS antigens as well as antibodies against them in the sera of 6 VL patients. An inverse correlation between the blood platetet count and level of anti-TryR and anti-TryS antibodies in patient serum was observed, and the causes need to be investigated. Preliminary analysis of the results also hints at TryR being a putative serum biomarker for VL, but further experimentation is required to substantiate this claim.

Investigation of Structural Transition in DHN1 by new tool: Protein Charge Transfer Spectra

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Protein Charge Transfer Spectra (ProCharTS) originate when charged amino/carboxylate group in the side chain of LYS/Glu, act as electronic charge acceptor/donor for photoinduced charge transfer either from/to the polypeptide backbone or to each other. The Absorption band intensities in roCharTS at wavelength 250 -800 nm are dependent on 3D spatial proximity between these charged functional groups across the protein. Intrinsically Disordered Proteins (IDPs) which are often rich in charged amino acid residues and hence easily probed by ProCharTS. IDPs in the past few years have emerged as a special class of proteins and are known to play a key role in various cellular processes despite lacking a unique three dimensional structure. Many recent studies strongly support the notion that structural fuzziness renders IDPs uniquely capable of functioning in key regulatory processes in biology. As the IDPs are functional under extreme conditions, they are envisioned to play important roles in various plant abiotic stresses.
Here we exploit abundant charged amino acid residues in Dehydrin (DHN1) (a member of Late Embryogenesis Abundant protein family) from Zea mays to probe the structural transitions.

Phytochemical estimation and antioxidant studies of different botanicals effective against Phoma exigua

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Fruit rot of brinjal is one of the most destructive disease causing severe damage to the fruits in the field and considerable losses during storage, transit and marketing. The commercial cultivation of the crop is under serious threat in Assam due to the disease. The incitant fungus of fruit rot of brinjal was identified and confirmed as Phoma exigua (Id No. - 8221.16) of the National Centre of Fungal Taxonomy, New Delhi). The aqueous extracts of fifteen botanicals were evaluated at 25 per cent concentration in vitro for their efficacy against the fruit rot pathogen of 'brinjal'- Phoma exigua. Out of these fifteen botanicals tested, Allium sativum (90.24%), Allamanda cathertica (87.80%), Lawsonia inermis (79.67%), Laurus nobilis (73.28%) and Lasia spinosa (70.15%), exhibited considerably higher inhibition (above 70%) on mycelial growth of the pathogen. The present investigation aimed at estimation of total alkaloid, total phenol content and antioxidant activity profiles of these five botanicals in vitro. Results revealed considerable variation among the extracts of these test botanicals. Significantly higher alkaloid content (g/100gm) was found in case of A. cathertica (2.764) followed by L. inermis (2.550), A. sativum (2.192), L. nobilis (1.450) and L. spinosa (0.086). Similarly, higher phenol content (mg/g) was found in case of A. cathertica (55.50) followed by L. inermis (49.68), A. sativum (30.60), L. nobilis (26.95) and L. spinosa (3.71). The highest antioxidant activity (inhibition %) was found in L. inermis (84.49) followed by L. nobilis (84.10), A. cathertica (44.56) , A. sativum (38.58) and L. spinosa (36.91). The antifungal activity of the botanicals against the pathogen Phoma exigua may be because of these phytochemical compounds present as secondary metabolites or may be due to the presence of some other bioactive compounds in addition to these phytochemicals.

Scope and importance of Abhayapuri lime in Assam

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Citrus is one of the most important fruit crops, grown in the tropical and subtropical regions of the world. They are grouped under the family Rutaceae and subfamily Aurantioideae. Swingle (1943) had divided Citrus into two subgenera, Citrus (formerly Eucitrus) and Papeda. North eastern region of India is considered as one of the natural home or primary gene centre and reservoir of various Citrus species . Bhattacharya and Dutta (1956) in thei r excellent work "Classi fication of citrus Fruits of Assam" described 17 species, 52 varieties and six probable hybrids. Assam is also rich in citrus wealth. Generally Lime does not have commercial importance in Assam, although there is an enormous scope for its cultivation. Among the varieties of Lime, Abhayapuri Lime occupies a large area and is particularly found to be grown in Pathsala, Pathsarkuchi, Bongaigaon, Kokrajhar and Abhayapuri district of Bongaigaon. Citrus aurantifolia (Christm.) Swin. Abhayapuri lime is oval elli[ptical to round shaped fruit with flower white coloured and juice vesicle green white. This variety mostly predominates in Assam valley but it is cultivated in limited extend. It is extensively used for various culinary purposes and for preparing pickles, chutneys and sherbet. On the other hand lime (C. aurantifolia) varieties has high market demand that encourages the orchardists to grow citrus in their backyard and kitchen garden as well. Kokrajhar district provides a suitable agro-climatic condition for large-scale citrus cultivation which is bounded by Bhutan in North, Dhubri district in South, Bongaigaon and Chirang district in East and West Bengal in West.Citrus production in Kokrajhar district is not encouraging even though suitable agro-climatic conditions prevail for large scale cultivation. Therefore, it is requi red to cultivate this variety that can be developed by using proper propagation technique. Various propagation methods have been employed for improvement of the quality of seedling by developing nursery .

Assessing the anti-microbial potential of actinobacteria isolated from rhizosphere of a medicinal plant Rubus ellipticus Sm. in Meghalaya, India

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Actinobacteria were isolated from the rhizosphere of a medicinal plant Rubus ellipticus Sm. found growing in the forest in Upper Shillong, Meghalaya, India. 16 actinobacterial colonies were isolated and screened for anti-microbial properties against two Gram-negative bacteria viz. Escherichia coli (MTCC 1669) and Pseudomonas aeruginosa (MTCC 4673), three Gram-positive bacteria viz. Staphylococcus aureus (MTCC 9886), Bacillus cereus (MTCC 1305) and Micrococcus luteus (MTCC 1538) and two fungal strains viz. Candida albicans (MTCC 7253) and Aspergillus niger (MTCC 4325). The crude extracts of the isolates were prepared and anti-microbial assay was performed by the agar-well diffusion method. From the 16 isolates screened, 8 isolates showed significantly visible anti-bacterial activity and 3 isolates showed anti-fungal activity (see fig 1 & 2). The isolates were also assessed for the presence of biosynthetic genes (PKS-I, PKS-II and NRPS) which are involved in many pharmacological activities including antibiotic activity. Out of the 16 isolates, 8 isolates have so far been assessed for the presence of the above biosynthetic genes by multiplex PCR and all of them were found to have at least one of the three biosynthetic genes (see table 1). Based on these results, it is clear that more study needs to be done on PKS-I, PKS-II and NRPS gene expression and isolation & characterization of bioactive metabolites.

Keywords: Actinobacteria, Rhizosphere, Rubus ellipticus, Anti-microbial properties, Biosynthetic genes

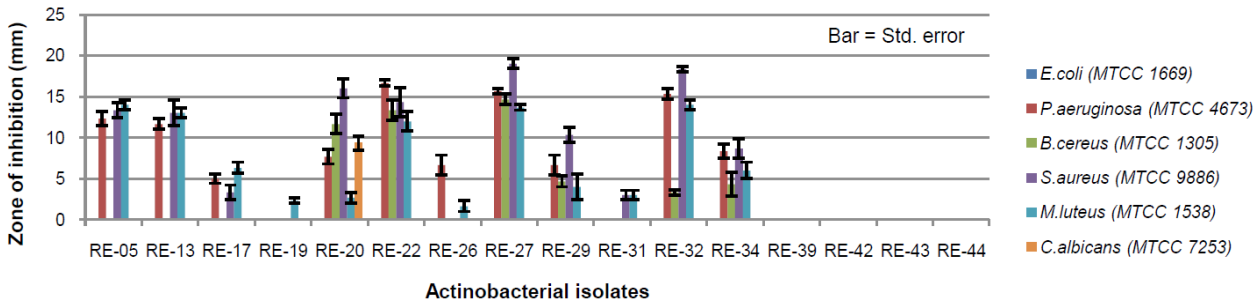

Fig 1. Agar well diffusion assay results showing anti-microbial activity of actinobacterial isolates against different microbial strains

Fig 1. Agar well diffusion assay results showing anti-microbial activity of actinobacterial isolates against different microbial strains

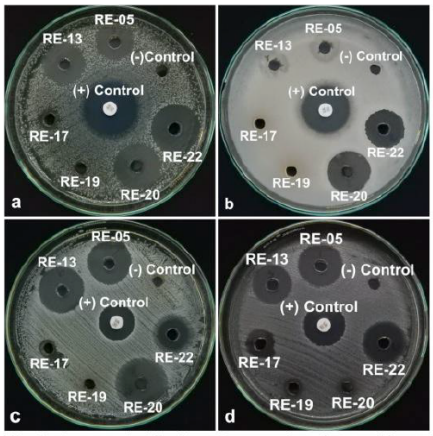

Fig 2. Agar-well diffusion pictures showing anti-bacterial activity of actinobacterial isolates against
(a) *Pseudomonas aeruginosa* MTCC 4673,
(b) *Bacillus cereus* MTCC 1305,
(c) *Staphylococcus aureus* MTCC 9886 and
(d) *Micrococcus luteus* MTCC 1538

Isolate	PKS-I	PKS-II	NRPS
RE-05	(+)*	(+)	(-)
RE-13	(+)	(+)	(-)
RE-17	ND	ND	ND
RE-19	(+)	(-)	(-)
RE-20	(+)	(+)	(-)
RE-22	(+)	(+)	(+)
RE-26	ND	ND	ND
RE-27	(+)	(+)	
RE-29	ND	ND	ND
RE-31	ND	ND	ND
RE-32	ND	ND	ND
RE-34	ND	ND	ND
RE-39	ND	ND	ND
RE-42	(+)	(+)	(-)
RE-43	(+)	(+)	(-)
RE-44	ND	ND	ND

Table 1. Multiplex PCR results of genomic DNA of actinobacterial isolates for detection of biosynthetic genes (PKS-I, PKS-II, NRPS).
*(+) = present; (-) = absent; ND = not determined

ADVERSE EFFECT OF PROCESSED FOOD ON HUMAN HEALTH

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Today, the majority of foods that humans consume are processed to some extent. "The term 'food processing' is mainly defined as a process of mechanical or chemical operations to change or preserve it by various methods like grading, , concentrating, pressurizing, irradiating, microwaving, sorting and packaging" (Floros et al.,2010). Food processing industry is one of the largest industry in India and is ranked 5th in terms of production, consumption and export (Anwar et al.,2017). Both fresh and processed foods make up vital parts of the food supply. Processed food has a bad reputation and some consider it to be not good for health, as they are loaded with sweeteners, salts, artificial flavors, factory – created fats, coloring chemicals- that alter texture & preservatives. Regular consumption of processed foods has a tremendous negative effect on our digestive system and is known to play a vital role in our nation's increasing rates of obesity, hypertension and Type II diabetes. But sometimes, processed foods are advantageous and not all of them are bad. Based on the degree of processing, all foodstuffs classified into three groups: such as "minimally processed" foods, "culinary ingredients", or

"moderately processed" and "ultra-processed foods" (Monteiro et al.,2011).Ultra- processed products are unhealthy as compared with the combination of minimally processed foods and processed culinary ingredients. This method of food classification that recognises the significance of different types of food processing is essential. We believe the classification is a sound basis for the work needed to protect and improve food, nutrition and public health in all societies and circumstances worldwide.

REFERENCES Anwar, M and Hussain, Z.(2017). Is all processed food harmful? J Nutrition health and food engineering.,6: 6-20 Floros, J.D. Newsome, R. Fisher, W. Canovas, G.V. Chen, H. Dunne, P. German, J.B. Hall, R.L. Heldman, D.R. Karwe, M.(2010) Feeding the world today and tomorrow: the importance of food science and technology. An IFT Scientific Review. Compr Rev Food Sci Food Saf.,9: 572–99. Monteiro, C.A. Levy, R.B. Claro, R.M.(2011) Increasing consumption of ultra-processed foods and likely impact on human health: evidence from Brazil. Public Health Nutr.,14: 5–13.

Investigating application of ProCharTS in monitoring binding of nucleic acid to protein

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Proteins are an important class of biomolecules implicated in a wide variety of cellular functions. Proteins participate in key processes in the life cycle of a cell all through its development, signalling and senescence. Because of involvement in a large number of biological processes, understanding protein structure-function is an important task. Understanding protein structure-function requires the employment of many biophysical and biochemical techniques. Near UV-visible spectroscopy is routinely employed in the qualitative and quantitative characterization of proteins. Unusual absorption spectra namely ProCharTS (Protein Charge Transfer Spectra) in Near UV region and visible range from charged amino acid has been reported recently. The unconventional chromophore apart from aromatic amino acids, implicated in this process. Investigation shows that in peptide specifically charge transfer occurs between a large no of charged amino acids, which can come closely in three-dimensional space. Nucleic acid binding proteins are rich in charged amino acids. It is possible that the binding of protein to highly negatively charged phosphate backbone could affect the charge transfer process (ProCharTS phenomena). The ProCharTS phenomena of nucleic acid binding protein should change with change in biochemical condition (pH change, salt concentration) surrounding the protein. Possibility is there that nucleic acid binding can be monitored by unusual absorption spectra exploiting ProCharTS phenomena. In an attempt to understand the nature of this unusual spectra in nucleic acid binding proteins and create a new way to monitor nucleic acid binding we present an investigation on absorption spectra of histone like DNA binding HU protein from Mycobacterium tuberculosis (Mtb).

Reference:

[1] Prasad. S. et al. Near UV- Visible electronic absorption originating from charged amino acids in a monomeric protein. Chem. Sci. 8, 5416-5433(2017)
[2] Bhowmick,T., ,Ghosh, S.,Dixit, K.,Ganesan, V.,Sarma, S. P.,Ramakumar, S.,Nagaraja, V. Targeting Mycobacterium tuberculosis nucleoid- associated protein HU with structure based inhibitors. Nat Commun. 5, 4124(2014)
[3] M. Z. Ansari, A. Kumar, D. Ahari, A. Priyadarshi, P. Lolla, R. Bhandari and R. Swaminathan, Faraday Discussions, 2017

EFFECT OF SEED COCOON, MATING DURATION AND COUPLING DEVICE ON REPRODUCTIVE PARAMETERS IN SILKWORM

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Sericulture is an agro based small cottage industry mostly confined to rural areas. India is the second largest producer of silk after china with an annual output of 18370 MT and provides employment to over 7 million people. India has the unique distinction of being the only country in the world producing all the four types of natural silk, viz., mulberry (Bombyx mori L.), tasar (Antheraea mylitta Drury and A. proylei Jolly), eri(Samia ricini Donovan) and muga (Antheraea assamensis Helfer). The golden muga silk produced in North East India is the country's monopoly in the world (Siddiqui, 2012). Several factors affect the reproductive parameters in silkworm like seed cocoon (selection, transportation and preservation), mating duration, coupling device, etc. During seed cocoon selection crop history should be maintained and disease free layings should be selected. Transportation of cocoons should be done in the cooler hours of the day avoiding severe jerks and direct sunlight (Rath, 2010; Anon., 2010). Temperature of 25˚C±1˚C and humidity of 75-80% in mulberry (Narasimha.,1988), 26-28˚C temperature and 80- 85% RH in eri and muga and temperature below 35ºC and 40-60 % RH should be maintained in tasar during cocoon preservation (Anon., 2010). Mating duration of 2.3, 4.3-5, 4-5 hours was sufficient for egg laying in mulberry, eri, muga and tasar respectively. (Sarkar et al., 2009; Behura and Panda, 1978; Goswami and Singh, 2012). Nylon bag (Debaraj, et al., 2003) and paper made coupling device are found effective in eri and muga respectively (Saikia, 2017).

REFERENCES:

1. Anonymous (2010).Wild silks of India – a user's compendium,vol-2, Central Silk Board, Bangalore, pp. 129-205.
2. Behura, B.K. and Panda, M.N. (1978). Effect of different coupling durations and polygamy on preoviposition period and fecundity of the Eri silk moth Samia ricini Hutt. (Lepidoptera : Saturniidae),J. Zool. Soc. India, 30(122),pp 65-67.
3. Debaraj, Y., Sarmah, M.C. and Suryanarayana, N.(2003). Seed technology in eri silkmoth- experimenting with other oviposition devices. Indian J. Seric.,42(2), pp 118-121.
4. Goswami, D. and Singh, N.L.(2012).Effect of coupling duration on fecundity and fertility of muga silk moth Antheraea assama WW. Indian Journal of Entomology,74(2), pp 132-135.
5. Narasimhanna, M.N. (1988).Manual on silkworm egg production. Central Silk Board, Bangalore, India, pp 142.
6. Rath, S.S. (2010). Tasar Culture-Principles and practices: Seed production technology. C.T.R. & T.I., Jharkhand, pp 87-152.
7. Sarkar,K., Mandal, M. and Moorthy, S.M.(2009). Effect of mating duration and multiple use of male moth on reproductive performance of some cross breeds of silkworm, Bombyx mori L.Int. J. Indust. Entomol. Vol.19(2), pp 215-219.
8. Saikia, D. (2017). Effect of coupling devices and mating durations of muga silkworm (Antheraea assama Ww.),M. Sc.(Agri.) in Sericulture, A.A.U., Jorhat.
9. Siddiqui, A.A. (2012). Biodiversity of muga silkworm host plant and their utilization, Central Silk board, Bangalore, India. Pp 1-10.

PROBIOTICS IN FOOD AND HEALTHCARE INDUSTRY

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Probiotics are defined as 'live microorganisms which when administered in adequate amount confer health benefits to the host' (FAO/WHO, 2002). As nutrition is moving towards the use of foods to promote better health and well-being, functional foods such as probiotic products have become more important to consumers because of their health promoting properties (Cardarelli et al., 2008). Since time immemoriable, the use of microbials have existed in our traditional food system in the form of fermented foods, vegetables, fish products, beverages, yogurt, cheeses (Amara and Shahibi , 2012). The most common probiotic species used in the food industry for manufacturing of yoghurt, health drinks, infant foods are Lactobacillus sp, Streptococcus sp and Bifidobacterium sp. Probiotics is the rapidly expanding area in the field of functional foods and the global probiotics market had increased by US $ 31.1 in 2015. The largest market of probiotics is Europe with an estimated $13.5 billion. Asia is the second largest with an estimated CAGR of 11.2%. Over the last century, different micro-organisms have been used for their ability to prevent and cure diseases. At present, several well-characterized strains of Lactobacilli and Bifidobacteria are available for human use to reduce the risk of non-communicable diseases.(NCD) (West et al., 2015). The uses of probiotics and their applications have shown tremendous increase in the last two decades due to their beneficial effects on human health and nutritional values.

REFERENCES:

1. Amara, A.A. and Shahibi A. (2012). Role of Probiotics in health improvement, infection control disease treatment and management. Saudi pharm journal, 23(2):107-114.
2. Cardarelli, H.R.; Buriti, F.C.A.; Castro, I.A. and Saad, S.M.I. (2008) Inuline and oligofructose improve sensory quality and increase the probiotic viable count in potentially symbiotic petit-suisse cheese. LWT Food Sci. Technol,41:1037-1046.
3. West, E.C.; Renz, H.; Jenmalm, M.C.; Kozyrskskyj, A.l.; Allen,K.J.; Vuillermin, P. and Prescott, S.L. (2015) The gut microbiota and inflammatory noncommunicable diseases: Associations and potentials for gut microbiota therapies, The Journal of Allergy and Clinical Immunology, 135(1):3-13.

NEEDLE FREE INJECTIONS

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Needle free injection technology is innovative ways to introduce a variety of medicines in patients without piercing the skin. These systems work by the mechanism in which liquid medication is forced at an elevated speed through a small orifice that is held against the skin. Due to this an ultrafine stream of high pressure fluid is created, that penetrates the skin devoid of the use of a needle, thus faster administration of drug occurs as compared to conventional needles. Needle free systems are designed to solve the problems created due to conventional needles making them safer, less expensive, and more suitable. Moreover, they should decrease the occurrence of needle stick accidents that have been seen in some health care workers contracting diseases. Today, they are an increasingly rising technology that promises the administration of medicine efficient with reduction of pain. Companies are not only working on developing technologies that are safer and easier to use, but also on alternatives which can deliver more types of medicines. These posters discuss about the needle less injection, their applications and advantages over needle injections. This poster also explains about needle free injections technologies and needle free injection devices currently available on the market and the information regarding it was clearly placed in this poster. The main drawbacks of needle injections that prompt scientists to look for the needle less injections were explained. An overview of recent trends and other needleless drug deliveries was also explained.

References

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Edible Flowers Of Ornamental Crops: A New Source Of Neutraceutical Food

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Edible flowers have been traditionally used for human consumption in various cultures. They improve the appearance, taste and aesthetic value of food (Fernandes et al., 2017). Both the quality of foodstuffs and aesthetic aspects contribute to the appearance of consumed meals. The attraction and appeal of individual dishes could be enhanced by edible flowers (Rope et al., 2012). More importantly they gain interest because of the presence of different biologically active compounds (Mlcek and Rop, 2012). These active compounds found in edible flowers are different anti-oxidants, anthocyanins, carotenoids, flavonoids, some phenolic compounds etc. Edible flowers contain numerous phytochemicals which contribute to their health benefits, and consumption of edible flowers has increased significantly in recent years (Lu et al., 2016). The best nutraceutical performances are mainly seen in more pigmented flowers (Benvenuti et al., 2016). The growing need for nutraceutical new foods has generated interest in edible flowers. Despite the potential health benefits associated to edible flowers consumption, particular attention must be given to their harvest and preservation, due to their high perishability (Fernandes et al., 2017). These edible flowers should save as potential rich resources of natural neutraceutical compounds for use as functional food ingredients or in different pharmaceuticals for control of diseases and other health hazards (Li et al., 2014).

Keywords: edible flower, neutraceutical food

References:

1. Benvenuti, S.; Bortolotti, E. and Maggini, R. (2016). Antioxidant power, anthocyanin content and organoleptic performance of edible flowers. Scientia Horticulturae 199: 170-177.
2. Fernandes, L.; Casal, S.; Pereira, J.A.; Saraiva, J.A. and Ramalhosa, E. (2017). Edible flowers: A review of the nutritional, antioxidant, antimicrobial properties and effects on human health. Journal of Food Composition and Analysis 60: 38-50.
3. Li, A.; Li, S.; Li, B.H.; Xu, P.D.; Xu, R.X. and Chen, F.(2014). Total phenolic contents and antioxidant capacities of 51 edible and wild flowers. Journal of Functional Foods 6: 319-330.
4. Lu, B.; Li, M. and Yin, R. (2016). Phytochemical Content, Health Benefits, and Toxicology of Common Edible Flowers: A Review (2000–2015). Food Science and Nutrition 56: 130-148.
5. Mlcek, J. and Rop, O. (2012). Fresh edible flowers of ornamental plants. Food Science & Technology 22: 561-569.
6. Rop, O.; Mlcek, J.; Jurikova, T.; Neugebauerova, J. and Vabkova, J. (2012). Edible Flowers—A New Promising Source of Mineral Elements in Human Nutrition. Molecules 17: 672-683.

Cloning, expression, purification and biochemical characterization of first α-L-arabinofuranosidase (PsGH43) from Pedobacter saltans

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Arabinoxylans have the backbone of β-(1→4)-linked xylose residues with the substitution of one or more L-arabinofuranosyl residues, at position 2 or 3. The α-L-arabinofuranosidase are accessory enzymes that cleave α-L-arabinofuranosidic linkages and act synergistically with other hemicellulases and pectic enzymes for the complete hydrolysis of hemicelluloses and pectins. The action of α-L-arabinofuranosidase alone or in combination with other lignocellulose degrading enzymes represents a promising biotechnological tools as alternative to some of the existing chemical technologies such as chlorination in pulp and paper industry sourdough fermentation and pretreatment of lignocelluloses for bioethanol production. In present study, the gene (1.7 kb, Genbank Acc. No. ADY53124.1) encoding

α-L-arabinofuranosidase, a family 43 glycoside hydrolase (PsGH43) was cloned into pET-28a(+) vector and expressed in E. coli BL21 (DE3) cells with His-6 tag as a soluble protein. PsGH43 on purification by His GraviTrap column and analysis by SDS-PAGE the protein gave single band displaying the molecular mass approximately, 65 kDa. The optimum pH for enzyme activity was 6.5 and the optimum temperature was 50°C. The PsGH43 enzyme displayed activity against rye arabinoxylan and wheat arabinoxylan with specific activity 88.7 U/mg and 78.9 U/mg, respectively, at 50°C and pH 6.5. The K_m and V_{max} for PsGH43 were 3.02 mg/ml and 103 µmole/min/mg, respectively, with rye arabinoxylan.

Cultural and morphological characteristics of Colletotrichum musae causing anthracnose of banana

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Anthracnose disease of banana which is caused by Colletotrichum musae(Berk. & M.A. Curtis) Arx, (1957) is one of the most important post harvest disease of banana worldwide causing a loss of about 22%. The fungus mainly infects the necks of banana fingers. Later, the infection may spread to peduncles and fingers also. The fungus may also be associated with the rotting of the crown portion of banana fruit. Small, circular, black spots may first be noticed on the infected parts which later enlarge in size leading to anthracnose. Due to infection by the fungus the ripening of fruits increases. On ripened infected fruits, orange colour acervuli develop. In this study, the cultural and morphological characteristics of C.musae have been observed after isolation of the fungus from an infected sample of banana (Cavendish variety). The culture was grown in Potato dextrose agar (PDA) medium and showed loose, aerial white mycelial growth on petriplates. Study of the morphological characters showed that the fungus produces conidia after incubation of the culture on PDA for seven days at room temperature. The conidia are oval in shape with an oil globule at the centre (guttulate). Slide culture technique was also done to observe appressorium formation of the fungus.

Keywords- Anthracnose, Colletotrichum musae, conidia, appressorium

Localized and Targeted Anticancer Drug Delivery Using Nano Hybrid Injectable Silk Hydrogel

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The incidence and mortality rate due to cancer is increasing worldwide. Chemotherapy is a major therapeutic approach available to treat cancer. However, there exist major limitations using chemotherapeutic approaches due to hydrophobic nature of molecules, lack of solubility and selectivity, loss of activity in blood circulation, burst release and drug resistance by cancer cells. To countercheck, the indiscriminating action of anticancer drugs and specific targeting of drug molecule into cancer cells becomes inevitable for treatment modalities. In our approach, we have used a novel silk hydrogel impregnated with folic acid functionalized doxorubicin (Dox) loaded carbon nanotubes (CNT-FA/DOX). The in vitro studies demonstrated the active targeting of CNT-FA/DOX to folic acid receptor positive cancer cells. Increased Dox release was observed from both CNT and silk hydrogel individually as well as their hybrid system at lower pH. Further, CNT also showed thermo responsive Dox release due to their heat conductive property. Therefore, the silk-CNT hybrid system is presented here as pH and temperature responsive system. The mechanical strength and rheology supported the ease of its injectability. Hence the developed silk-CNT hybrid system might allow its near or intra-tumoral implantation, where it may act as depot for Dox-loaded nanoparticles. The sustained and targeted release of Dox at tumour site will reduce its side effects as well as frequent patient visits for efficacious cancer treatment.
Keywords: injectable silk hydrogel, carbon nanotubes, targeted drug delivery

Artificial Induction Of Cordyceps bassiana stromatal fruiting body from Beauveria bassiana

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Cordyceps, an ascomycete fungus, have been a subject of curiosity for hundreds of years. They have been prized for their hidden medicinal values, especially in the Eastern Asian society. Recent studies suggest that several species in this genus possess wide-ranging pharmacological properties, such as immunomodulating, antioxidant, antitumor, hepatoprotective, nephroprotective, hypoglycemic and hypocholesterolemic activities, and effects on apoptotic homeostasis. The challenge to develop it commercially is in understanding their growth habit in in vitro culture conditions. Therefore, different carbon sources like Brown rice, Black rice, Rice Bran, Wheat Bran, Maize meal were tried for artificial induction of stromatal fruiting body from Beauveria bassiana isolates in single and also from their combinations. Primordia of fruiting bodies were observed in Brown rice and Black rice media only, hence, the experiment was further carried out with these two carbon sources. The inoculated fruiting media containing Brown rice or Black rice supplemented with pupa as nitrogen source were incubated in 25oC at 70~80% relative humidity and 1000 lux light intensity. After 60 days of incubation, initial primordial development and matured fruiting bodies of 8 mm were observed in liquid and solid media of Black Rice, respectively. Similarly, stromatal fruiting bodies of 2mm length were produced in Brown rice solid media with no primordia development in liquid media.
Keywords : Cordyceps bassiana, Brown rice, Black rice, Stromatal fruiting body.

References:
1. Lee JO, Shrestha B, Kim TW, Sung GH, Sung JM. Stable formation of fruiting body in Cordyceps bassiana. Mycobiology 2007;35:230-4.
2. Sung JM, Lee JO, Humber RA, Sung GH, Shrestha B. Cordyceps bassiana and production of stromata in vitro showing Beauveria anamorph in Korea. Mycobiology 2006; 34:1-6.

Studies on Antimicrobial Activities of Some of the Indigenous Herbs Against Aureimonas altamirensis, an Opportunistic Human Pathogen Associated with Cotton Fabric

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The inherent properties of the textile fibers provide scope for growth of various forms of microorganisms. In some cases, these microorganisms lead to unpleasant odors, staining, fabric deterioration, and even can cause physical irritation, such as skin allergies, skin infections and other medical issues. Aureimonas altamirensis is an aerobic Gram-negative bacillus and is a potential opportunistic pathogen of humans, causing inflammation of the lining of the inner wall of the abdomen (peritoneum). The bacterium was recently found to be associated with used cotton fabrics of hot and humid climatic conditions of Assam and was reported to be associated with cotton fabric deterioration. This raises potential scope for the microorganism to enter into the elementary canal of the user from cotton fabrics. Bioremediation is a natural and cost effective method to deal with microorganisms and can be perceived by public as an acceptable treatment process for different microbial agents. Therefore, we initiated this work to test antimicrobial susceptibilities of Aureimonas altamirensis against 22 local herbs with known ethno-medicinal values using the agar diffusion method. Syzgium cumini and Phyllanthus fraternus showed the best results against the pathogenic bacterium A. altamirensis. It was also found that the antimicrobial properties of the two plant extracts can remain till 11 washes and laundering procedures. These results will help to formulate herbal extract recipes to stop microbial contamination in cotton fabrics and will assist the community to get rid of humidity related health issues.

Morphological diversity of Colletotrichum musae causing post-harvest diseases of banana in Assam and its management by plant resident microorganisms

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Anthracnose of banana caused by Colletotrichum musae is a serious post-harvest problem of banana in Assam. Hundred and fifty samples of banana fruits expressing sunken lesion symptom of anthracnose were collected from different growing areas of Assam and the pathogen isolated was identified as C. musae. Based on cultural characteristics in Potato Dextrose Agar, all the 150 isolates were categorized under 4 groups according to the grouping used- viz. group I: fast growing mycelia with white to salmon orange, group II: fast growing mycelia with pinkish to light orange mycelia, group III: sparse, slow growing, suppressed, light orange mycelia and group IV: dense, fast growing, orange mycelia. C. musae was also inoculated on different media such as Czapek's Dox agar, Oat meal agar, Carrot agar, Richard's agar, Host leaf extract agar and sabourd's agar to investigate the growth pattern of the pathogen on their nutrient sources. C. musae has shown fast growth, good mycelium texture and salmon orange and conidial population colour when compared with other media. To manage the pathogen, endophytic and epiphytic microbes were isolated from healthy leaf of banana plant collected from different locations of Assam showed a promising level of inhibition (up to 80 per cent) in vitro by dual culture technique (Dennis and Webster 1971). The promising microbes may further be investigated for attributes other than already studied and be tested under field situation for commercial formulation.

Keywords: Banana, Colletotrichum musae, Endophytes, media.
Reference:
Dennis, C. and Webster, J. 1971. Antagonistic properties of specific groups of Trichoderma; Production of volatile antibiotics. Trans. Br. Mycol. Soc. 57: 41-48.

Designing of an inducible expression vector for Entomopathogenic fungi based on MCL1 promoter.

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The promoter is the key to an efficient gene expression vector in molecular biology. In prokaryotes, the promoters are about few tens of base pairs which make it easier to use in genetic engineering, but the fungal promoters size range from few hundreds to thousands of base pairs, which considered as a hurdle in genetic engineering. In this study, the inducible collagen like protein promoter MCL1was amplified from the genomic DNA of Metarhizium anisopliae and then truncated into different sizes through a series of targeted and random deletions based on various transcription factor binding sites. After that, fusion of the full and the truncated promoters with a reporter gene (GFP) which has been already fused with the MCL1 signal peptide to direct its expression to the haemolymph. Then, the transformation of M. anisopliae was done using Agrobacterium tumefaciens mediated transformation method. The GFP protein found to be expressed in the full and truncated promoters' clones as observed by fluorescence microscope and later, the gene expression will be confirmed quantitatively using quantitative RT- PCR and qualitatively by insect bioassay.

SOUS-VIDE TECHNIQUE

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Cooking is the art of preparing food for ingestion by the application of heat. In modern days, different types of innovative cooking techniques are developed, to give consumers safety against physical, chemical and biological hazards. Sous-vide are one of those techniques where raw food materials are cooked under controlled conditions of temperature and time inside heat-stable vacuumized pouches (Schellekens, 1996). These products require refrigerated storage (0–3oC), and under this condition they could be stored for 3–5 weeks before reheating and consumption (Vaudagna et al., 2002). Sous-vide cooking are quite popular in western countries because it reduces loss of nutrients and flavor compounds from food and improves the sensorial characteristics as compared to those of traditional cooked products (Renna et al., 2014). This is due to precise heating applied during sous-vide technology. Moreover the vacuum sealing and refrigerated storage extends the shelf life of the product (Renna et al., 2014). Sous-vide foods act as a convenient means for serving large public catering and restaurants. The prime advantage of this technology is that it allows greater control over doneness of food than traditional cooking methods. So, this technology is anticipated to have an avant-garde effect on Indian population in near future.

REFERENCES

1. Renna, M., Gonnella, M., Giannino, D., & Santamaria, P. (2014). Quality evaluation of cook-chilled chicory stems (Cichorium intybus L., Catalogna group) by conventional and sous vide cooking methods. Journal of the Science of Food and Agriculture, 94(4), 656-665.
2. Schellekens, M. (1996). New research issues in sous-vide cooking. Trends in Food Science & Technology, 7(8), 256-262.
3. Vaudagna, S. R., Sánchez, G., Neira, M. S., Insani, E. M., Picallo, A. B., Gallinger, M. M., & Lasta, J. A.(2002). Sous vide cooked beef muscles: Effects of low temperature–long time (LT–LT) treatments on their quality characteristics and storage stability. International Journal of Food Science & Technology, 37(4), 425-441.

Nanoparticles and nanofertilizers for enhancing crop growth and nutrient use efficiency

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Nutrient Use Efficiency is a critically important concept for evaluating crop production systems and can be greatly impacted by fertilizer management as well as soil- and plant-water relationships. Improving NUE have been listed among today's most critical and daunting research issues (Thompson, 2012). The objective of nutrient use is to increase the overall performance of cropping systems by providing economically optimum nourishment to the crop and supporting agricultural system sustainability through contributions to soil fertility or other soil quality components (Mikkelsen et al., 2012).

The mobility of the nano-particles is very high which lead to transport of the nutrient to all parts of the plant (Torabian et al., 2017). The effectiveness of nano-fertilizers may surpass the most innovative polymer-coated conventional fertilizers due to a high surface area to volume ratio (Naderi and Danesh, 2013). Fertilizers encapsulated in nano-particles will also increase availability and uptake of nutrient to the crop plants (Tarafdar et al., 2012). Saturated nano zeolite with ammonium sulfate based on dis-solution and ion-exchange reactions, can increase P solubility incalcareous soils in two ways: decreasing the soil pH and adsorbing its calcium (Mikhak et al., 2016). Comparison of Organic carbon contents in zeolitic materials showed that nanozeolite plays an important role in increasing the Organic carbon contents in different aggregate size fractions compared with the zeolite (Aminiyan et al., 2015).

References:
1. Aminiyan, M.M.; Sinegani, A.S. and Sheklabadi, M. (2015). Aggregation stability and organic carbon fraction in a soil amended with some plant residues, nanozeolite, and natural zeolite. Intern. J. Recycl. Org. Waste Agric. 4: 11–22.
2. Mikhak, A.; Sohrabi, A.; Kassaeeb, M.Z. and Feizian, M. (2017). Industrial Crops and Products 95: 444–452
3. Mikkelsen, R.; Tom, L.; Jensen, C.S. and Tom, W.B. (2012). Nutrient Management Planning and Accountability. In 4RPlant Nutrition: A Manual for Improving the Management of Plant Nutrition (T.W. Bruulsema, P.E. Fixen, G.D. Sulewski, eds.), International Plant Nutrition Institute, Norcross, GA, USA.
4. Naderi, M.R. and Danesh, S.A. (2013). Nanofertilizers and their roles in sustainable agriculture. Intern. J. Agric. Crop Sci. (19): 22-29.
5. Tarafdar, J.C.; Agarwal, A.; Raliya, R.; Kumar, P.; Burman, U. and Kaul, R.K. (2012). Adv. Sci. Engg. Medicine 4: 1-5.
6. Thompson, H. (2012). Food science deserves a place at the table – US agricultural research chief aims to raise the profile of farming and nutrition science. Nature, July 12.
7. Torabian, S.; Zahedi, M. and Khoshgoftar, A.H. (2017). Effects of foliar spray of nano-particles of FeSO4 on the growth and ion content of sunflower under saline condition. J. Plant Nutr. 40(5): 615-623.

Tailoring Mechanical Properties of Silk Based Engineered Disc to Modulate Matrix Deposition of Annulus Fibrosus cells

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For successful tissue engineering application towards load bearing application recapitulating the biomechanical functions which are directly related to the structural intricacy, becomes crucial. Mimicking such anatomical complex structure of the annulus fibrosus (AF) remains challenging due to their biochemical and biomechanical heterogeneity. Tissue engineers have yet to capture the multi-lamellar hierarchy structure and region-specific mechanical properties of AF tissue [1-3]. Reconstruction of the native tissue's anatomical and biophysical milieu dictates the success of tissue engineered graft's cellular fate. Herein, we report a fabrication procedure to replicate the anatomical and biomechanical features of annulus fibrosus (AF) tissue. A seamless, full thickness disc-like angle-ply construct was fabricated using silk fibroin (SF) protein. To mimic the gradual transition of mechanical gradient from inner to outer region of native AF tissue, SF proteins from two different sources (namely Bombyx mori, BM SF as mulberry, and Antheraea assamensis, AA SF and Philosamia ricini, PR SF as non-mulberry) were blended in various ratios that provided differential mechanical and cell binding properties. Fabricated constructs were physicochemically and biologically characterized. The substantial alterations in physical properties e.g., pore size/porosity, inter-lamellar distance, swelling, degradation, and mechanical properties of the construct were attained in blends, when compared to control BM SF. The seeded porcine AF cells were found to align along the lamellar pores as visualized through staining. Enhanced AF cell proliferation was observed within constructs created of non-mulberry silk. Gene expression study concluded increased expression of collagen-I with enhancement of mechanical properties (particularly in the blends of BM SF and AA SF), whereas an opposite trend was observed for both collagen-II and aggrecan. Overall, the angle-ply construct with tailored mechanical properties supported cellular alignment and proliferation, and modulated the extracellular matrix (ECM) deposition forming a functional AF tissue like construct, thus providing a robust foundation as an alternative tissue engineered strategy in intervertebral disc (IVD) regeneration for future replacement therapy.

Key words: Silk; Annulus fibrosus; Mechanosensing; Biomaterial; Tissue engineering

References:
1. S. Hariharan, J. A. Scarlett & S. E. Abram, Techniques in Regional Anesthesia & Pain Management 13, 67-75 (2009).
2. N. Nandan L, S. Sen, A.H. Huang, D. M. Elliott & R. L. Mauck, Spine 35, 867-873 (2010).
3. P. S. Hyug, E. S Gil, B. B. Mandal, H. Cho, J. A. Kluge, B. H Min & D. L. Kaplan, Journal of tissue engineering and regenerative medicine 6, s24–s33 (2012).

A Novel genosensor for Invasive Aspergillosis

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Invasive Aspergillosis (IA) is one of the leading infectious disease worldwide caused by Aspergillus fumigates especially in the third world. The early detection in miniaturized settings has utmost importance to combat the disease in such demography. In this context, we have fabricated a novel electrochemical biosensor for its detections in early stages by targeting the glip gene found in virulent strains. The sensing probe has been fabricated with the nano-material assisted modified composite biomaterial. This sensor has been extensively characterized using various surface as well as electrochemical characterization techniques. The excellent analytical performances have been obtained where dynamic range was found to be 1 × 10−14- 1 × 10−2 M with the detection limit of 0.32 ± 0.01 × 10−14 M.

Calmodulin and calcium/calmodulin dependent kinases are important for normal growth and development in Neurospora crassa

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Calcium (Ca2+) is critical second messenger molecule that has found to mediate various cellular processes from higher to lower eukaryotes. In Neurospora crassa 48 Ca2+- signalling genes have been identified. Calmodulin (CaM) is an essential gene with four EF hand domains and acts as one of the main receptors for Ca2+. Calcium/calmodulin dependent kinases (CaMKs) are serine /threonine kinases that have a CaM binding domain, they are capable of phosphorylating broad range of substrates. Studies using CaM antagonist trifluoperazine (TFP), chlorpromazine (CPA), Repeat-Induced Point mutation (RIP) and knockout mutants of all four CaMKs have unveiled their role in normal growth, sexual development and survival under stress condition N. crassa.

Pretreatment optimization of Lantana camara for the lignocellulosic bioethanol production

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Lignocellulosic bioethanol, the second generation and environmental sustainable biofuel. High crystallinity of cellulose and presence of lignin in lignocellulosic biomass results less yield of bioethanol by direct fermentation. Pretreatment makes the cellulose and hemicellulose more accessible for enzymatic hydrolysis. In present study, Lantana camara is used as biomass, because it is a weed and not used even as fodder and has easy availability. Holocellulose content of stem and leaves were 66.75±1.06% and 58.25±1.76%, respectively. Various pretreatment methods for Lantana camara were screened. The physical pretreatment methods such as mechanical comminution and uncatalyzed autohydrolysis at neutral pH, the chemical pretreatment methods such as acid, alkali, oxidizing agent and ammonia treatment and the physicochemical pretreatment such as the combination of physical and chemical pretreatment were used. Among these pretreatments, the acid pretreatment resulted high yield of total reducing sugar (TRS). The process parameters investigated for acid pretreatment were; biomass loading 10% (w/v), H2SO4 concentration 2% (v/v) for stem and 3% (v/v) for leaves, temperature 121oC, pressure 15 psi and duration for treatment was 20 min. The TRS yield of 0.275 g/g of raw stem and 0.185 g/g of raw leaves were obtained. The ammonia pretreatment showed lowest TRS yield of 0.005 g/g of raw stem and 0.022 g/g of raw leaves.

The composition analysis of pretreatment and crystallinity of pretreated biomass are being carried out. The results in details will be presented.

Keywords: Bioethanol; Lignocellulosic biomass; Holocellulose; Acid pretreatment; Total reducing sugar (TRS)

References:

1. Kumar, P., Barrett, D. M., Delwiche, M. J., & Stroeve, P. (2009). Methods for pretreatment of lignocellulosic biomass for efficient hydrolysis and biofuel production. Industrial and Engineering Chemistry Research, 48(8), 3713-3729.
2. Singh, S., Sarma, S., Agarwal, M., Goyal, A., & Moholkar, V. S. (2015). Ultrasound enhanced ethanol production from Parthenium hysterophorus: a mechanistic investigation. Bioresource Technology, 188, 287-294.

Development of biointensive Integrated Pest management module against rice yellow stem borer

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A field experiment was carried out carried out in ICR (Instructional Cum Research) Farm, Assam Agricultural University, Jorhat to study the performance of biorational insecticides against yellow stem borer, Scirpophaga incertulas in Sali and Ahu rice during the year 2016-2017.

Eight treatment viz, Beauveria bassiana (Bals.) Vuill. WP formulation of indigenous strain-KR855715 10g/l , Pestoneem @ 5ml/l ,Crude bael (Aegle marmelos) extract @ 5ml/l, Chlorpyriphos 20EC @ 2ml/l, B. bassiana WP formulation + pestoneem @ 5ml/l , B. bassiana WP formulation + Crude bael extract @ 5ml/l, B. bassiana. WP formulation + chlorpyriphos 20EC @ 1ml/l and untreated control Water Spray) were laid out in randomized block design with three replications. . The observations on per cent of dead heart and white ear head along with yield of the crop in different treatments were recorded. Out of the eight treatment tested, the treatment comprising of Beauveria bassiana WP @ 10gm/l along with chlorpyriphos 20EC @ 1ml/l was found comparatively most effective in reducing the infestation of stem borer followed by chlorpyriphos 20EC @ 2ml/lit during Sali and Ahu 2016-2017. Result showed that 97.8% and 89.57% % reduction of dead heart and white ear head were achieved over the control by two sprayings. Apart from this B. bassiana WP formulation + pestoneem @ 5ml/l, B. bassiana WP formulation + Crude bael extract @ 5ml/l EC also proved better in reducing the dead heart and white ear head, respectively.

Keywords: Scirpophaga incertulas, Beauveria bassiana, chlorpyriphos

Food Fraud: A major concern to human health

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Food fraud from a general sense includes more defined sub-categories of economically motivated adulteration. The main reason lies to achieve economic gains. While most food safety are unintentional acts, food fraud is very intentional and can argument food risks . Its types include adulterant substances, substitution, dilution, stolen goods, tampering, mislabelling and intellectual property rights counterfeit. Food fraud can be committed by any individual or groups involved in supply chains including manufactures, retailers and importers. Top food fraud ingredients include fish and sea foods, olive oil, milk products, honey and spices.The goal is not to catch the fraudulent product, but to put in place systems that will prevent it from being in the supply chain. Considering the widespread increase of fraudulent food products, intensive and continous monitoring will likely grow over time. Detection, self authentication and traceability systems with access to proper technological help reduction to some extent. Additionally detection measures are measured by prevention. The shift to prevention can be added to reduced food fraud vulnerability.Further research and ideas will stimulate the effects of food fraud, mistrust and food risks in general.

Keywords: Economically modified adulteration •Supply chain• Food fraud vulnerability •Traceability systems •Detection systems •Food fraud prevention

A Fluorescence bimolecular complementation tool for monitoring ribosome assembly defects in Escherichia coli.

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We utilized bimolecular fluorescence complementation (BiFC) for detecting assembly defects in bacterial ribosomes. The fusion of N and C-terminal fragments of Venus fluorescent protein to the ribosomal proteins uS13 and uL5, respectively, in Escherichia coli facilitated the incorporation of the tagged uS13 and uL5 onto the respective ribosomal subunits. When the ribosomal subunits associated to form the 70S particle, the complementary fragments of Venus were brought into roximity and rendered the Venus fluorescent. Assembly defects that inhibit the subunits association were provoked by either the loss of the known assembly factors such as RsgA and SrmB or the presence of small molecule inhibitors of ribosome maturation and several ribosome-targeting antibiotics and this showed abrogation of the fluorescence complementation. This suggests that BiFC can be employed as a surrogate measure to detect ribosome assembly defects proficiently by circumventing the otherwise cumbersome procedures. BiFC thus offers a facile platform not only for systematic screening to validate potential assembly factors but also to discover novel small molecule inhibitors of ribosome assembly toward mapping the complex assembly landscape of ribosome.

Cultural and morphological characteristics of Colletotrichum musae causing anthracnose of banana

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Anthracnose disease of banana which is caused by Colletotrichum musae(Berk. & M.A. Curtis) Arx, (1957) is one of the most important post harvest disease of banana worldwide causing a loss of about 22%. The fungus mainly infects the necks of banana fingers. Later, the infection may spread to peduncles and fingers also. The fungus may also be associated with the rotting of the crown portion of banana fruit. Small, circular, black spots may first be noticed on the infected parts which later enlarge in size leading to anthracnose. Due to infection by the fungus the ripening of fruits increases. On ripened infected fruits, orange colour acervuli develop. In this study, the cultural and morphological characteristics of C.musae have been observed after isolation of the fungus from an infected sample of banana (Cavendish variety). The culture was grown in Potato dextrose agar (PDA) medium and showed loose, aerial white mycelial growth on petriplates. Study of the morphological characters showed that the fungus produces conidia after incubation of the culture on PDA for seven days at room temperature. The conidia are oval in shape with an oil globule at the centre (guttulate). Slide culture technique was also done to observe appressorium formation of the fungus.
Keywords- Anthracnose, Colletotrichum musae, conidia, appressorium

Catecholamines as chemical messengers for host-Leptospira interaction

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Background: Pathogens have evolved crucial mechanisms to sense the presence of stress hormones in the human or animal body upon infection (Lyte, 2004). This study is aimed at understanding the modulation of gene expression in Leptospira interrogans on exposure to catecholamines under in vitro condition.
Methods: In this study, the effect of host-stress hormone catecholamine on Leptospira gene transcripts encoding outer membrane proteins was investigated. Selective transcript analysis of outer membrane genes of L. interrogans in response to catecholamines (Epinephrine/Norepinephrine) and its antagonist, propranolol was performed using real time quantitative-

reverse transcriptase polymerase chain reaction. Recombinant LIC20035 protein which was differentially down regulated in the presence of epinephrine was used to generate polyclonal antibodies against it. Phase separation experiment for cellular localization was performed with Triton X-114. Immunoassay (ELISA) with MAT positive and negative human/bovine leptospirosis serum was performed. The ability of LIC20035 to mediate Leptospira attachment to extra cellular matrix (ECM) components of host was evaluated by binding assays.

Results: There was no effect on the growth pattern of Leptospira grown in the presence of catecholamines, however, 7 genes out of 41 were differentially transcribed and the effect of which was reversed to basal level in the presence of its antagonist propranolol. Phase separation of the proteins of Leptospira showed native LIC20035 localized predominantly in the detergent phase and partly in the aqueous phase. Recombinant LIC20035 was serologically detected by human and bovine leptospirosis serum and it also showed adhesion property with various host extracellular matrix components with a higher affinity toward collagen and chondroitin sulfate.

Conclusion: Modulation of gene transcription by stress hormones in Leptospira is essentially utilized as a vantage point for dissemination in various tissues of host during infection process.

Keywords: Leptospira, catecholamines, qRT-PCR, differential transcription, stress

REFERENCES:

Lyte, M. (2004). Microbial endocrinology and infectious disease in the 21st century. Trends in microbiology 12, 14-20.

Bioactive silk based wound dressings treat acute and diabetic wounds by regulating extracellular matrix deposition and tissue remodelling

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Abstract: Silk fibroin (SF) is a natural protein polymer from mulberry and non-mulberry silkworms possessing excellent biocompatibility that support wound healing process. Non-mulberry SF (NMSF) possesses additional cell-binding motifs (arginine, glycine, and aspartate) and Arg rich cores in the protein sequence, offering cell–material interactions. We developed silk based nanofibrous wound dressings containing additional bioactive molecules like growth factors and antimicrobial peptides using electrospinning technique. The bioactive wound dressings exhibited essential properties like biocompatibility, high water retention capacity (440 %), water vapor transmission rate (2330 g m-2 day-1) and high elasticity (~2.6 MPa). Sustained and gradual delivery of the bioactive molecules in the wound microenvironment was easily achieved due to weak protein-protein interaction. Extensive in vivo wound healing assessment demonstrated accelerated wound healing, enhanced re-epithelialization, highly vascularized granulation tissue and higher wound maturity by silk mats as compared to control. Presence of skin appendages and isotropic collagen fibers in the regenerated skin also demonstrated scar-less healing and aesthetic repair in the acute wounds. Further, examination of the wound dressings in chronic wounds was performed in Alloxan-induced diabetic rabbit model. Following post 14-day treatment, NMSF-based dressings healed the wounds faster, in comparison with their mulberry Bombyx mori SF, poly(vinyl alcohol), and control counterparts ($p \leq 0.01$). Gene expression study of matrix metalloproteinases (like MMP 1, MMP 2, MMP 9) and collagen proteins (collagen type I and collagen type III) affirmed higher extent of tissue remodelling during the repair process. Furthermore, there was organized extracellular matrix deposition (total collagen, elastin, and reticulin) and higher wound breaking strength in NMSF compared with other groups after 4 weeks. These results validated the potential of silk based bioactive dressings to regulate extracellular matrix deposition leading to faster and complete repair of even chronic cutaneous wounds.

Keywords: biomaterial, diabetic wounds, extracellular matrix, silk fibroin, tissue remodelling, wound healing

References:
[1] Falanga, V. "Wound healing and its impairment in the diabetic foot". The Lancet (London, England), 2005; 366: 1736–1743.
[2] Dimple Chouhan, Bijayshree Chakraborty, Samit K. Nandi and Biman B Mandal. "Role of non-mulberry silk fibroin in deposition and regulation of extracellular matrix towards accelerated wound healing". Acta Biomaterialia, 2017; 48:157-174.
[3] Nandana Bhardwaj, Dimple Chouhan, Biman B. Mandal. "Tissue engineered skin and wound healing: current strategies and future directions". Current pharmaceutical design, 2017; 23: 3455–3482.
[4]. Bellis, S. L. "Advantages of RGD peptides for directing cell association with biomaterials". Biomaterials, 2011; 32: 4205–4210.
[5]. Dimple Chouhan, Janani Guru, Bijayashree Chakraborty, Samit Nandi and Biman B Mandal. "Functionalized PVA-Silk blended nanofibrous mats promote diabetic wound healing via regulation of extracellular matrix and tissue remodelling". Journal of Tissue Engineering and Regenerative Medicine, 2017.

A protein engineering platform to improve stability of proteins for industrial applications

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Background: Research on extremophilic proteins has seen immense growth in the past decade. Enzymes extracted from extreme milieus found ubiquitously in nature have better potential and versatility for industrial applications. Developing a priori knowledge about the mechanism behind protein extreme-stability by understanding genomic and proteomic attributes will thus lay the foundation for protein engineering.
Methodology: The present study deciphers the rationale behind halo-alkali-thermostability of enzymes for finding the contributing factors to design mutant enzymes for industrial applications through model generation by rational approaches such as machine learning and multi-criteria decision making (also known as Analytic Hierarchy Process) approaches. In silico prediction of plausible mutations and their validation in Bacillus subtilis lipase by substituting the preferred protein attributes to attain halo-alkali-thermostability of proteins was done. Then, in vitro cloning, mutagenesis, expression, purification and characterization of lipases was carried out for immobilization on synthesized ZnO nanoparticles which was characterized by UV-Vis, FT-IR, Raman, DLS, ζ-potential analyzer, powder XRD, TEM and FESEM analysis. The improved stability of the mutant was determined by FT-IR (ATR mode) and Differential Scanning Fluorimetry (Thermal shift assay). Further, the immobilized engineered lipases was examined for storage stability, reusability and their compatibility with various oxidizing agents, surfactants, commercial detergents and was applied for oil/grease stain removal from cotton fabrics.
Results: In silico analysis revealed that the charged amino acid (such as Asp, Glu, Arg and Lys), ionic interactions, salt bridges and charged accessible surface area played significant role in protein haloalkali- thermostability. The predicted attributes were utilized to design mutations in Bacillus subtilis lipase which showed optimum activity at pH 9 and 55°C and at pH 11 and 45°C, respectively. Further, the engineered lipases were successfully immobilized on ZnO NPs and were used for detergent formulations. Results showed that the maximum removal of oil and grease stains were up to 87% and 82%, respectively. The engineered immobilized mutant gave 2.3-folds increase in stain removal than wild type lipase and were recycled upto 15 times at 1.5 M NaCl, pH 10 and 50°C.
Conclusion: Thus, this study reveals a promising perspective of using low-cost nanoparticle conjugated biocatalysts which was produced through rationalized protein engineering approach for detergent formulation to overcome the drawbacks of the chemical counterparts.
Keywords: Protein stability; Protein engineering; Lipase; Immobilization; Detergent application

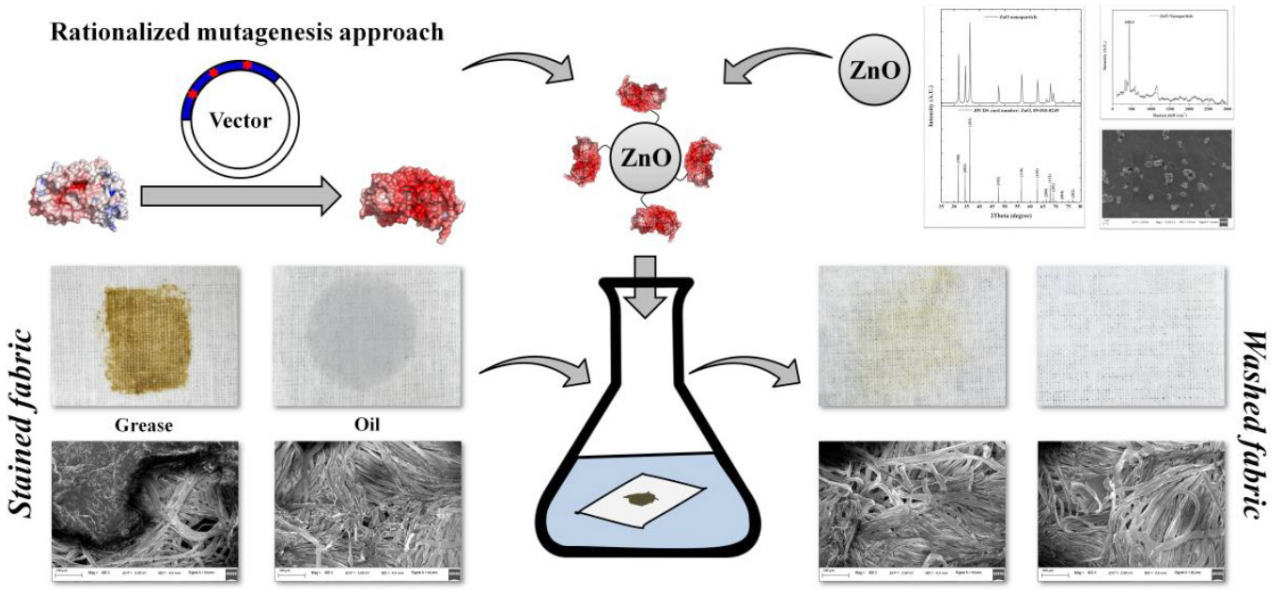

Figure: Schematic representation of the workflow.

Immuno-informed Islet-encapsulating Silk Scaffold Mediates M2 Macrophage Polarization and Enhances Insulin Production

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Islet transplantation is considered the most promising treatment for Type 1 diabetes. However, the clinical success is limited due to the islet dysfunction during long-term culture and post-transplantation. Also, transplant-associated inflammatory responses create an unfavourable microenvironment for islet survival. The current study delineates the development of cell-encapsulating immunomodulatory 3D silk scaffolds as bioartificial pancreas (BAP) systems for sustained insulin release. Insulin producing cells were encapsulated inside the silk scaffolds with either alginate or agarose for immunoisolation to augment islet survival and function. The scaffolds were extensively characterized for pore architecture, porosity, swelling index, water uptake, and density. Further, suitability of these scaffolds was assessed through diverse in vitro tests, including cell adherence, viability, proliferation, 3D spheroid like pancreatic structures development, glucose stimulated insulin secretion, and macrophage polarization. Rat insulinoma (RIN-5) cells were metabolically active and remained viable for a prolonged period within the macroencapsulates and proliferated up to 2.5-fold over 5 week's culture. Cultured RIN-5 cells formed 3D islet-like spheroids spontaneously as evident from live/dead assay. Primary islets maintained their function (glucose sensitivity) in macroencapsulates with enhanced glucose stimulation index when compared to non-encapsulated islets, 1.2 vs 1.7. RT-qPCR with islet functional genes (insulin I, insulin II, glucagon and somatostatin) and immunohistochemistry (insulin and glucagon) results supported the results obtained from glucose challenge assay. Controlled release profiles of antiinflammatory cytokine interleukine-4 (IL-4) and dexamethasone evinced their prospective application in reducing local foreign body response and immunosuppression. Released IL-4 was biologically active an polarized M0 macrophages to the M2 phenotype. Significant upregulation in CD206 and CD209 surface marker with downregulated CCR7 (inflammatory marker) expression advocate the immunosuppressive function, without affecting normal physiology of the rat islets. Reduced inflammatory responses illustrated the biocompatibility of these scaffolds. In

conclusion, this novel biomaterial system was successfully used to encapsulate insulin-producing cells with enhanced cell functions. Further development of the system may have potential BAP applications.

Keywords: Silk; Type 1 Diabetes; Islet macroencapsulation; Bio-artificial pancreas; Immunomodulation

References:

1. Davis NE et al., Biomaterials, 2012; 33: 6691-6697.
2. Mandal BB et al., Biomaterials, 2009; 30: 5170-5177.
3. Kumar M et al., ACS Applied Materials & Interfaces, 2016; 8:29310-29322.

Reusable Arsenic Filtration Unit for Water Purification

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Arsenic is found in the groundwater of 20 districts of Assam which is higher than the permissible limit recommended by World Health Organisation (10µg/L). Drinking of arsenic contaminated water mainly causes lung, bladder, kidney and skin cancer. The present work describes the development of low cost water filter and the role played by CuO nanoparticles in arsenic removal from contaminated water. Nanoparticles show an excellent adsorption property due to their unique structures. Structural and spectroscopic properties of prepared CuO nanoparticles (NP) were confirmed by XRD pattern, UV-absorption spectra, FTIR spectra and Raman spectra. Morphology of prepared CuO nanoparticles were studied by SEM. Adsorption of arsenic took place on the surface of the nanoparticles which was confirmed by FTIR spectra. Arsenic concentrations were determined by using spectroscopic method. Desorption of arsenic from the surface of CuO nanoparticles were studied by treating the used CuO nanoparticles by NaOH aq.solution.

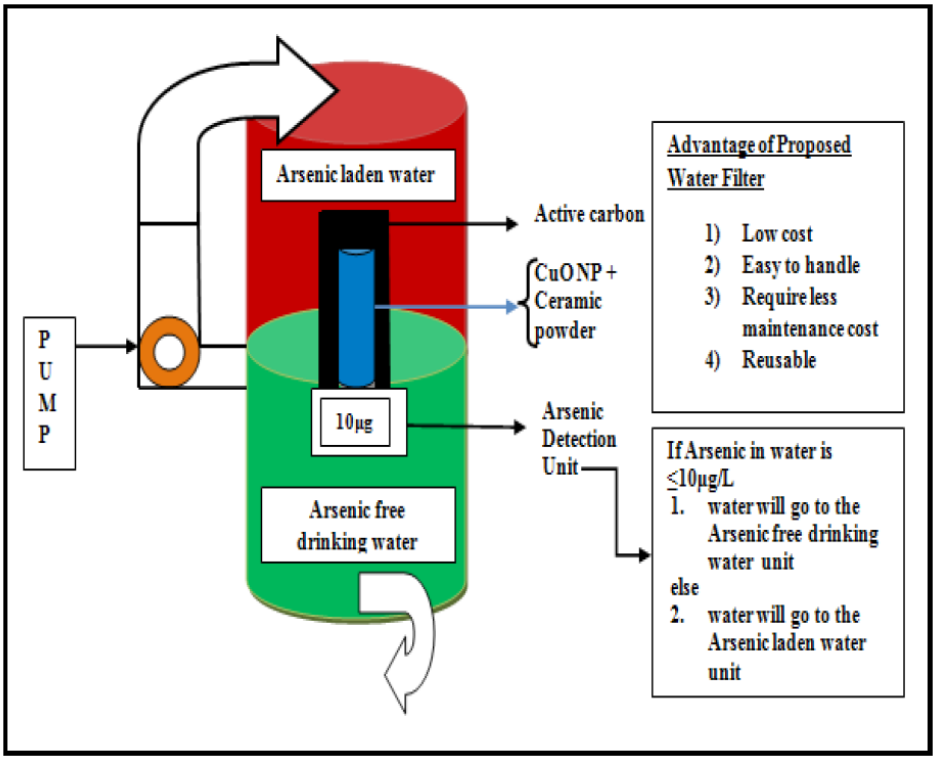

Figure1. Proposed Arsenic Filtration Unit for Water Purification as Home Appliance

Small Synthetic Molecules as Potent Antibacterials

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The emerging threat of drug-resistant pathogenic bacteria coupled with a diminishing antibiotic armoury continues to be a scourge in modern healthcare. This crisis demands judicious medicinal chemistry in order to develop antibacterials that can act on indispensable cellular targets and are not compromised by resistance development. Our research group has been working at the interface of chemistry and biology and striving to develop potent antibacterials that may bear significant therapeutic potential against antibiotic-resistant pathogenic bacteria. We have generated a potent dual target bactericidal synthetic amphiphile that is counterproductive to resistance development. [1] The therapeutic prospect of the amphiphile has been harnessed through the development of amphiphile-loaded non-toxic nanocarriers that can breach the extracellular DNA (eDNA) barrier and render efflux pump inhibition resulting in effective elimination of Staphylococcus aureus biofilm. [2, 3] We have also demonstrated the potential of zinc complexing synthetic amphiphile and ligands in the mitigation of S. aureus biofilm. [4, 5] The presentation will highlight the salient findings of our research and emphasize the rationale of developing small synthetic molecules as potentially therapeutic antibacterials.

References

1. Thiyagarajan, D., Goswami, S., Kar, C., Das, G. and Ramesh, A. Chemical Communications 2014, 50, 7434-7436.
2. Thiyagarajan, D., Das, G. and Ramesh, A. ChemNanoMat 2016, 2, 879 - 887.
3. Thiyagarajan, D., Das, G. and Ramesh, A. ChemMedChem 2017, 12, 1125-1132.
4. Goswami, S., Thiyagarajan, D., Samanta, S., Das, G. and Ramesh, A. Journal of Materials Chemistry B 2015, 3, 7068-7078.
5. Kapoor, V., Rai, R., Thiyagarajan, D., Mukherjee, S., Das, G. and Ramesh, A. ChemBioChem 2017, 18, 1502-1509.

Functional annotation, classification and assignment of translocation pathway of phospholipases C

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Bacterial pathogens have developed a plethora of strategies to invade host systems and impede host immunogenic response during infection. One of the common strategies utilized by many pathogens involves the secretion of phospholipase C (PLC) across plasma membranes. PLC has been reported to play a crucial role in promoting bacterial pathogenicity and are responsible for the manifestation of various pathophysiological effects in the host body. The enzyme is extra-cytoplasmic in nature and hence exported out of the cytoplasm to their functional locality either via Sec or Tat pathway. It has previously been postulated that characteristics of protein signal peptide are responsible for the selection of a particular transport pathway. The cytosolic chaperone SecB has also been speculated to drive the pre-proteins towards the Sec-pathway by interacting with their signal peptide or protein sequence. This study documents a sequence-based method for characterization of PLCs from different bacterial sources and their classification into four groups (1) Zinc-Metallo PLCs, (2) Phosphatidylinositol-Hydrolyzing PLCs, (3) PLCs from acid phosphatase superfamily and (4) Sphingomyelinases. The current work also addresses the canonical features of PLC signal peptide sequences that govern the selection of transport pathway and how they could be used as reliable tools for pathway prediction. In silico results indicate that Tat- and Sec-mediated PLC sequences should have a significant difference when it comes to the characteristics of their signal peptide especially the conservation of twin-arginine motif, signal peptide length and hydrophobicity. Furthermore, the current work confirms that apart from Sec-predicted proteins, Tat-predicted proteins also possess similar SecB binding motifs implying the non-existence of any sequence level distinction between Sec- and Tat-specific PLCs with respect to the number of potential SecB binding sites.

References:
1. Flores-Díaz, M. et al., 2016. Bacterial sphingomyelinases and phospholipases as virulence factors. Microbiol. Mol. Biol. Rev. 80(3), 597-628.
2. Songer, J.G., 1997. Bacterial phospholipases and their role in virulence. Trends Microbiol. 5(4), 156-161.
3. Berks, B.C., 1996. A common export pathway for proteins binding complex redox cofactors? Mol. Microbiol. 22(3), 393-404.

Bromelain along with olive leaf extract can inhibit benzo(a)pyrene induced lung carcinogenesis associated Oxidative stress and inflammation.

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The aim of the study was to evaluate the anti-inflammatory role of bromelain alone and along with olive leaf extract during benzo(a)pyrene(BaP) induced lung carcinogenesis in Swiss albino mice. BaP, the first carcinogen to be discovered in cigarette smoke is one of the most potent polycyclic aromatic hydrocarbons responsible for lung carcinogenesis. Mainly BaP induces oxidative stress in the lung, which in turn increases inflammation in lung tissue and these ultimately result in lung carcinogenesis. As bromelain is known for its various biological activities, that is why we aimed to find the effect of bromelain alone and along with olive leaf extract; to inhibit the inflammation produced in the lung after BaP exposure. A single dose of bromelain(70mg/kg of b.w.) and two doses of olive leaf extract(100 mg/kg of b.w. and 200 mg/kg of b.w.) were used through out the study. After completion of treatment, the level of various enzymatic and non-enzymatic antioxidant parameters in lung and liver was measured. The level of various inflammatory markers was also studied in the lung to find the anti-inflammatory role of bromelain and olive leaf extract. In these way, the protective role of bromelain and olive leaf extract was studied against BaP induced lung carcinogenesis associated inflammation. The histological change was also studied to confirm the therapeutic effect of those two agents. Our study confirms that bromelain along with olive leaf extract; can reduce the inflammatory changes that take place in lung tissue after BaP induced lung carcinogenesis.

Probing the Structural Transitions in c-Myc PEST region by Protein Charge Transfer Absorption Spectra and other Biophysical Techniques

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The c-Myc oncoprotein is a transcription factor which plays an important role in various processes like cell growth, proliferation, differentiation and programmed cell death. Deregulation of c-Myc expression causes many types of cancer in human. It's centrally located intrinsically disordered PEST region (amino acid 201 to 268), is rich in Proline (P), Glutamic acid (E), Serine (S) and Threonine (T). This PEST region lacks a stable tertiary structure which is responsible for its rapid degradation. The aim of our present study is to investigate the consequences of pH, temperature and salt on the structure and dynamics of c-Myc PEST region by using Protein Charge Transfer Absorption Spectra (ProCharTS) and other biophysical techniques. ProCharTS originate when charged amino/carboxylate groups in the side chains of Lys/Glu, act as electronic charge acceptors/donors for photo induced electron transfer either from/to the polypeptide backbone or to each other. The absorption band intensities in ProCharTS at wavelengths 250—800 nm are dependent on 3D spatial proximity between these charged functional groups across the protein. IDPs are rich in charged amino acids, but lack the intrinsic spectral probes like Tyr or Trp, making their structural characterization difficult. Here, we exploit the richness of charged amino acid in PEST fragment and its mutant to sense structural transitions using ProCharTS. Our results revealed a significant changes in ProCharTS spectrum with changing pH in the range 3—11, which correlated with changes in structure of PEST fragment monitored by other techniques. ProCharTS intensity was sensitive to changes in the structure

of PEST fragments induced by increase in temperature from 25 to 85°C. Presence of 0.25 M NaCl or KCl in the medium also altered the ProCharTS spectrum. Taken together, our work highlights the utility of ProCharTS as a label-free intrinsic probe to monitor structural changes in the PEST fragment.

References

S. Prasad, I. Mandal, S. Singh, A. Paul, B. Mandal, R. Venkatramani and R. Swaminathan, Chemical Science, 2017, 8, 5416-5433.
L. Homchaudhuri and R. Swaminathan, Bulletin of the Chemical Society of Japan, 2004, 77, 765-769.
M. A. Gregory and S. R. Hann, Molecular and Cellular Biology, 2000, 20, 2423-2435.

Bioactivity of recombinant insect-specific neurotoxin, LqqIT1 against major crop pest Spodoptera litura

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Agrochemicals are playing substantial role in controlling agriculturally important crop pests. But predominant use of synthetic chemical pesticides resulted in insecticide resistances and also exert their harmful effect on non-targeted organisms. Scorpion produces large number of insect specific neurotoxins as defensive molecule. These neurotoxins can be a potential alternative to chemical insecticides because of their potency and selectivity. LqqIT1is an insect specific excitatory β-toxin which binds to insect Voltage Gated Sodium channel causing flaccid paralysis in insects. To study the potency and selectivity, codon optimized LqqIT1 was cloned in pET28a and soluble expression was achieved in SHuffle T7 Express LysY cells induced with 0.5 mM IPTG and further purified using Ni-NTA affinity chromatography and Gel Filtration Chromatography. Based on the assessment of rLqqIT1 cytotoxicity with Sf-21 insect cells with different rLqqIT1 concentrations, 6 μM rLqqIT1 effectively inhibited the progressive growth of Sf-21 insect cells. Profound morphological changes also observed in Sf-21 cells treated with rLqqIT1 using Inverted Phase contrast microscopy and FE-SEM. Bioassay with agriculturally important insect Spodoptera litura was done based on haemocoel injection of rLqqIT1 which resulted in paralysis and ultimate death of insects within 36 hrs of post injection. Further exploitation of LqqIT1 neurotoxin would pave the way to development of potential biopesticide.
Keywords: Biopesticide, neurotoxin, LqqIT1, cytotoxicity, Spodoptera litura

Characterizing the dual targeting/function of the peroxisomal protein Pex30

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Peroxisomes are dynamic cellular organelles found in most eukaryotic cells whose number and function can vary according to the requirements of the cell. They are involved in β-oxidation of fatty acids and neutralizing harmful reactive oxygen species (ROS) produced by the cell (Deb and Nagotu, 2017). The conundrum associated with peroxisome biogenesis is dependent on a group of peroxisomal proteins known as peroxins (Pex). Yeast mutants lacking peroxisomes regenerate peroxisomes after complementation with the wild-type version of the mutated gene (Kragt et al., 2005). Studies now show that several peroxisomal membrane proteins (PMPs) can be targeted to the ER and subsequently lead to the formation of pre-peroxisomes which mature to fully formed peroxisomes (Hettema et al., 2014). Although it is apparent that the ER plays a primary role in trafficking key peroxins essential for de novo peroxisome biogenesis, the function of ER-resident proteins and the ER structure itself in peroxin trafficking and the formation of peroxisomes has just begun to be understood (Kim and Hettema, 2015). Previous studies have reported

that Pex30 not only associates with peroxisomes but also localizes to the ER and regulates de novo biogenesis of peroxisome from the ER. Pex30 interacts with reticulon proteins that are essential to maintain tubular structure of ER (Mast et al., 2016). Our study aims to understand the importance of this dual localization of Pex30 in both peroxisome inducing and non-inducing growth. For this we have constructed Saccharomyces cerevisiae strains expressing Pex30-GFP and GFP-Pex30. Only a fraction of the Pex30 was observed to be co-localized with peroxisomes labelled with DsRed-SKL. Our in silico analysis also revealed several post-translational modification sites in Pex30. We aim at characterizing mutants affected in these modifications and understand the role of these modifications in the function and localization of the protein.

References:

Deb, R., and S. Nagotu. 2017. Versatility of peroxisomes: An evolving concept. Tissue and Cell. 49:209-226.
Hettema, E.H., R. Erdmann, I. van der Klei, and M. Veenhuis. 2014. Evolving models for peroxisome biogenesis. Current opinion in cell biology. 29:25-30.
Kim, P., and E. Hettema. 2015. Multiple pathways for protein transport to peroxisomes. Journal of molecular biology. 427:1176-1190.
Kragt, A., T. Voorn-Brouwer, M. van den Berg, and B. Distel. 2005. Endoplasmic reticulum-directed Pex3p routes to peroxisomes and restores peroxisome formation in a Saccharomyces cerevisiae pex3Δ strain. Journal of Biological Chemistry. 280:34350-34357.
Mast, F.D., A. Jamakhandi, R.A. Saleem, D.J. Dilworth, R.S. Rogers, R.A. Rachubinski, and J.D. Aitchison. 2016. Peroxins Pex30 and Pex29 dynamically associate with reticulons to regulate peroxisome biogenesis from the endoplasmic reticulum. Journal of Biological Chemistry. 291:15408-15427.

Plant health and protection advisories thought ICT (Information communication technology) tools in agricultural field.

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India has agrarian economy where around 60 per cent of population engaged in Agriculture for their lively hood. In order to make the Agriculture a profitable business the cost of cultivation required to be reduced by effective utilization of the modern ICT technologies in the Agriculture field. Electronic Solutions against Agricultural Pests (e-SAP) model is unique in its functionality and utility empowers individual extension worker with hand-held device containing preloaded the complete set of information on agriculture pest's and it's used for the identification, diagnosis and management of agricultural pests in formers field. During 2015-16 cropping season, field devices (e- SAP software) was made use to record observation on important insect pests and diseases on field crops in Northern Karnataka. Based on the observation recorded, maximum infestation/severity of root grub, early shoot borer, wooly aphid, rust and ring spot diseases in sugarcane; aphid, grey mildew and angular leaf spot diseases in cotton; pink stem borer and maydis leaf blight in maize; gram caterpillar in chickpea; spodoptera and rust disease in soybean and leaf hopper and bihary hairy caterpillar, necrosis disease in sunflower was noted. Some newly emerging problems viz., wire worm, root aphid, yellow leaf disease, pokka boeing in sugarcane; midge fly in cotton; banded leaf and sheath blight in maize were recorded. Important advisories for management provided in former's field were soil drenching of chlorpyriphos 20 EC@ 10ml/l. or Metarizium anisopliae 25 kg + Fym 1250 kg/ ha for sugarcane root grub, spraying of fipronil 80WG 0.1 g/l of water for cotton sucking pests; seed treatment with Trichoderma harzianum @4g/kg or carbendazim 50 WP@1g/l for chick pea wilt and use of resistant cultivar (DSB-21) or spraying of hexaconazole @1 ml/l 35-45 days after sowing for soybean rust. and four out ten farmers interviewed, expressed satisfaction for receiving timely advisories and realized 4-5% increase yield in sugarcane, cotton and chickpea. Thus real time surveillance thought ICT tools has helped for plant protection measures at appropriate period.

KEY WORD- e-SAP, Pest's, Diseases, Infestation and Severity

Uptake and intracellular fate of nona-arginine cell penetrating peptide in yeast

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Cell-penetrating peptides (CPPs) comprise a group of peptides of about 8 to 30 amino acids in length that can be efficiently taken up by cells and mediate the uptake of the conjugated cargo (Milletti, 2012). Different mechanisms of cellular uptake of CPPs depending on their nature, concentration and experimental conditions have been proposed in literature (Madani et al., 2011). However the two most common uptake mechanisms are direct entry/energy-independent pathway and various endocytosis mechanisms (Madani et al., 2011).
In this study we analyzed the uptake of nona-arginine CPP in Saccharomyces cerevisiae cells using two methods: luorescence microscopy and flow cytometry. The effect of different conditions like pH, temperature, and peptide concentration was studied. In addition to this we also report the subcellular localization of the peptide after internalization. Furthermore we investigated the influence of endoosmolytic agents and endocytic inhibitors on the entry of the peptide into the cell. Our results suggest that the efficiency of internalization of the peptide in yeast depends on conditions like pH, temperature and media compositions. However, no significant alteration in fluorescence intensity after a particular time point also suggests a probable saturation point for the entry of the peptide. These findings will enable us to understand in detail the mechanism of entry of arginine CPP in yeast cells which can be used as a promising tool for several cell biology related studies.

REFERENCES

Madani, F., S. Lindberg, Ü. Langel, S. Futaki, and A. Gräslund. 2011. Mechanisms of cellular uptake of cellpenetrating peptides. Journal of Biophysics. 2011:414729.
Milletti, F. 2012. Cell-penetrating peptides: classes, origin, and current landscape. Drug discovery today. 17:850-860.

Investigation of the Effects of Various Drinks on Human Enamel surface

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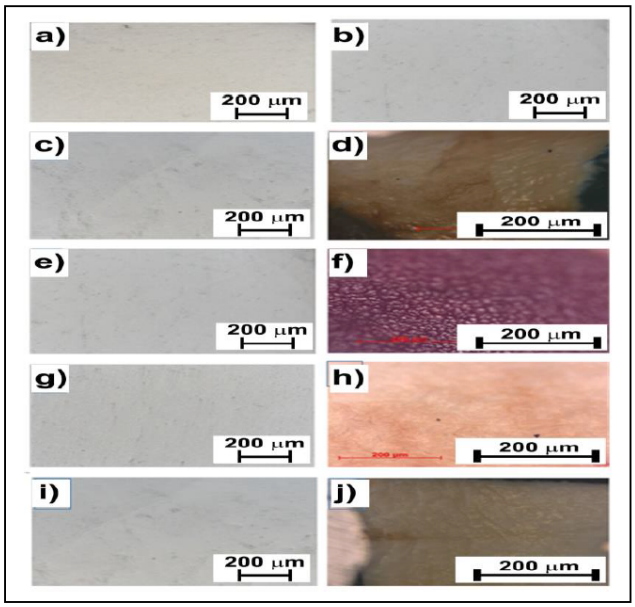
The excessive and regular drinking of carbonated drinks, energy drinks and fruit juices have been attributed as one of the major causes of potential oral health problems (1 - 3). The purpose of this investigation was to detect pH and titratable acidity (TA) of the drink and to qualitatively evaluate the erosion caused by drinks using the optical microscope. The change in composition in terms of protein content of human enamel sample on exposure to various drinks was also evaluated. Fourteen freshly extracted human permanent molar teeth were selected for the experiment and were processed. Care was taken that the teeth were free from hypocalcification as well as caries. They were then divided into seven groups for exposure of the enamel portion of the teeth into seven particular drinks for a period of seven days at 37 °C, Group 1 (Thums Up®), Group 2 (Bovonto®), Group 3 (Realmix® high-energy drink), Group 4 (Red Bull® high-energy drink), Group 5 (Minute Maid® Pulpy Orange juice), Group 6 (Maaza® Mango juice) and Group 7 (drinking water, the control). The pH and the titratable acidity of each beverage were measured and classified as lower activity and higher activity drinks. The surface morphology of the enamel surface before and after treatment with drinks was examined using optical microscopy. Specimens treated depicted irregular surface morphology with erosion pits and loss in material. To estimate the loss of enamel proteins due to treatment with drink, Lowry assay of protein estimation was used. The loss of protein content

followed the order: Red Bull® > Realmix® > Thums Up® > Bovonto® > Minute Maid® > Maaza®. These results prove that the intake of these drinks cause enamel surface erosion, dissolution and loss of protein content. Therefore, children and adolescents should avoid excessive drinking of such drinks.

Keywords: Soft drinks, Energy drinks, Fruit juices, pH, Titratable acidity, Surface erosion, Protein content.



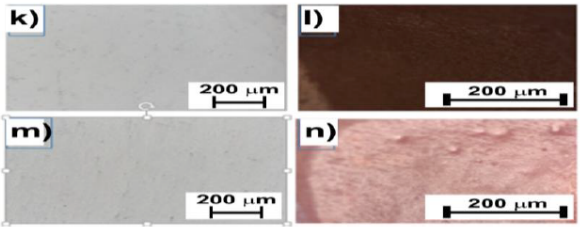


Figure: Photograph of enamel specimens taken under (10X) optical microscope both before and after treatment. Photograph of specimen before immersion in drinking water (A), Red Bull® (C), Thums Up® (E), Minute Maid® (G), Realmix® (I), Bovonto® (K) and Maaza® (M). Photograph of specimens after immersion in drinking water (B), Red Bull® (D), Thums Up® (F), Minute Maid® (H), Realmix® (J), Bovonto® (L) and Maaza® (N) for a period of seven days at a temperature of 37°C.

References:

1. Mehta, Shamir B., et al. "Current concepts on the management of tooth wear: part 1. Assessment, treatment planning and strategies for the prevention and the passive management of tooth wear." British dental journal 212.1 (2012): 17-27.
2. Davis, W. B., and P. J. Winter. "The effect of abrasion on enamel and dentine after exposure to dietary acid." British dental journal 148.11/12 (1980): 253-256.
3. Ranjitkar, Sarbin, John A. Kaidonis, and Roger J. Smales. "Gastroesophageal reflux disease and tooth erosion." International journal of dentistry 2012 (2012).

ALIMENTARY PASTE

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Alimentary paste is dried dough with a definite shape (such as macaroni, spaghetti, vermicelli, etc.) prepared from semolina, farina or wheat flour or a mixture of these with water or milk and with or without egg or egg yolk. These ingredients are typically added to a continuous, high capacity extruder, equipped with a variety of dies that determine the final shape of the product. The product emerging out of die are then dried and packaged for market. Based on shape and size, alimentary paste can be classified into long and short type. The long type includes linguini, vermicelli, spaghetti; the short type includes elbow shells, pipe rigate, penne, fusilli, rigatoni, etc (Krishnan & Prabhasankar, 2012). Alimentary pastes are widely known as one of the most ancient nourishments and versatile dishes, originating from Italy and Asia (Antognelli, 1980). They are easy to prepare, have versatile sensory attributes, low cost and long shelf life, making them acceptable worldwide (Gurpreet et al., 2013). They provide significant quantities of complex carbohydrates, proteins, B-vitamins and iron and are low in sodium and total fat (Douglass & Mathews, 1982). Researches have been carried out to fortify alimentary paste products with various protein sources (Gurpreet et al., 2013). In this context, supplementation of this convenience food with legumes is considered to be the best solution to overcome malnutrition, particularly in the developing countries (Madhumita & Prabhasankar, 2011).

REFERENCES
Antognelli, C. (1980). The manufacture of pasta as a food ingredient: A review. Journal of Food Technologyl 5: 125-145. Douglass, J. S., & Matthews, R. H. (1982). Nutrient content of pasta products, Cereal Foods World, 27: 558-561. Gurpreet, K., Savita, S., Nagi, H. P., & Ranote, P. S. (2013). Enrichment of pasta with different plant proteins. Journal of Food Science and Technology 50(5): 1000-1005 Krishnan, M., & Prabhasankar, P. (2012). Health based Pasta: Redefining the concept of the next generation convenience food, Critical Reviews In Food science & Nutrition, 52: 9-20. Madhumita, S., & Prabhasankar, P, (2011). Influence of additives on functional & nutritional quality characteristics of black gram flour incorporated pasta. Journal of Texture Studies, ISSN 0022-4901

Removal Of Perchlorate From Wastewater And Groundwater Using Bioelectrochemical System

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Perchlorate containing waste pose a threat to human health and ecosystem. Perchlorate is an emerging surface water and groundwater contaminant, and it is of concern because of its mobility in the environment and its inhibitory effect on thyroid function. Although conventional biological treatment methods are inexpensive but not effective for treating wastewater and in situ bioremediation. Bioelectrochemical system are emerging as a new technology platform for removal and recovery of contaminant from wastewater streams. The breakneck industrialization contributes to the procreation of substantial abundance of wastewater and its treatment becomes highly indispensable. Decreasing the wastewater treatment expenditure and finding ways to outturn useful products from it is achieving importance in view of environmental sustainability. Freshwater is a fundamental source to human, hence the recent shrinkage in freshwater necessity and increase in water pollution are imperative problem that vigorously affect the people and the environment worldwide Water remediation holds a. peat scope in water treatment technology. Traditional water remediation is done to treat wastewater but these technologies are very energy intensive, that need to find out the new way to treat these types of wastewater. This article explains the state of art of bioelectrochemical system for removal and recovery of perchlorate and pertaining removal mechanism.

Efficacy of Dental Ceramics on Biofilm Formation

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In the recent years, the use of implantable devices are increasing in dentistry. Biofilm formation takes place on the biomaterials used for the restoration of oral function [1]. Both hydrophobic as well as hydrophilic surfaces allow oral bacteria to adhere to it, but in vivo, only a small amount of biofilm accumulates on the hydrophobic surfaces. So in order to reduce the number of infection related implant failures [2], there is an urgent need for control strategies that can prevent biofilm formation on the implants. We investigated two different types of dental scaffolds, named as S1 and S2. The dental scaffolds differed from each other in the concentration of the constituting compounds. Staphylococcus aureus and Staphylococcus epidermidis biofilm formation was carried out in tryptic soy broth. In the experiment, six samples of each type of dental implant was used. The dental implants were submerged in tryptic soy broth inoculated with a particular concentration of the specific bacterial strain for biofilm formation. Analysis of the amount of biofilm developed on the surface of the dental scaffolds was done by sonication and MTT assay and Scanning Electron Microscopy (SEM) was used to analyse the morphology of the biofilms on the scaffolds. ProTox, a web based bioinformatic tool was used to predict the probable LD50 values of the dental scaffold composing compounds used for the experiment. Biofilm formation was seen in all the scaffolds. The biofilm grown on the scaffold S2 showed higher value of absorbance and log10 cfu/ml when compared to scaffold S1. SEM images also showed high biofilm density on scaffold S2, compared to scaffold S1. According to the results obtained from ProTox, the compounds comprising the dental scaffolds fall under toxicity class 2 with prediction accuracy of 70.97%.

Keywords: Biofilm, Dental Scaffold, Staphylococcus aureus, Staphylococcus epidermidis.

References:

1. Trampuz A, Osmon DR, Hanssen AD, Steckelberg JM, Patel R. Molecular and antibiofilm approaches to prosthetic joint infection. Clin Orthop Relat Res. 2003; 414:69–88.
2. Costerton JW, Stewart PS, Greenberg EP. Bacterial biofilms: a common cause of persistent infections. Science. 1999; 284(5418): 1318–22.

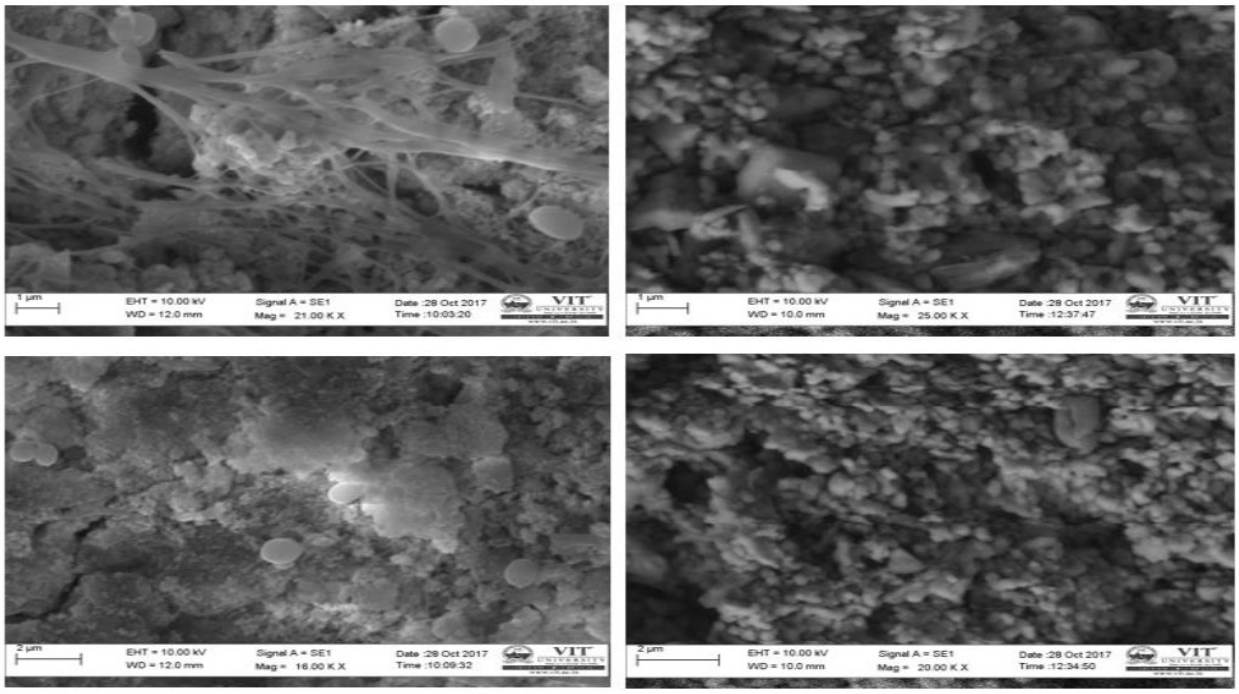

Figure 5: SEM images of the two investigated dental scaffold types. Two enlargements were used per material, from a larger enlargement (images on top; scale bar: 1 µm) to a more smaller enlargement of broken surfaces (images at the bottom; scale bar: 2 µm). (A) and (C) are of Scaffold S1 and (B) and (D) are of Scaffold S2.

Investigation of Image processing techniques for Diagnostic Support

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Recent advances in Optical Imaging procedures and modalities have facilitated early diagnosis and treatment evaluation of cri tical diseases. Optical imaging and processing techniques such as optical coherence tomography, confocal microscopy multispectral endoscopy, multiphoton microscopy and diffuse reflectance are used to capture anatomical, physiological, metabolic and functional information of human body [1]. In most of the developing countries lacking resources and skilled physicians optical imaging techniques using a simple low cost digital camera for image acquisition and reliable image processing techniques can provide non-invasive, simpler, faster and cost effective solution to masses in healthcare and management sector. Digital Image processing techniques can be used to explore primitive diagnostics methods for diseases detection at early stages with limited resources and skilled labor. These techniques can also assist doctors during clinical examination without any need for invasive pathological test, this will help to facilitate pati ent comfort and avoid infection during blood test like HIV, Hepatitis viruses. Various blood components such as haemoglobin and billirubin whose approximate measure can directly be identified by just viewing the color of patient skin, nails, eye or any other target area can be measured and classified in terms of the color content of the image of the targeted area. Further, some diseases like anaemia and yellow fever and prenatal jaundice can also be detected and monitored time to time by processing the color information[2][3 [4]]. Life threatening chronic diseases such as skin cancer, which shows visual deformation on a patient skin, can be detected and its intensity can be evaluated [5]. Many physiological disorders which is associated with a subjects facial features can also be diagnosed and monitored [6]. Analysis of image processing techniques in conjunction with specialized supervision can provide significant exploration in the field of biomedicine and clinical applications. This research work proposes an image processing based non-invasive method of measuring haemoglobin(Hb) concentration present in patient's blood by analyzing the color and texture of digital photographs of patient's palpebral conjunctiva. The images of patient's palpebral conjunctiva were processed and 8 relevant features were extracted .ANN classifier was used to correlate the output quantity to be measured with the values of the quantity measured by the standard method as per the guidelines given by WHO. Further, based on the testing results obtained by the classifier the patients whose Hb concentration was less than 11g/dL were screened as anaemic patients. A confusion matrix was then plotted to evaluate and compare the predicted classification results with the actual value of Hb obtained from invasive test. It was found that the proposed algorithm was able to diagnose anaemia with 71.42% sensitivity and 89.47% Specificity .The proposed work is targeted to be useful for giving assistance to medical practitioners for reliable diagnosis of anaemia in the clinic itself and in low resource settings.

[1] Atam P. Dhawan et. al "Optical Imaging Modalities for Biomedical Applications," IEEE Reviews In Biomedical Engineering, VOL.
3, 2010
[2] C.C.Fan, "Application of artificial classification techniques to asscess the anemia conditions via palpebral conjunctiva color component(Master thesis)",National Ilan University,Taiwan,2013
[3] Yi-Ming Chen et.al "Examining palpebral conjunctiva for anemia assessment with image processing methods," Journal of Computer Methods And Programs In Biomedicine -125–135, Elsevier,2016
[4] Mustafa Aydın et.al "Neonatal Jaundice Detection System," springer sciences ,Journal of Medical System, July 2016
[5] Roberta B. Oliveira et.al "A computational approach for detecting pigmented skin lesions in macroscopic images" Journal of Expert Systems With Applications 61 (2016) 53–63, Elsevier , 11 May 2016
[6] Yunhua Chen et.al "Hybrid facial image feature extraction and recognition for non -invasive chronic fatigue syndrome diagnosis," Journal of Computers in Biology and Medicine Elsevier, 5 June 2015

Synthesis of two types of fluorescent gold nanoclusters [Au NCs] in a single enzyme matrix for detection of hydrogen peroxide (H2O2):

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In recent years protein-encapsulated gold nanoclusters have been intensively studied due to many advantages being identified over the other gold nanocluster support systems, such as, green synthesis, biocompatibility, high water solubility and increased stability. For this work we chose catalase enzyme and gold nanoclusters [reported to have peroxidase activity] to develop the detection system. This work is based on formation of two types of fluorescent gold nanoclusters using catalase protein[Cata-Au NCs] and use them for detection of hydrogen peroxide (H2O2)[One of the harmful radicals for organisms] . Two types of gold nanoclusters having red and blue fluorescence were successfully synthesized, both of them having excitation peak (λ) ~368 nm and emission peaks (λ) ~660 nm and ~455 nm for red and blue nanoclusters respectively. The Red Fluorescent Cata-Au NCs had a diameter of about 2.4 nm with lattice spacing of ~0.060 nm, while the diameter of 5BFCata-Au NCs was around 1.5 nm with lattice spacing of ~0.051 nm. Both the clusters are reactive towards H2O2 and their fluorescence get quenched during the reaction. By calculating the proportion of fluorescence quenching of both the red and blue gold nanoclusters one can detect the concentration of H2O2.

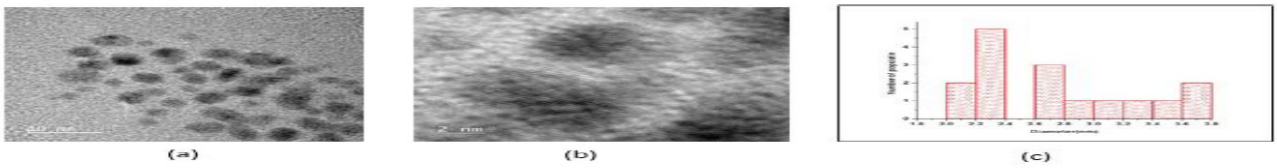

Fig.1. TEM images of Red Fluorescent Cata-AuNCs (a) 10nm scale, (b) 2nm scale and (c) Histogram showing size (Number of population vs. Diameter) distribution of the clusters

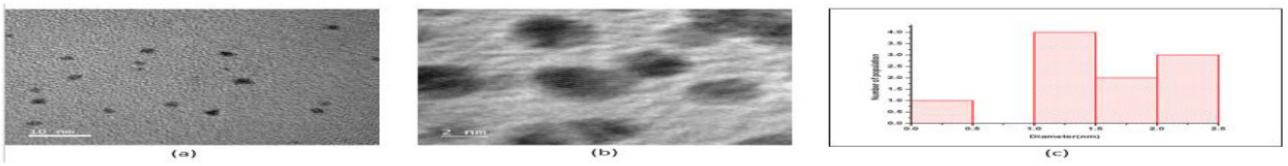

Fig.2. TEM images of blue Fluorescent Cata-AuNCs (a) 10nm scale, (b) 2nm scale and (c) Histogram showing size (Number of population vs. Diameter) distribution of the clusters

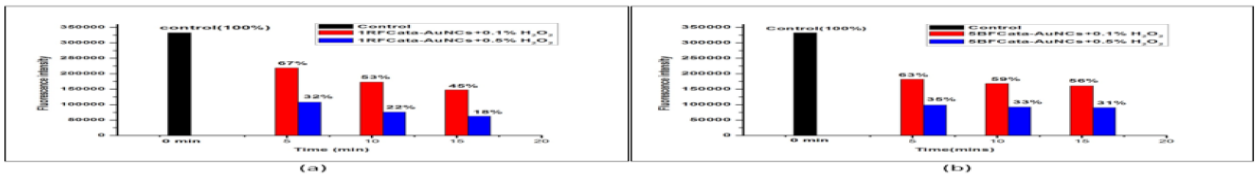

Fig.3. Quenching of (a) Red Fluorescent Cata-Au NCs and (b) Blue Fluorescent cata-Au NCs by H_2O_2

Strain improvement of Bacillus amyloliquefaciens SS35 by UV and chemical mutagenesis for producing hyperactive mutant strain for improved β-glucanase and xylanase activities

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The research on development of bioethanol is getting most attention worldwide mainly due to continuous depletion of fossil fuels and environmental pollution caused by them. The saccharification of lignocellulosic biomass by enzymes such as cellulases and hemicellulases for release of reducing sugars for their subsequent microbial conversion to bioethanol is the cost limiting step. Therefore, for reducing the cost of bioethanol production the strain improvement of cellulase producing microorganisms is of prime concern. The aim of present study was to improve the carboxymethyl cellulase activity from isolate Bacillus amyloliquefaciens SS35 [1] by UV and chemical (ethyl methane sulphonate) mutagenesis for efficient hydrolysis of the cellulosic biomass. The culture at 10-4 dilution was spread plated and exposed to UV light frequency at 0.6 J/cm2 for 5s to 3h using direct plate irradiation method. The lethality rate 98.9% at 3h was obtained. 14 mutant colonies were qualitatively screened by 0.3% congo red. Out of 14, 4 UV mutant colonies showed increase in carboxymethyl cellulase activity grown in medium as described earlier [2] under batch fermentation at 40°C and 120 rpm for 48 h. Out of 4, the UV mutant colony no. 2 (UV2), as cell free supernatant gave specific activity (0.24 U/mg) against carboxymethyl cellulose which was 16.5% higher than the wild-type strain enzyme (0.206 U/mg). The enzyme from UV2 after partial purification by 90% ammonium sulphate saturation showed 1.9 (β-glucan), 2.3 (carboxymethyl cellulose) and 1.8 (Birchwood xylan) fold increase in β-glucanase, carboxymethyl cellulase and xylanase activities, respectively. UV2 was further subjected to chemical mutagenesis with ethyl methane sulphonate (EMS). At 2% EMS a lethality rate of 99.97% was obtained for UV2. 14 mutant colonies were qualitatively screened by 0.3% congo red. Two EMS mutant colonies out of 14, showed increase in carboxymethyl cellulase activity when grown in the medium as described earlier [2] under batch fermentation at 40°C and 120 rpm for 48 h. Out of 2, EMS mutant the colony no. 7, as cell free supernatant gave specific activity 0.26 U/mg against carboxymethyl cellulose which was 26% higher than the wild-type strain enzyme and 8% higher than that of UV2. The results on purification of enzyme from EMS mutant strain will be presented.

References 1. Singh, S., Moholkar, V. S. & Goyal, A. (2013) Isolation, identification, and characterization of a cellulolytic Bacillus amyloliquefaciens strain SS35 from Rhinoceros dung. ISRN Microbiology, 2013, Article ID 728134. 2. Singh, S., Moholkar, V. S. & Goyal, A. (2014) Optimization of carboxymethylcellulase production from Bacillus amyloliquefaciens SS35. Biotech, 4(4), 411-424.

Antitumor activity of bromelain and peroxidase mixture from pineapple against lymphoma: An invivo study

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Pineapple contains a protease enzyme called bromelain. Along with bromelain, pineapple extract also contains different types of endopeptidase like peroxidase. It is reported that commercially available bromelain has anticancer, anti-inflammatory and other therapeutic benefits. But there are few reports available about the activity of peroxidase i.e. how peroxidase enhances the activity of bromelain. The purpose of this study was investigating experimentally the possible antitumor effect of pineapple extract on Dalton's lymphoma ascites (DLA) bearing mice. Mice were administered pineapple extract at a dosage of 25, 50mg/kg of body weight for 15days after 24h of DLA inoculation. The pineapple extract reverted the increased number of the WBC count, platelets and decreased the number of the RBC count, hemoglobin content. The

effect of pineapple extract also increased the pathophysiological marker enzyme, lipid profile and decreased the enzymatic and non-enzymatic antioxidants better than bromelain. The body weight of the treated mice is decreased significantly. A histopathological result shows the loss of liver hepatocytes and kidney architecture in DLA bearing mice. However, mice treatment with pineapple extract which contains bromelain and peroxidase improves the liver and kidney function and rearranges more or less normal architecture better than bromelain. The present work indicates that the bromelain along with peroxidase exhibited significant antitumor activity.

ARTIFICIAL FRUIT RIPENING

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Fruit ripening is a natural process in which the fruit goes through various chemical changes and gradually become sweet, flavoured, coloured, gets soft and become palatable (Brady, 1987).The fruit ripening process can be stimulated by using various chemicals on fruits or ripening agents. Artificial ripening is done to achieve faster and more uniform ripening. It is the process by which ripening is controlled and product may be achieved as per requirement by controlling different parameters. Ripening agents are substances which hasten the ripening process, and it comes in different forms. These include ethylene gas, ethephon, ethylene glycol, etherel and calcium carbide (Singal *et al.,* 2012). In recent times there is much concern about artificial ripening. Various artificial methods of fruit ripening have been studied mostly to meet consumer's demand and other economic factors. Fruit sellers artificially ripen green fruits even during the due season to meet the high demand and make high profit of seasonal fruits. The effect of these artificial ripening agents on the food nutritional value and human health has drawn national and global attention. The adverse potential of calcium carbide as a ripening agent has been established (Singal *et al.,* 2012) while other chemical ripening agents like ethepon, etherel and ethylene glycol are also considered hazardous to health and they have to be used within recommended safe limits (Hakim *et al.*, 2012). Use of chemicals accelerates ripening, but affects the nutritional quality of fruits. Some of these chemicals are harmful for human health. It is necessary to build awareness among fruit producers, traders and consumers.

REFERENCES

Brady, C.J. (1987). Fruit ripening. Annual Review of Plant Physiology and Plant Molecular Biology 38: 155–178.

Hakim, M.A; Obidul Huq, A.K.; Alam, M.A.; Khatib, A.; Saha, B.K.; Formuzul Haque, K.M and Zaidul, I.S.M (2012). Role of health hazardous ethephone in nutritive values of selected pineapple, banana and tomato. Journal of Food, Agriculture and Environment 10(2):247–251.

Singal,S; Kumud, M and Thakral, S (2012). Application of apple as a ripening agent for banana. Indian Journal of Natural Products and Resources, 3(1):61–64.

Oxidative stress induced by silk sericin triggers apoptosis in human cancer cell lines

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Cancer cells enhance their antioxidant capacity to maintain the redox balance and metabolic activities. Pro-oxidants elevate reactive oxygen species (ROS) levels, which disrupt the redox balance of cells and leads to apoptotic/necrotic cell death. Silk sericin (SS), a protein polymer possessing antioxidant activity suppresses the cell growth above its optimum concentration. In the present study, we have evaluated the pro-oxidant activity of SS extracted from the cocoons of Antheraea assamensis (AA), Bombyx mori (BM) and Philosamia ricini (PR) using human breast cancer (MCF-7), tongue carcinoma (SAS) and squamous carcinoma (A431) cell lines. Cytotoxicity studies revealed that the MCF-7 (AA), SAS (BM, AA and PR) and A431 (BM, AA and PR) cells treated with 4 mg mL-1 of SS survived <50% in contrast to control. Whereas, ~70% of human keratinocytes (HaCaT) and breast epithelial cells (MCF-10) survived post SS treatment. Cell cycle analysis attested that SS treatment caused the cell death as represented by the gate population present at sub-G1 phase. Elevation of ROS levels and mitochondrial membrane potential showed that SS treatment elevated the level of ROS, which leads to the depletion of inner mitochondrial membrane potential (in MCF-7). Annexin V/propidium iodine (PI) was used to assess the cause of cell death, which revealed that SS treatment leads to apoptotic cell death. AA sericin treated MCF-7 cells exhibited significant upregulation of caspase-9, Bax and cytochrome c (cyt c) expression, whereas Bcl-2 genes were downregulated. SAS and A431 cells treated with SS showed significant upregulation of p53, cyt c, caspase-3 expression, whereas Bcl-2/Bax dysregulation was observed. Thus, our study supports that SS acts as pro-oxidant at 4 mg mL-1 concentration nd leads to apoptotic cell death. SS possessing pro-oxidant activity may be used as a potential molecule for treating cancer without affecting normal tissue.

Keywords: Pro-oxidants, ROS, Silk sericin, Membrane potential, Apoptosis.

References

1. W. L. Lee, J. Y. Huang and L. F. Shyur, Oxidative Medicine and Cellular Longevity, 2013, 925804, 25.
2. J. Fang, T. Seki and H. Maeda, Advanced Drug Delivery Reviews, 2009, 61, 290-302.
3. J. P. Kumar and B. B. Mandal, Free Radical Biology and Medicine, 2017, 108, 803-818.

Potential application of α-amylase for desizing of fabrics in textile industry

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Introduction: In modern civilization, enzymes play an important role in the industries as it has no biohazards like chemicals. It has influential effect in the textile industries of our country. However, the present work focuses on the applications of α-amylase in textile industry for desizing of fabrics. The α-amylases are used for starch hydrolysis in the starch liquefaction process that converts into fructose and glucose. Starch is a very well-known and widely used in 'sizing of fibre' to prevent the breakage of fibre which should be removed in the process of 'desizing'.
Methods: The methodology begins with cloning of full-length and truncated Bacillus subtilis amylase, followed by characterization, expression and purification of α-amylases. Both the α- amylases were independently immobilized on ZnO nanoparticles to further improve in the stability and reuseablity of the enzyme. The crystalline structure of synthesized ZnO nanoparticles and immobilized amylase ZnO nanoparticles were confirmed using FT-IR, FESEM and powder XRD analysis. Then, the starch-coated cotton, linen and silk fabrics were tested for efficient starch removal using these two immobilized α-amylases.

Results: The optimum temperature stability and activity of full-length and truncated α-amylase was obtained at 45°C and optimum pH stability was recorded at pH 7 and pH 8, respectively. The results showed that the truncated α-amylases performed 3-fold better than full-length α-amylases. The optimum experimental conditions for starch removal were obtained at 50 U/ml truncated α- amylases at 45°C and pH 8 for treatment time of 30 minutes and were recycled upto 15 times. Comparative analysis of starch removal for cotton, linen and silk fabrics was found to be 70%, 85% and 75% removal, respectively.
Conclusion: Conclusively, this work reveals a promising perspective of using low-cost nanobiocatalysts in the textile industries to overcome the drawbacks of the chemical counterparts Keywords: Starch; α-amylases; ZnO nanoparticle; Enzyme immobilization; Fabric desizing
Methods: The methodology begins with cloning of full-length and truncated Bacillus subtilis amylase, followed by characterization, expression and purification of α-amylases. Both the α- amylases were independently immobilized on ZnO nanoparticles to further improve in the stability and reuseablity of the enzyme. The crystalline structure of synthesized ZnO nanoparticles and immobilized amylase ZnO nanoparticles were confirmed using FT-IR, FESEM and powder XRD analysis. Then, the starch-coated cotton, linen and silk fabrics were tested for efficient starch removal using these two immobilized α-amylases.

Oxidative stress induced by silk sericin triggers apoptosis in human cancer cell lines

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Cancer cells enhance their antioxidant capacity to maintain the redox balance and metabolic activities. Pro-oxidants elevate reactive oxygen species (ROS) levels, which disrupt the redox balance of cells and leads to apoptotic/necrotic cell death. Silk sericin (SS), a protein polymer possessing antioxidant activity suppresses the cell growth above its optimum concentration. In the present study, we have evaluated the pro-oxidant activity of SS extracted from the cocoons of Antheraea assamensis (AA), Bombyx mori (BM) and Philosamia ricini (PR) using human breast cancer (MCF-7), tongue carcinoma (SAS) and squamous carcinoma (A431) cell lines. Cytotoxicity studies revealed that the MCF-7 (AA), SAS (BM, AA and PR) and A431 (BM, AA and PR) cells treated with 4 mg mL-1 of SS survived <50% in contrast to control. Whereas, ~70% of human keratinocytes (HaCaT) and breast epithelial cells (MCF-10) survived post SS treatment. Cell cycle analysis attested that SS treatment caused the cell death as represented by the gate population present at sub-G1 phase. Elevation of ROS levels and mitochondrial membrane potential showed that SS treatment elevated the level of ROS, which leads to the depletion of inner mitochondrial membrane potential (in MCF-7). Annexin V/propidium iodine (PI) was used to assess the cause of cell death, which revealed that SS treatment leads to apoptotic cell death. AA sericin treated MCF-7 cells exhibited significant upregulation of caspase-9, Bax and cytochrome c (cyt c) expression, whereas Bcl-2 genes were downregulated. SAS and A431 cells treated with SS showed significant upregulation of p53, cyt c, caspase-3 expression, whereas Bcl-2/Bax dysregulation was observed. Thus, our study supports that SS acts as pro-oxidant at 4 mg mL-1 concentration and leads to apoptotic cell death. SS possessing pro-oxidant activity may be used as a potential molecule for treating cancer without affecting normal tissue.

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References
1. W. L. Lee, J. Y. Huang and L. F. Shyur, Oxidative Medicine and Cellular Longevity, 2013, 925804, 25.
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Redesigning Ayurvedic formulation triphala as anticancer agent.

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Triphala is known to be one of the most ethnic ayurvedic products having a remarkable impact against the cancer cells to eliminate the cause and generate relief to the sufferers. It is not just a single entity responsible for the same but it contains various phytochemicals which collaboratively generate the anticancer activity. Moreover, the studies reveal that the pkc-alpha domain is chiefly incorporated in the cancer signaling pathways which insights its potential towards being exploited for the target specific anticancer screening of triphala and other phytochemicals particular to the respective plant species. The above mentioned informations can be clubbed to investigate newer formulations of triphala content. This can lead to redesign better ayurvedic triphala based drugs having anti-cancer activity. As the pkc alpha domain of the respective enzyme is found to have specific action in the cancerous cells, the triphala and its other formulatory herbal products are mandatory to have similar response towards the cancerous infirmity of the cells. The above knowledge is exploited to understand the binding capacity of the various phytochemicals content in the plant species containing triphala through the in-silico molecular docking studies. The products corresponding to the highest degree of the binding are sought and screened after the molecular docking. The selected phytochemical containing products are tested for its activity towards the various cancerous cell lines in different concentrations. This would henceforth be utilized to reformulate and successfully redesign the triphala content with other phytochemical ingredients of various ayurvedic products showing higher activity towards the cancerous cells. This approach ultimately renders us to come up with a better, more resolved and cost effective ayurvedic drug formulation against cancer.

Characterization of grey water to access its feasibility to reuse

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Grey water reuse, reclamation and recycling are essential in coming years for the development of sound water management policy. About 60% of world population is expected to suffer water scarcity by the year 2025. Grey water is an important component of water conservation and comprises 50-80% of residential wastewater and offers a great potential as an economic and resource conservation component of the integrated water resources management especially in dry areas. Characterization of grey water with special reference to key water quality parameters signifies immense importance for further reutilization so far the water productivity is concerned. A study conducted at Assam Agricultural University on characterization of grey water collected periodically envisaged that irrespective of dilution of grey water due to onset of monsoon from the month of March onward there was not much variations in respect of pH, while, concentration of PO4 although was recorded higher initially during the month from November to February, it was found to decrease from March and evidently negligible during June to August. In regards to Biochemical Oxygen Demand (BOD) and Dissolved Oxygen (DO), it revealed that DO concentration was found minimum in the months from November to March and their value was found increasingly high onwards and attained its maximum in the month of June. This trend was reversed in the case of observed values of BOD. Total N, Total Soluble Solid (TSS), Chloride and EC although showed higher value initially during the months of November to January but decreased gradually thereafter and maintained minimum values in the month of August, which might possibly due to dilution effect owing to downpour. In soil column study, irrespective of soil types, percent removal efficiency found to decrease for BOD and phosphate with increase in soil depths while, reverse trend was noticed for NH4, TSS, Cl, EC and alkalinity. Highest percent daily compliance with Environmental Protection Agency(EPA) recommended criteria was recorded for phosphate followed by NH4.

Key words: (Grey water, characteristics, quality, soil column, EPA)

Abstract for Research Conclave 2018
Title - Morphological and molecular Genetic Characterization of Ornamental Trichogaster spp. of Assam

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North Eastern Region of India is rich in fish biodiversity and 115 species are recorded to be of ornamental values. Trichogaster (Colisa) is a genus, distributed in the Brahmaputra and Barak Basin and is represented by the four species, viz., T. fasciata, T. labiosa, T. lalia and T. Sota. These four species have both food and ornamental value. The natural stock of many such ornamental fishes of North Eastern Region are depleting gradually due to habitat loss, expansion of agricultural practices and discharge of effluents in the water bodies. For their proper conservation it is necessary to study the status of these important species and also to understand the biology of each species. Biodiversity documentation and characterization of these species is also necessary to restrict illegal trading and to prevent bio-piracy related issues. Phylogenetic analysis is the most reliable and scientific method of characterizing biodiversity. Since, there is very little information on the genetic makeup of the species under the genus Trichogaster, we initiated this study to accumulate preliminary knowledge on morphogenetic and phylogenetic features. This study for the first time report the genetic features of the four locally available species of Trichogaster on the basis of morphology, ISSR and Cox – 1 Gene locus. This work will contribute towards better understanding of the genetic features of the local fishes and will help to formulate better conservation strategies.

Key words: Molecular marker, Trichogaster, Ornamental fish

BIODYNAMIC FARMING: A PROMISING PATH TOWARDS TOMORROW'S SUSTAINABLE AGRICULTURE

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Biodynamic Farming is the first consciously organized organic movement that includes various anthroposophic concepts drawn from the ideas of Rudolf Steiner (1861-1925). Biodynamic approach emphasizes integration of human, animals, crops and soil as a single organism. Nine biodynamic preparations (BD500 –BD508) including some special preparations described by Steiner are used for the purpose of enhancing soil quality and stimulating plant life. Lunar and astrological cycles play a key role in the timing of biodynamic practices, such as the making of BD preparations and when to plant and cultivate. From many research findings it is proved that BD farming improves soil health and fertility (Condron et al. 2010, Perumal and Vatsala 2002), sequesters higher amount of soil organic carbon on long term basis (Turinek et al., 2009) which helps to combat climate change, provides better or equal yield potential than that of other farming systems (Sharma et al. 2012), produces quality food with better taste (Penfold and Collins 2015), manage insect and pest in a eco-friendly manner. Despite of being started in 1920's, BD farming is still in its infancy in India. It should be incorporated to the modern agricultural world to prevent damage to our fragile earth in a sustainable manner. Misconception of people about BD farming of being pseudoscience should be eradicated through various training and participatory programmes.

Key words – Astrological cycles, BD500 –BD508, anthroposophic concepts

Turinek, M., Grobelnik-Mlakar, S., Bavec, M. and Bavec, F. (2009) Biodynamic agriculture research progress and priorities. Renewable Agriculture and Food Systems 24, 146–154.

References:
Condron, L.M., Cameron, K.C., Di, H.J., Clough, T.J., Forbes, E. A., McLaren, R.G. and Silva, R.G. (2010) A comparison of soil and environmental quality under organic and conventional farming systems in New Zealand. New Zealand Journal of Agricultural Research 43, 443-466.
Penfold, C. and Collins, C. (2015) The relative sustainability of organic, biodynamic and conventional viticulture. Australian Grape and Vine Authority.
Perumal, K. and Vatsala, T.M. (2002) Utilization of local alternative materials in cow horn manure (BD500) preparations:A case study on biodynamic vegetable cultivation. Journal of Biodynamic Agriculture -Australia 52, 16-21.
Sharma, S.K., Laddha, K.C., Sharma, R.K., Gupta, P.K., Chatta, L.K. and Pareeek, P. (2012) Application of biodynamic preparations and organic manures for organic production of cumin (Cuminum cyminum L.). International Journal of Seed Spices 2, 7-11.
Turinek, M., Grobelnik-Mlakar, S., Bavec, M. and Bavec, F. (2009) Biodynamic agriculture research progress and priorities. Renewable Agriculture and Food Systems 24, 146–154.

Toxicity of an important plastic cosntituent Bisphenol S (BPS), on Pearl spot (Etroplus suratensis)

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Plastic pollution in the aquatic environment has become a major problem in the freshwater and marine water system. Bisphenol S (BPS) has been frequently detected both in environment and biota. In the present study, Etroplus suratensis fishes were exposed to different ppm of BPS for 28 d, and the effects on liver, antioxidant enzymes, MDA level and immunological parameters were investigated. BPS leached from the discarded plastics, thermal papers directly affect the natural population of fishes in inland waters and as well as coastal waters. The LC 50 concentration of Bisphenol S exposed to Etroplus suratensis was found to be 407 ppm. The exposed fishes showed excess mucus secretion, abnormal movement, avoidance of feeds and high opercular movements. In all treatments after sub lethal exposure for 4 weeks the liver and blood collected for studies. Specific activity of antioxidant enzymes found to be decreased to the higher concentration of exposure level. Exposure to BPS resulted in increased malondialdehyde (MDA) production. Serum glutamate oxaloacetate transaminase (SGOT), serum glutamate pyruvate transaminase (SGPT) and alkaline phosphatase (ALP) activity were elevated in exposed than the control.

KEYWORDS- BPS, Antioxidant enzymes, Etroplus suratensis

Effect of Auxins Augmentation on Yield and Quality of Guava

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Guava (Psidium guajava L.), the "poor man's fruit" or "apple of the tropics" (Singh, 2007) was introduced in the early 17th century in India is a highly prolific, remunerative fruit and has gained considerable prominence because of its high nutritive value (Boora et al., 2015). The production of poor quality guava fruits is a matter of common experience. Application of auxins in guava controls many aspects of fruit development, including fruit set and growth, ripening and abscission (Pattison et.al, 2014). It can influence size, appearance and quality parameters of fruits by indirectly affecting the crop growth and development or directly by synchronizing flowering, improving fruit-set, decreasing pre-harvest fruit drop and thinning of excessive flowers or young fruits of guava (Bhardwaj et.al, 2005). Auxins such as NAA, NAD and 2, 4- D applications significantly increase the canopy volume, fruit weight, pulp thickness, pulp seed ratio, TSS, ascorbic acid, total sugars and reducing sugar in guava (Agnihotri et.al, 2016).These also influence on crop regulation that manipulates natural flowering and fruiting of guava plant to increase the fruit yield in desired season (Ojah, 2014).
Keywords: Guava, Auxins.

REFERENCES
Agnihotri, M.K.; Sarolia, D.K.; Singh, V.; and Shukla, A.K. 2016. Crop regulation in guava cv. Sardar as influenced by chemicals and cultural practices under semi arid conditions of Rajasthan. Journal of Agriculture and Ecology. 85-90
Bhardwaj, R.L.; Meena, R.R.; and Mukherjee, S. 2005. ROLE OF PLANT GROWTH REGULATOR'S IN GUAVA '(PSIDIUM GUAJAVA L.) - A REVIEW. Agric. Rev., 26 (4): 281 – 287
Boora, R.S.; Dhaliwal, H.S.; and Arora, N.K. 2016. Crop regulation in guava-A review .AGRICULTURAL RESEARCH COMMUNICATION CENTRE. 37 (1) 2016: 1-9
Ojah, D. 2014. Regulation of flowering in Guava (Psidium guajava L) cv., Allahabad Safeda. MSc Thesis submitted to Assam Agricultural University Jorhat
Pattison, R.J.; Csukasi, F.; and Catala, C. 2014. Mechanisms regulating auxin action during fruit development. https://www.ncbi.nlm.nih.gov/pubmed/24329770. 151(1):62-72
Singh, G. 2007. Recent development in production of Guava. Acta Horti. 735: 161.

Understanding the Energetics of Stop Codon Recognition by Eukaryotic Release Factor by Molecular Dynamics and Free Energy Simulations

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In translation termination, eukaryotic release factor (eRF1) recognizes mRNA stop codons (UAA, UAG or UGA) in ribosomal A-site and triggers release of nascent polypeptide chain from P-site tRNA. eRF1 is highly selective for U in the first position and combinations of purines (except two consecutive guanine: GG) in the 2nd and 3rd positions. Eukaryotes decode all the three stop codons with a single release factor eRF1, instead of two (RF1 and RF2) in bacteria. Furthermore, unlike bacterial RF1/RF2, eRF1 stabilizes compact U-turn mRNA configuration in the ribosomal A-site by accommodating four nucleotides instead of three. Despite the available cryo-EM structures (resolution ~3.5-3.8Å), the energetic principle for eRF1 selectivity towards a stop codon remains a fundamentally unsolved problem. Using cryo-EM structures of eukaryotic translation termination complexes as templates, we carried out molecular dynamics free energy simulations of cognate and near cognate complexes to quantitatively address the energetics of stop codon recognition by eRF1. Our results suggest that eRF1 has a higher discriminatory power against sense codons, compared to that reported earlier for RF1/RF2. The compact mRNA formed specific intra-mRNA interactions, which itself contribute to stop codon specificity. Furthermore, the specificity is enhanced by the loss of protein-mRNA interactions, and most importantly, by desolvation of the incorrect codons in the near-cognate complexes. Our work provide a clue to how eRF1 discriminates between cognate and near cognate codons during protein synthesis.

"Exploitation of bio agents and botanicals for eco-friendly management of grape (Vitis vinifera l.) anthracnose caused by Elsinoe ampelina"

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Grape (Vitis vinifera L.) is a fruit, botanically a berry, is among the oldest plants on earth. India being the major producer of grapes, production suffers from biotic and abiotic stresses. Biotic stress such as anthracnose is a fungal disease caused by Elsinoe ampelina is also referred as "Bird's eye spot". Presently anthracnose is most devastating disease in grape and affects all the aerial parts in the early stage. In early stage, leaves show small circular to irregular dark brown spot with 1-5 mm diameter in size which later turn gray in the center with dark brown margins and typical bird's eye spot symptoms appear on berries. To manage the disease, chemicals are used indiscriminately, which are hazardous to human health and environment. In order to reduce the damage to the environment and humans, an attempt was made to study the antagonistic property of six bio agents viz, Bacillus subtilis, Pseudomonas fluorescens, Trichoderma harzianum, T. virens,

T.virede and T. koningii for radial growth inhibition using dual culture technique and seven botanicals viz, Azadirachat indica, Allium sativum L., Allium cepa L., Eucalyptus teretecornes, Parthenium hysterophorus, Pongamia pinnata and Ocimum basilicum were tested by poison food technique against E.ampelina. Among the fungal bio agents evaluated, the maximum per cent mycelial inhibition of E. ampelina was recorded in treatment involving T. harzianum (82.41 %) which found significantly superior over rest of the treatments and it was followed by T. viride (77.82 %). Among the Seven botanicals tested the maximum per cent mycelial inhibition was recorded in treatments involving Onion extract (78.00 %) and Garlic extract (72.23 %) at 10 per cent concentrations which was found to be significantly superior over rest of the treatments and it was followed by Azardirachta indica (51.62 %). Key words : Bioagents, Elsinoe ampelina, Trichoderma, bio agents, botanicals.

Application of recombinant pectinolytic enzymes from Clostridium thermocellum in textile industry

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Pectinases are an ecofriendly tool of the nature that are being extensively used in various applications such as in processing of fruit and vegetables juice, bioscouring and degumming of plant fibres [1]. In this study, recombinant pectin methylesterase (CtPME) from family 8 carbohydrate esterase and pectate lyase (PL1B) belonging to family 1 polysaccharide lyase from Clostridium thermocellum were employed for bio-scouring of cotton and degumming of jute. The cotton fabric (6 cm x 4cm) treated with crude CtPME extract (10 mg/ml; 4.2U/mg) for 1 h at 50°C resulted in reduction of water absorption time from 7 min for untreated fabric to 24 s for the treated fabric. The treatment of cotton fabric with crude PL1B (10 mg/ml; 3.0U/mg) for 1 h at 50°C resulted in reduction of water absorption time from 7 min for untreated fabric to 21 s for the treated fabric. Upon treatment with combination of both crude enzymes [PL1B (5 mg/ml; 3.0 U/mg) and CtPME (5 mg/ml; 4.2U/mg)] resulted in reduction of water absorption time from 7 min for untreated fabric to 10 s for the treated fabric. Degumming of the jute fibre was performed separately with the crude CtPME (10.0 mg/ml; 4.2U/mg) and PL1B (10.0 mg/ml; 3.0U/mg) as well as with cocktail of both these enzymes [PL1B (5 mg/ml; 3.0U/mg) and CtPME (5 mg/ml; 4.2U/mg)]. FESEM analysis showed that enzyme cocktail resulted in better smoothening of fibre surface, as compared to the individual enzymes. This was due to the efficient removal of pectin-associated wax by the two enzymes. The results in detail will be presented.

Reference

[1] Garg, G., Singh, A., Kaur, A., Singh, R., Kaur, J. & Mahajan, R. (2016) Microbial pectinases: an ecofriendly tool of nature for industries. 3 Biotech, 6(1), 47.

HERBAL ALCOHOLIC BEVERAGES: A REVIEW IN NORTH-EAST INDIA'S PERSPECTIVE

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The science of distillery was still at its infancy in Europe when a movement started in steeping certain medicinal herbs into alcohol extracted for their beneficial qualities. From then on, consumption of these liqueurs became parts of the tradition impacting health with benefits. People started producing a large array of variants in alcoholic beverages infusing more and more herbs into it which later became commercially available worldwide. In India, North-East region is inhabited by many indigenous tribes who, as a part of their socio-cultural life, prepare their own local brew. The preparation and consumption of this type of alcohol emerged mainly due to their long-time reliance on the local natural resources for health benefits which gradually became deeply rooted to their tradition. Herbs used in making of the traditional alcohol are believed to

be beneficial for health with tremendous therapeutic potential in curing various ailments (Deka and Sarma, 2010). Dearth of scientific investigations into the standard production procedures, lack of people's knowledge on commercial aspects and general tendency to keep these in the comfort zone of their 'tradition', the local brews are still in the same stage where it was long time back. There is an urgent need to take every effort to document, preserve and encourage the practice of indigenous knowledge of the tribal people with systematic and scientific approach to augment the industry in technological and commercial footholds.

REFERENCES:

Deka, D. and Sarma, G.C. (2010). Traditionally used herbs in the preparation of rice-beer by the Rabha tribe of Goalpara district, Assam. Indian Journal of Traditional Knowledge 9(3): 459-462.

Development of a Leishmania donovani membrane protein as a vaccine candidate against Visceral Leishmaniasis

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Visceral Leishmaniasis, a tropical disease caused by protozoan Leishmania donovani seeks immediate attention for development of a potent vaccine due to failure of current therapeutic. Leishmania is known to suppress the expression of Th1 type cytokines (which helps the host to maintain the parasite load) and instead overexpress the Th2 type cytokines (which helps in disease progression). A vaccine which can direct the development of naive macrophage towards Th1 differentiation could be effective against this pathogen. Membranous or secretory proteins are mostly used as organism specific antigens in vaccines as they are the first group to encounter with the host system. Glycosomal membrane protein like protein, a membrane protein was selected as vaccine candidate based on the immunogenicity bioinformatics data. It was fused with Human IL-2 to develop Th1 response as well as long term memory against the parasite. Cloning and expression of the construct will be followed by animal studies (on mouse and/or hamster) for immunological studies to validate the vaccine candidate.

Refernce: Duthie MS, Pereira L, Favila M, Hofmeyer KA, Reed SJ, Metangmo S, Townsend S, Laurance JD, Picone A, Misquith A, Hossain F, Ghosh P, Khan MAA, Guderian J, Bailor HR, Liang H, Vergara J, Oliveira F, Howard RF, Kamhawi S, Mondal D, Coler RN, Valenzuela JG, Reed SG. A defined subunit vaccine that protects against vector-borne visceral leishmaniasis. NPJ Vaccines. 2017 Aug 21;2:23.

INDUCED RANDOM MUTAGENESIS IN GREEN GRAM (Vigna radiata (L.) R. Wilczek)

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Mutations are sudden, random and inheritable changes that occur in organisms. Such changes, although generally harmful, are sometimes beneficial for plant breeders as they may introduce new characters in homogenous plant populations. Naturally, mutations occur at a very slow pace and it may take generations for the phenotypic establishment. However, some Physical and Chemical agents are known to induce mutagenesis. Study was conducted to understand the effect of selected Gamma radiation doses of 100 Gy, 200 Gy, and 300 Gy along with 0.1%, 0.2%, and 0.3% (w/v) Ethyl Methane Sulphonate (EMS), a known chemical mutagen, and a combination of 0.2% EMS + 200 Gy on Green Gram.. All these seeds were grown in the field in RBD design with eight blocks including Control. Selected pre-harvest characters and post-harvest characters were recorded. It was observed that in comparison to the Control the Treated plants showed superior variation in Laboratory germination, Seed Vigor Index, Number of Picking, branches per plant, clusters per plant and pods

per clusters, however, among these, the combination (i.e. 0.2% EMS + 200 Gy Gamma radiation) produced better results. Such variations may be helpful in inducing variations in self-pollinated crops like green gram and may provide selection materials for plant breeders in establishment of new varieties.

Localized and Targeted Anticancer Drug Delivery Using Nano Hybrid Injectable Silk Hydrogel

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The incidence and mortality rate due to cancer is increasing worldwide. Chemotherapy is a major therapeutic approach available to treat cancer. However, there exist major limitations using chemotherapeutic approaches due to hydrophobic nature of molecules, lack of solubility and selectivity, loss of activity in blood circulation, burst release and drug resistance by cancer cells. To countercheck, the indiscriminating action of anticancer drugs and specific targeting of drug molecule into cancer cells becomes inevitable for treatment modalities. In our approach, we have used a novel silk hydrogel impregnated with folic acid functionalized doxorubicin (Dox) loaded carbon nanotubes (CNT-FA/DOX). The in vitro studies demonstrated the active targeting of CNT-FA/DOX to folic acid receptor positive cancer cells. Increased Dox release was observed from both CNT and silk hydrogel individually as well as their hybrid system at lower pH. Further, CNT also showed thermo responsive Dox release due to their heat conductive property. Therefore, the silk-CNT hybrid system is presented here as pH and temperature responsive system. The mechanical strength and rheology supported the ease of its injectability. Hence the developed silk-CNT hybrid system might allow its near or intra-tumoral implantation, where it may act as depot for Dox-loaded nanoparticles. The sustained and targeted release of Dox at tumour site will reduce its side effects as well as frequent patient visits for efficacious cancer treatment.

Keywords: injectable silk hydrogel, carbon nanotubes, targeted drug delivery.

Cell instructive silk-bioactive glass composite scaffolding matrices towards osteoinductive, proangiogenic and resorbable bone grafts

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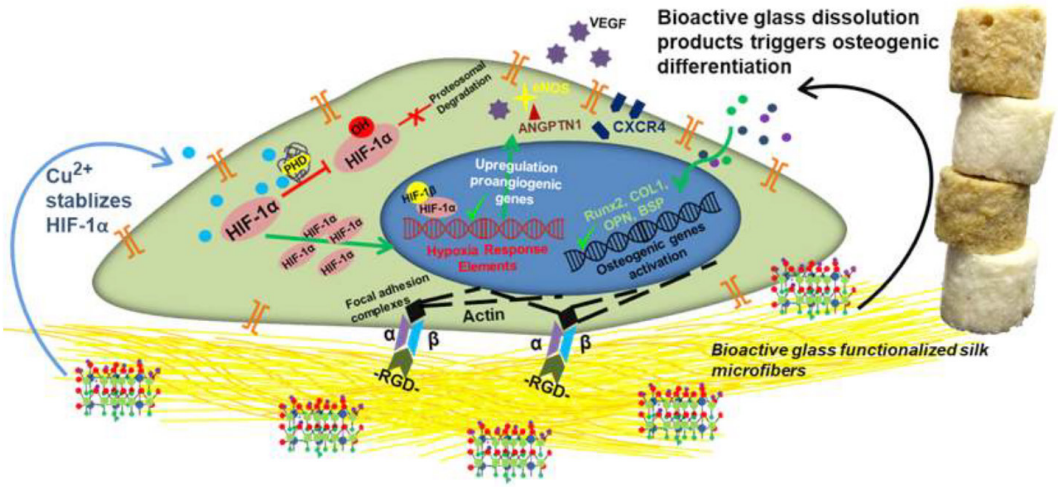
Successful reconstruction of large volume segmental bone defects necessitates the use of resorbable and proangiogenic scaffolding matrix. Vascularization forms the main essence of bone formation and bone remodelling during healing process. Herein, we investigated the use of copper doped bioactive glass silk composite matrices for mediating osteogenesis, angiogenesis and bone resorption. Two silk varieties namely, mulberry (Bombyx mori) and non-mulberry (Antheraea assama) were studied as scaffolding matrices. Silk microfibers functionalized with copper doped bioactive glass were used as reinforcements in the silk matrices to augment the mechanical properties and also to improve the osteoinductive properties of these chosen silk matrices. The composite matrices enhanced the osteogenic potential of adipose derived human mesenchymal stem cells (hMSCs) in comparison to pure silk matrices. The functionalized silk microfibers also improved cell attachment and migration of adipose derived hMSCs and primary endothelial cells, in co-culture. The incorporation of Cu2+ in sol derived bioactive glass helped in stabilization of nuclear hypoxia-inducible factor-1α resulting in upregulation of angiogenic specific markers. Additionally, the expression of C-X-C chemokine receptor type-4 in adipose derived hMSCs helped in endothelial cell homing and migration, establishing a primitive plexus like vascular network

in coculture. The non-mulberry matrices presented a conducive micro-millieu resulting in upregulation of remodelling enzymes such as matrix metalloproteinase-9, cathepsin-K and tartarate resistant acid phosphatase in human osteoclasts, thereby substantiating the resorbable nature of the composite matrices.

Keywords: biomimetic, angiogenic, resorbable, bioactive glass, silk fibroin, nonmulberry silk, fiber reinforcement
References:
1. Mandal, Biman B., et al. "High-strength silk protein scaffolds for bone repair." Proceedings of the National Academy of Sciences 109.20 (2012): 7699-7704.
2. M, Joseph Christakiran, et al. "Mimicking Hierarchical Complexity of the Osteochondral Interface Using Electrospun Silk–Bioactive Glass Composites." ACS Applied Materials & Interfaces 9.9 (2017): 8000-8013.



Scheme *representing the holistic cellular mechanisms involving osteogenesis, angiogenesis and resorption, regulated by cell instructive silk composite matrices*

Natural food colour, its Sources and applications

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Color is a measure of quality and nutrient content of foods. The objective of adding color to foods is to make them appealing, augment the loss of color during processing, to improve the quality and also to influence the consumer to buy a product. At present, the demand for natural dyes is increasing worldwide due to the increased awareness on therapeutic and medicinal properties and their benefits among public and also because of the recognized profound toxicity of synthetic colors. Natural dyes are those derived from naturally occurring sources such as plants, insects, animals and minerals. The masking of colour of wine began 400 years B.C. when the early Egyptians and Romans coloured wines with herbs and spices to make it more appealing. Synthetic colours have been used and developed throughout the commercial food industry during the late 1800s to help decorate as well as disguise low-quality food.
The following are the certified colour additives for use in food: Food, Drug & Cosmetic (FD&C) Blue No. 1, FD&C Blue No. 2, FD&C Green No. 3, FD&C Red No. 40, FD&C Red No. 3, FD&C Yellow No. 5, FD&C Yellow No. 6, Orange B and Citrus Red No. 2. There are an additional 22 colours that are exempt from certification with the FDA. A growing number of natural food dyes are being commercially produced, partly due to consumer concerns surrounding synthetic dyes. Europe presently has 13 permitted pigments derived from natural sources, which may be used for food colouration. These are curcumin, lutein, beta-carotene, bixin/norbixin, capsanthin/capsorubin, betanin, carminic acid and carmine, chlorophyll

and copper chlorophyll/chlorophyllin, caramelised sugar and malt extract and anthocyanins. Monica Giusti et al., studied acylated anthocyanins from edible sources and their applications in food systems and they found there is a particular demand for a red colorant that can effectively substitute for FD&C Red No. 40 (allura red), the certified dye with the highest per capita consumption in the USA. Puspita Sariet al., studied colour properties, stability and free radical scavenging activity of jambolan fruit anthocyanins and found that the colour property of natural anthocyanins, described as absorption spectra, was evaluated in the pH range of 1-8. The results indicated that the absorbance values at maximum absorption wavelength decreased with increasing pH up to pH 6. The high absorbance values were observed only at pH 1-2 and the colour of anthocyanins was strong red. As the food industry works with the health industry, the use of natural colours will become more prevalent, not only for colour but also for properties that could benefit for the health of children and adults.

References:

1.Bridle, P. & Timberlake, C.F. (1997). Anthocyanins as natural food colours- selected aspects. Food Chemistry, 58(1-2), 103-109.
2. Downham, A. & Collins, P. (1999). Colouing our foods in the last and next millenium. International Journal of Food Science & Technology, 2000, 35, 5-22.
3. Guisti Monica, M. & Wrolstad Ronald, E. (2003). Acylated anthocyanins from edible sources and their applications in food systems. Biochemical Engineering Journal, 14, 217-225.
4. Sari Puspita, Wijaya Christofora Hanny, Sajuthi Dondin, Supratman Unang. (2012). Colour properties, stability, and free radical scavenging activity of jambolan (Syzygium cumini) fruit anthocyanins in a beverage model sysytem : Natural and copigmented anthocyanins. Food Chemistry, 132, 1908-1914.

Low cost Flexible Electro-chromic Devices for Applications in Visual Indication

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Flexible Electro-chromic device was developed using Screen Printing Technique. This device consists of multilayer printing as shown in Fig. 1. Electrolyte is sandwiched between two layers of conductive substrate printed with electro-chromic material. Change in colour of the electro-chromic material is observed due to Change in state of the electro-chromic material. Various characterizations such as Raman spectroscopy absorbance of electrochromic layers and electrical characterization were performed before and after the colour change. Electro-chromic display using tungsten oxide using active material was found to change colour from green to blue (Image 1) at low voltage such as 1.6-1.8V. These electro-chromic devices are highly useful for visual indication when coupled with other electronic sensors and the low cost manufacturability allows this to be used in FMCG food packaging coupled with gas sensors indicating the freshness level of the food. Other applications can be in the indication of harmful gases integrating with toxic gas sensors, the shade of colour can be used to indicate the toxicity of gas.

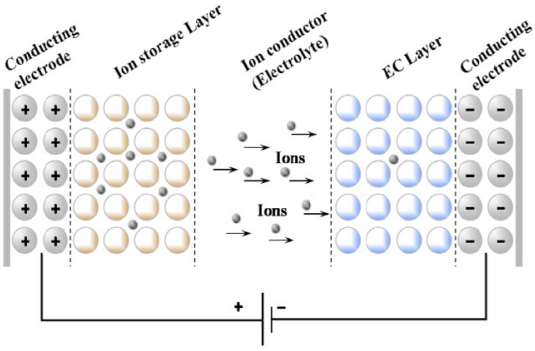

Fig 1: Schematic of Electro-chromic

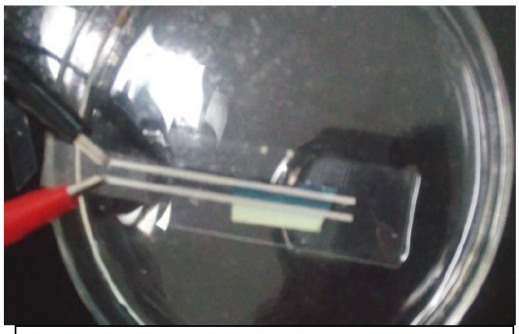

Image 1: Change in colour in presence of electric charge in WO_3

Some Cassava (Manihot esculenta Crantz) fermented products and their associated Lactic Acid Bacteria (LAB).

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Cassava as a staple food possesses many benefits above rice, maize, millet and other grain crops in places with a degraded resource base, unreliable rainfall and feeble market structure; being drought tolerant; this characteristic brands it the most suitable food crop for cultivation during drought and famine periods. Use of lactic acid bacteria in food processing dates back to ancient times, used primarily for their contributions in improving shelf life of fermented products; various LAB strains produce definite composites called bacteriocins, which possess antimicrobial properties, and they are believed to carry prospective preservation application. LAB commonly isolated from different fermented cassava food products include Lactobacillus plantarum strains, Leuconostoc mesenteroides strains, Pediococcus sp. and Lactococcus lactis strains among others. Non-lactic bacteria involved in the submerged fermentation of cassava, except for a single bacteria isolate that was a Gram positive, cocci cell in morphology, were Gram positive rods, catalase positive and spore forming, presumptively identified to be Bacillus spp. 139 predominant isolated strains from fermenting cassava during the production of gari were identified and it was established that Lactobacillus plantarum was the predominantly isolated species, trailed by Leuconostoc fallax and Lactobacillus fermentum, while Lactobacillus brevis, Leuconostoc pseudomesenteroides and Weissella paramesenteroides were occasionally isolated. The order of dominance of the LAB strains during cassava fermentation to produce fufu were L. plantarum, followed by Lc. mesenteroides, while L. lactis, L. coprophillus, L. acidophilus and L. brevis had the same frequency of isolation. Many of the isolates were homofermenters/heterofermenters Lactobacillus species and heterofermenters Leuconostoc species (Oyedeji et al., 2013).

Biological removal and recovery of selenium from wastewater

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Selenium (Se), an essential toxin is now becoming a matter of increasing concern to natural ecosystems due to its bioaccumulation potential. Industrial activities that include energy generation, metal and oil refining, mining and agricultural irrigation generate effluents tainted with Se. Biological selenium reduction has emerged as the leading technology for removing selenium from wastewaters since it offers a cheaper alternative compared to physico-chemical treatments as it has overcome the overlying limitations of separation and appropriate disposal of the solid phase, relatively high cost, energy consumption and so on. Moreover, biological treatment has the advantage of forming elemental selenium nanospheres which exhibit unique optical and spectral properties for various industrial applications, i.e. medical, electrical, and manufacturing processes. Microbial reduction of soluble oxyanion (SeO3 2-, SeO4 2-) to insoluble nanoparticulate elemental selenium (Se0) can be achieved in a number of bioreactor configurations that are emerging as a viable bioremediation option as an efficient large scale basis. Various bioreactors such as upflow anaerobic sludge blanket (UASB), fluidized-bed bioreactors (FBBR), packed-bed bioreactor, membrane biofilm reactor (MBfR) systems have been adapted for Se treatment. This review highlights the significance and efficiency of different bioreactor configurations in treating Se contaminatedwastewaters.

Keywords: Selenium, Wastewater, Biological treatment, Bioremediation

Cloning expression and purification of Chimeric enzyme using fusion of two genes CtGH1 ß-1,4-glucosidase and an endoglucanase CtGH5 (mutant F194A).

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The plant cell wall is composed of a variety of polysaccharides and is the most abundant source of renewable biomass on our planet. Lignocellulosic biomass is comprised of three main biopolymers: cellulose (40-60%), hemicelluloses (20-40%), and lignin (10-25%), and other components such as proteins, ash, and other extractives. There is an increasing effort to convert the lignocellulosic component to alcohols that can serve as biofuels. Cellulose is a linear homopolymer of glucose linked by β-1,4-glycosidic bonds. Cellulose is the most abundant yet the most recalcitrant constituent of plant cell wall, cellulose hydrolysis involves action of three major types of cellulases: endoglucanases, exoglucanases (including cellodextrinases and cellobiohydolases) and β-glucosidase whereas hemicellulose is made up of other sugars like xylose,arabinose and galactose. As the hydrolysis of cellulosic biomass will require three type of cellulase, The requirement of multiple enzymes for lignocellulose depolarization is one of the obstacles to economical bioconversion as production of a large number of enzymes is energy and cost intensive. Challenges facing the cost effective enzymatic sacharification of lignocellulosic biomass include the need for increase hydrolase activities and reduction of the number of proteins required for the process. A new chimera 1 (CtGH1-L1-CtGH5) was developed using fusion PCR approach to fuse CtGH1 ß-1,4-glucosidase and an endoglucanase CtGH5 (mutant F194A).The chimera 1 was expressed and purified as soluble protein, it showed 3.5 and 2 fold increase in catalytic efficiency for cellulase and glucosidase activity respectively.

Screening of actinobacteria for plant growth promoting properties from rhizosphere of Ageratina riparia (Regel) R.M.King & H.Rob. at St. Edmund's College campus, Shillong, India

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Actinobacteria were isolated from the rhizosphere of a herbaceous plant Ageratina riparia (Regel) R.M.King & H.Rob. from the botanical garden of St. Edmund's College campus, Shillong, India. 11 actinobacterial colonies were isolated and screened for plant growth promoting properties such as their ability to produce Indole acetic acid (IAA), siderophores, phosphate solubilizing enzymes and their ability to fix atmospheric nitrogen. 3 isolates were found to produce IAA > 25µg/ml (see fig 1), 4 isolates were found to produce siderophores with halo diameter > 30mm (see fig 2a), 3 isolates were found to solubilize phosphate > 150µg/ml (see fig 3) and 4 isolates showed clear ability to fix atmospheric nitrogen (see fig 2b,c). The above isolates warrant further investigation through their interaction with plant systems and to find out if plants can benefit through such plant-actinobacterial interactions.

Keywords: - Actinobacteria, Rhizosphere, Ageratina riparia, Plant growth promotion

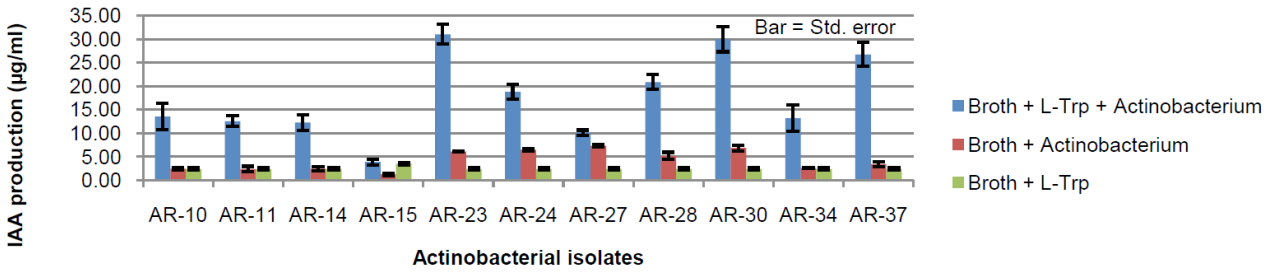

Fig 1. Screening results of actinobacterial isolates for Indole acetic acid (IAA) production

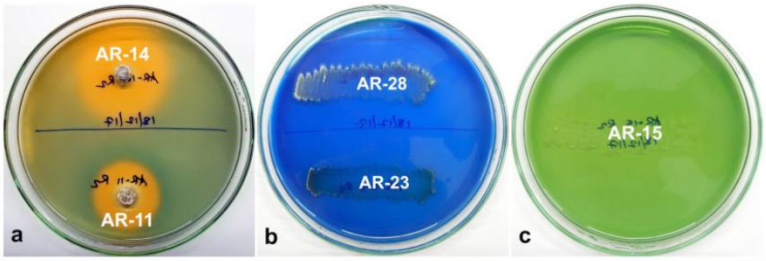

Fig 2. (a) Picture of a Petri dish containing two actinobacterial agar disc inocula (AR-14 & AR-11) showing siderophore activity on CAS medium.
(b) Picture of a Petri dish containing two actinobacterial streaks (AR-28 & AR-23) showing the ability to grow in a nitrogen-free medium and the ability to increase the pH of the medium (changing the colour of the medium from green to blue), signifying the ability to fix atmospheric nitrogen.
(c) Picture of a Petri dish containing an actinobacterial streak (AR-15) at the centre of the dish showing its inability to do the same in a nitrogen-free medium, signifying its inability to fix atmospheric nitrogen.

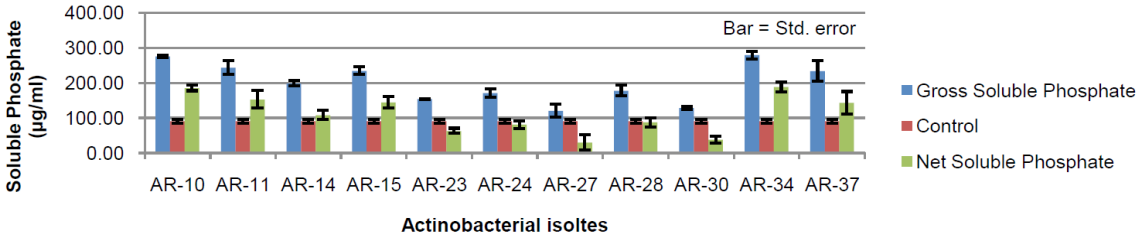

Fig 3. Screening results of actinobacterial isolates for solubilization of inorganic phosphate

Dietary Calcium regulates Adiposity and Lipogenesis activity in Adipose tissue of Male Wistar Rats

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Adipose tissue is considered to be the largest reservoir for conserving triacylglycerol (TG) in mammals and serves as the basic source of energy during starvation and high energy demand. The transformation of immature pre-adipocytes into mature adipocytes due to the accumulation of triacylglycerol (TG) which is considered as a crucial step in the pathogenesis of obesity is controlled by several factors such as endocrine, metabolic, environmental, genetic, pharmacological, neurological and nutritional factors. Dietary calcium has recently emerged as a potential candidate for therapeutic use against obesity. However, there are controversies regarding the role of dietary calcium on adipocyte metabolism. We used healthy male wistar rats and fed them with the control diet, low and high calcium diet for three consecutive months. Low calcium diet group showed significantly higher weight gain, accumulation of adipose tissue and increased adiposity index. High calcium diet provided a protection against dyslipidemia by reducing the serum cholesterol and triglyceride. Serum calcium level and PTH level varied significantly in low calcium diet group compared to other two groups. The results of our study revealed that dietary calcium regulates the adiposity of male wistar rats when fed with low and high calcium diet for a long period by altering both lipogenesis pathway by regulating the fatty acid synthase (FAS) activity within the adipocytes along with changes in serum PTH level.

"Epigenetic regulation of ADAMTS19 in breast cancer"

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Extracellular matrix (ECM) is a major component of the microenvironment, which plays a significant role in various cellular functions such as cell shape, adhesion, migration, proliferation, polarity, differentiation and apoptosis. Once in a while, ECM behaves abnormally like increased synthesis/breakdown of ECM proteins in various diseases like cancer. Matrix metalloproteinase (MMPs) and a disintegrin and metalloproteinase with thrombospodin motif (ADAMTS) are the important metalloproteinase enzymes which plays a significant role in ECM remodeling. ADAMTS19 encodes a member of the ADAMTS protein family, an orphan enzyme whose substrate and functions are still unknown but it seems to have a vital role in carcinogenesis and metastasis. For our work, we selected ADAMTS19 and tried to find out the effect of ADAMTS19 expression on survival of the cancer patients, expression of ADAMTS19 in various breast cancer cell lines and also the effect of methylation of promoter region on the expression of ADAMTS19. By survival analysis it was observed that ADAMTS19 expression provides the better survival for the breast cancer patient. Further, we have investigated the correlation of ADAMTS19 expression and methylation; we found that ADAMTS19 expression shows negative correlation with methylation. It means methylation of the CpG dinucleotide in the promoter region down regulates the ADAMTS19 expression. CpG dinucleotide of the ADAMTS19 promoter (using UCSC genome browser) was found to be differentially methylated in MCF-7 and T47D cell lines. We have also compared the methylation status of CpG island of ADAMTS19 in MCF-7 and T47D which expresses ADAMTS19 and also in MDA-MB231 and MDA-MB453 which do not expresses ADAMTS19. The modified COBRA (combined bisulfite restriction analysis) assays results indicated that the analyzed CpG dinucleotide of ADAMTS19 promoter was unmethylated in MCF-7 & T47D cell line but it was methylated in MDA-MB231 & MDA-MB453 breast cancer cell line. This study suggests that the DNA methylation is involved in the regulation of ADAMTS19 expression.

EFFICIENCY OF NEW VISUAL BIOFEED BACK DEVICE – SYNCHRONIZED BREATHING TRAINER – FOR TRAINING BREATHING CONTROL

Objectives: Designing a new device to evaluate the efficacy of the device in lung functions and physical performance for patients with respiratory problems and to construct reliability for the device. Design: Experimental study , cross-sectional design with constructional validity. Setting: Dr. D.Y.Patil Vidyapeeth Pimpri, Pune. Participants: Patients with obstructive and restrictive respiratory conditions. Intervention: Patients were selected through purposive sampling. Patients were selected based upon the set inclusion and exclusion criteria of the study. Pre and Post assessments were taken for each of the 30 subjects. Respiratory rate, Inspiratory:Expiratory ratio , chest expansion(upper and lower), 6 minute walk test(laps and distance covered) and ERV was assessed pre and post training with the new breathing control device. Breathing retraining was given for each patient for 15-20 minutes. Results: Respiratory rate(Pvalue<0.001), Inspiratory : Expiratory ratio(Pvalue-0.001), chest expansion(upper: Pvalue<0.001 and lower:Pvalue-0.002) and 6MWT(Laps covered:Pvalue-0.0009080; distance covered- Pvalue:<0.001) showed significant improvements after breathing with the new breathing control device. ERV did'nt showed any significant improvement with P value-0.083. Conclusions: Breathing retraining with the new breathing control device is effective in patients with respiratory disorders. The device showed functional improvements amongst the patients but there was no physiological improvements amongst the patients.

Storage capacity of guest molecules in the cages of clathrate hydrates

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Density functional theory (DFT) based studies are carried out to understanding structure, stability and reactivity of clathrate hydrates with or without hydrogen encapsulation. All geometries of clathrate hydrate were fully optimized using B3LYP/6-31G(d)//M06-2X/6-31G(d)//B97D/6-31G(d) level of theory. We systematically explore the gas capability of five standard water cavities (512, 435663, 51262, 512 64 and 51268) in clathrate hydrate. We have select for maximum cage occupancy of the five different cages (512, 435663, 51262, 512 64 and 51268) is one, two, three, four and five guest molecules in every cages. We used as a guest molecules Ar, CH4, CO2, H2, H2S, Kr, N2, O2 and Xe respectively. The maximum and optimum cage occupancy for all five considered cages as a guest molecule in the clathrate hydrate one, one, two, three, and four for CH4, one, one, two, three, and four for CO2, one, one, two, four and five for H2, one, one, two, three, and four for O2, one for all Xe, one, one, two, three, and four for Ar, one, one, two, three, and four for H2S and one, one, two, three, and four for Kr. The efficacy of trapping of hydrogen molecules inside the cages of clathrate hydrates depends upon the cavity sizes and shapes of the clathrate hydrates. The efficacy of trapping of hydrogen molecules inside the cages of clathrate hydrates depends upon the cavity sizes and shapes of the clathrate hydrates.

References:

1. X. Cao, Y. Su, Y. Liu, J. Zhao, C. Liu. Storage capacity and vibration Frequencies of guest molecules in CH4 and CO2 hydrates by first-principles calculations J. Phys. Chem. A, 118 2014, pp. 215-222.
2. Chattaraj, P. K., Bandaru, S., Mondal, S. Hydrogen Storage in Clathrate Hydrates J. Phys. Chem. A 115, 2011, 187-193.
3. Srivastava, H. K., Sastry, G. N. Viability of Clathrate Hydrates as CO2 Capturing Agents: A Theoretical Study J. Phys. Chem. A 115, 2011, 7633-7637.
4. X. Cao, Y. Su, J. Zhao. Stability and vibrations of guest molecules in the type II clathrate hydrate: a firstprinciples study of solid phase J. Phys. Chem. A, 119 2015, 7063-7069.
5. Ramya, K. R.; Venkatnathan, A. Vibrational Raman Spectra of Hydrogen Clathrate Hydrates from Density Functional Theory J. Chem. Phys. 138, 2013, 124305.

Study of socio-economic and psychological characteristics and its relationship with extent of participation of rural youth towards farming practices in Jorhat district of Assam

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The study entitled "Study of socio-economic and psychological characteristics and its relationship with extent of participation of rural youth towards farming practices in Jorhat district of Assam" following ex-post facto research design. A total of 120 respondents were selected using multi stage purposive cum random sampling technique. The data was collected by means of personal interview schedule. The findings revealed that age,size of the operational land holding ,annual income of the family, training exposure and mass media exposure of the respondents is positively significant and highly correlated with extent of participation in farming activities. However,occupation of parents had significant association with extent of participation in farming activities. The regression coefficient of age, sources of farm machineries and farm implements and attitude towards farming were found to be significant.

Nano-biocomposite scaffolds of chitosan, carboxymethyl cellulose and silver nanoparticle modified cellulose nanowhiskers for bone tissue engineering applications

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We synthesized highly efficient nano-composite polymeric scaffolds with controllable pore size and mechanical strength and also prepared nanocomposite (CCNWs-AgNPs) of silver nanoparticles (AgNPs) decorated on carboxylated CNWs (CCNWs) which serves dual functions of providing mechanical strength and antimicrobial activity. Scaffolds containing chitosan (CS) and carboxymethyl cellulose (CMC) with varying percent of nanocomposite were fabricated using freeze drying method. XRD and FESEM analysis of nanocomposite revealed highly crystalline structure with AgNPs (5.2 nm dia) decorated on ~200 nm long CCNWs surface. FTIR analysis was performed to confirm the interaction between CCNWs and AgNPs. Incorporation of nanocomposite during scaffolds preparation helped in achieving the desirable 80-90% porosity with pore diameter ranging between 150-500 μm and mechanical strength was also significantly improved matching with the mechanical strength of cancellous bone. The swelling capacity of scaffolds decreased after the incorporation of nanocomposite. In turn, scaffold degradation rate was tuned to support angiogenesis and vascularization. Scaffolds apart from exhibiting excellent antimicrobial activity, also supported MG63 cells adhesion and proliferation. Incorporation of CCNWs also resulted in improved biomineralization for bone growth. Overall, these studies confirmed excellent properties of fabricated scaffolds, making them self-sustained and potential antimicrobial scaffolds (without any loaded drug) to overcome bone related infections like osteomyelitis.

In Silico Functional SNP Analysis and Interpretation of Human Genes Associated with Amennorhea

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Despite the advances in diagnosis and treatment, infertility is a pressing concern in today's world with the rapid growth in population (1). Genetics plays a key role in identifying the susceptibility to a disease at the gene level (2). Amenorrhea is one such infertility condition where lack or absence of menstruation leads to infertility in women. Our study aims at predicting the role of the SNPs in 13 genes (LEPR, SHBG, GNRHR, TRH, SRY, ANDR, GHR, FSHR, PRL, CRFR2, MIS, ESR1 and LSHR) being widely suspected to be involved in causing amenorrhea. NCBI and Uniprot were used as databases for information retrieval, while SIFT and PANTHER-PSEP were used for predicting the effect of mutations on protein functions, in turn deciding whether a mutation has a significant chance of causing amenorrhea or not. From our study, it was observed that the LEPR gene mutations had the least damaging effect while the SHBG gene mutations had the most.

Keywords: Infertility, Amenorrhea, PANTHER-PSEP, SIFT.

References:.

1. Naina K. and Amit K. S. Trends of male factor infertility, an important cause of infertility: A review of Literature. J Hum Reprod Sci. (2015); 8(4): 191–196.

2. Fauser, B. C. J. M.; Diedrich, K.; Bouchard, P.; Domínguez, F.; Matzuk, M.; Franks, S.; Hamamah, S.; Simón, C.; Devroey, P.; Ezcurra, D.; Howles, C. M. (2011). Contemporary genetic technologies and female reproduction. Human Reproduction Update. 17 (6): 829–847.

Bioactive silk based in vitro liver construct assisting hepatocyte clusters towards functional liver recapitulation

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Liver, a highly regenerative organ performs crucial functions and regulates physiological homeostasis of human body. Cirrhosis, an end stage liver disease perturbs the self-healing ability and physiological functions of liver. Typical treatment strategy like orthotopic liver transplantation, is often challenged by the paucity of healthy liver leading to around 50 million deaths annually, as stated by World Health Organization. Alternate approaches with functional hepatocytes loaded three-dimensional (3D) liver construct acts as a 'clinical bridge' by accomplishing hepatocyte specific functions and convalescence of damaged liver. Existing in vitro 3D liver models are limited in terms of simulating micro-environmental niche of native liver and long term functionality which confines their utility in bioartificial liver and cell based tissue engineering. The present study focuses on fabrication of a novel bioactive 3D silk scaffolds by incorporation of both mulberry (Bombyx mori, BM) and non-mulberry (Antheraea assamensis, AA) silk fibroin. Blend scaffolds owning unique amino acid sequence, hydrophobicity and crystallinity offered suitable physicochemical attributes (porosity, mechanical compliance, hemocompatibility and diffusional characteristics) to the 3D matrix. Biological investigation of developed scaffolds using human hepatocarcinoma cells (HepG2) and primary neonatal rat hepatocytes witnessed long-term functionality over 21 days in terms of attachment, morphology and functionality facilitating both cell-cell and cell-matrix interactions. Further, subcutaneous implantation of scaffolds demonstrated minimal macrophage infiltration in blend scaffolds. Our findings revealed that integral biochemical property of blend scaffolds as an exciting biomaterial environment influencing spheroidal growth with enhanced expression of hepatic markers and metabolic activities (albumin synthesis, urea synthesis and cytochrome P450 enzyme activity). Taken together, the present study provides a new 3D bio-matrix niche for supporting long-term growth of functional hepatocytes concluding its future application in bioartificial liver, drug screening and liver tissue engineering.

Keywords: Silk fibroin, primary hepatocytes, 3D scaffolds, bioartificial liver, tissue engineering
References:
1. Nishida, Y. and Taniguchi, A., 2016. A three-dimensional collagen-sponge-based culture system coated with simplified recombinant fibronectin improves the function of a hepatocyte cell line. In Vitro Cellular & Developmental Biology-Animal, 52(3), pp.271-277.
2. Xu, L., Wang, S., Sui, X., Wang, Y., Su, Y., Huang, L., Zhang, Y., Chen, Z., Chen, Q., Du, H. and Zhang, Y., 2017. Mesenchymal Stem Cell-Seeded Regenerated Silk Fibroin Complex Matrices for Liver Regeneration in an Animal Model of Acute Liver Failure. ACS Applied Materials & Interfaces, 9(17), pp.14716-14723.
3. Liu, Z., Takeuchi, M., Nakajima, M., Hu, C., Hasegawa, Y., Huang, Q. and Fukuda, T., 2017. Threedimensional hepatic lobule-like tissue constructs using cell-microcapsule technology. Acta biomaterialia, 50, pp.178-187.

Inhibition of Newcastle disease virus replication by chicken viperin

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The identification of immune pathway which protects against pathogens may lead to novel molecular therapies for both livestock and human health. Viperin is one of the interferon stimulating gene (ISG) that is highly conserved from lower vertebrates to mammals and plays an important role in protection against virus. Viperin and other ISGs orthologues are not well studied in context of virus infection in chickens. Newcastle disease virus(NDV) is the causative agent of an

Newcastle disease, which is economically important for avian species. NDV is endemic in many developing countries including India. NDV outbreaks have been reported because of the emergence of its variant strains. In the present study, we cloned the chicken Viperin(cViperin) gene from peripheral blood mononuclear cells and analyzed its modulation upon NDV infection in chicken embryo fibroblast (CEF). Overexpression of cViperin showed inhibition of NDV replication in CEF. The cViperin gene expression was down regulated the expression of NDV protein genes. Similarly, protein expression studies showed significant down regulation of NDV in presence of cViperin. The findings in the study indicated the anti-NDV effect of cViperin which could be helpful in the development of antiviral therapies against its infection.

Synthesis and characterization of fluorescent gold nanoclusters in enzyme matrix for detection of hydrogen peroxide

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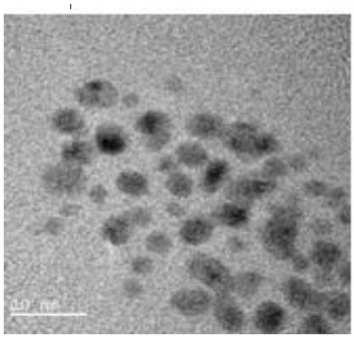
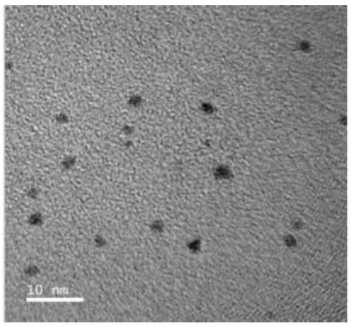
In recent years protein-encapsulated gold nanoclusters have been intensively studied due to many advantages being identified over the other gold nanocluster support systems, such as, green synthesis, biocompatibility, high water solubility and increased stability. For this work we selected industrially used enzyme and gold nanoclusters [reported to have peroxidase activity] to develop the detection system. This work is based on formation of two types of fluorescent gold nanoclusters using enzyme as stabilizer [E-Au NCs] and use them for detection of hydrogen peroxide (H2O2). Two types of gold nanoclusters having red and blue fluorescence were successfully synthesized, both of them having excitation peak (λ) ~368 nm and emission peaks (λ) ~660 nm and ~455 nm for red and blue nanoclusters respectively. The Red Fluorescent E-Au NCs had a diameter of about 2.4 nm with lattice spacing of ~0.060 nm, while the diameter of blue fluorescent E-Au NCs was around 1.5 nm with lattice spacing of ~0.051 nm. Both the clusters are reactive towards H2O2 and their fluorescence get quenched during the reaction. By calculating the proportion of fluorescence quenching of both the red and blue gold nanoclusters one can detect the concentration of H2O2.

Fig.1. (a) Red Fluorescent E-Au NCs (10nm scale), (b) Blue Fluorescent E-Au NCs (10nm scale), (c) Quenching of red nanoclusters by H2O2, (d) Quenching of blue nanoclusters by H2O2.



(a)



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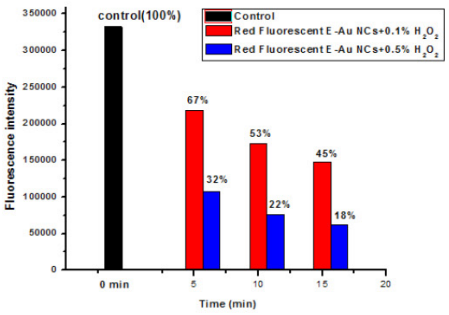
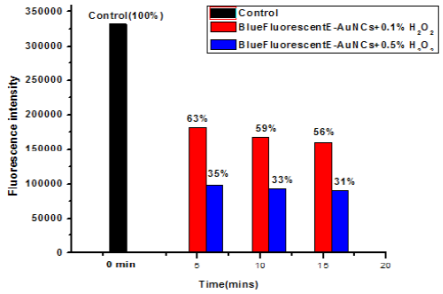


(c)



(d)

Fig.1. (a) Red Fluorescent E-Au NCs (10nm scale), (b) Blue Fluorescent E-Au NCs (10nm scale), (c) Quenching of red nanoclusters by H_2O_2, (d) Quenching of blue nanoclusters by H_2O_2.

Keywords: Fluorescent, Gold nanoclusters, Enzyme matrix, Quenching.

ALIMENTARY PASTE

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Alimentary paste is dried dough with a definite shape (such as macaroni, spaghetti, vermicelli, etc.) prepared from semolina, farina or wheat flour or a mixture of these with water or milk and with or without egg or egg yolk. These ingredients are typically added to a continuous, high capacity extruder, equipped with a variety of dies that determine the final shape of the product. The product emerging out of die are then dried and packaged for market. Based on shape and size, alimentary paste can be classified into long and short type. The long type includes linguini, vermicelli, spaghetti; the short type includes elbow shells, pipe rigate, penne, fusilli, rigatoni, etc (Krishnan & Prabhasankar, 2012). Alimentary pastes are widely known as one of the most ancient nourishments and versatile dishes, originating from Italy and Asia (Antognelli, 1980). They are easy to prepare, have versatile sensory attributes, low cost and long shelf life, making them acceptable worldwide (Gurpreet et al., 2013). They provide significant quantities of complex carbohydrates, proteins, B−vitamins and iron and are low in sodium and total fat (Douglass & Mathews, 1982). Researches have been carried out to fortify alimentary paste products with various protein sources (Gurpreet et al., 2013). In this context, supplementation of this convenience food with legumes is considered to be the best solution to overcome malnutrition, particularly in the developing countries (Madhumita & Prabhasankar, 2011).

REFERENCES

Antognelli, C. (1980). The manufacture of pasta as a food ingredient: A review. *Journal of Food Technology* **15:** 125–145.

Douglass, J. S., & Matthews, R. H. (1982). Nutrient content of pasta products, *Cereal Foods World,* **27:** 558–561.

Gurpreet, K., Savita, S., Nagi, H. P., & Ranote, P. S. (2013). Enrichment of pasta with different plant proteins. *Journal of Food Science and Technology*, **50(5):** 1000–1005

Krishnan, M., & Prabhasankar, P. (2012). Health based Pasta: Redefining the concept of the next generation convenience food, *Critical Reviews in Food science & Nutrition*, **52:** 9–20.

Madhumita, S., & Prabhasankar, P, (2011). Influence of additives on functional & nutritional quality characteristics of black gram flour incorporated pasta. *Journal of Texture Studies,* ISSN 0022–4901

Biohydrogen production

Hydrogen gas as a future fuel is very promising as a clean technology for future. With an energy yield of as high as 122 KJ/g, holds the potential to become future fuel for the globe. On combustion hydrogen it produces water as by-product which makes it clean fuel and it will contribute significantly towards the reduction of green house gas emission. With manifold increase in green house gases, the immediate need is to direct our efforts towards clean fuel through a sustainable path. Production of hydrogen via methods like auto thermal reforming, catalytic partial oxidation, thermal decomposition, gasification and pyrolysis are thermo chemical routes. Steam gasification of coal adds to the largest share of hydrogen production. The intensive use of fossil fuel to produce hydrogen though very efficient also produces other greenhouse gases like methane, carbon dioxide along with hydrogen in the process. The need of hour is to adopt a process of hydrogen production which eliminates the production of harmful gases. Presently hydrogen synthesis via biological pathway is an emerging sustainable path to walk on. Few decades ago in 1939, Hans Gaffron observed the metabolic pathway change of an green algae Chlamydomonas reinhaditi producing hydrogen, thus the term Biohydrogen came into picture. Dedicated research in this field brought multiple bioprocess technology into picture. Bio-photolysis, Photo-fermentation, Dark-fermentation and microbial electrolysis cells to name a few. Conversion efficiencies for direct bio-photolysis are below 1% and indirect bio-photolysis remains to be demonstrated. Dark fermentation of biomass or wastes presents an alternative route to biological hydrogen production that has been little studied. In this case the critical factor is the amount of hydrogen that can be produced per mole of substrate. Known pathways and experimental evidence indicates that at most 2–mol of hydrogen can be obtained from substrates such as glucose. Process economics require that means be sought to increase these yields

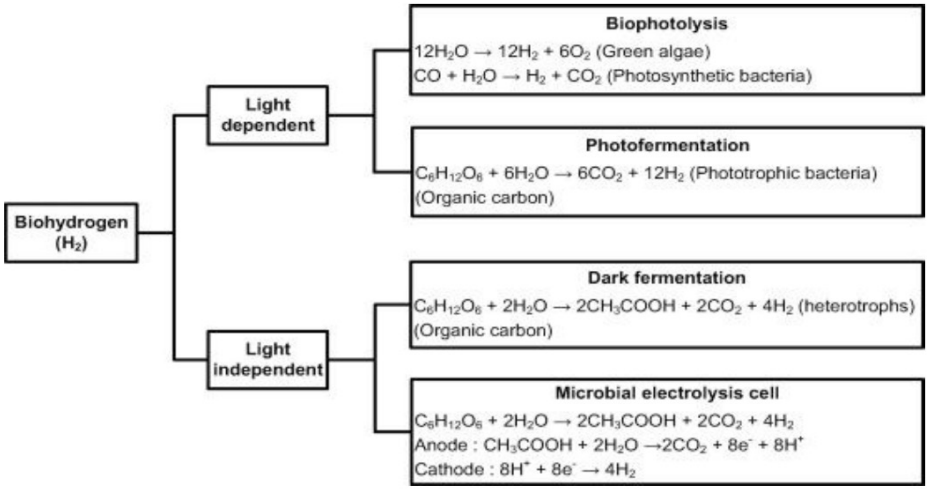

Fig 1.1. – Biological hydrogen to produce hydrogen [15]

BIOFUEL FROM ORNAMENTAL TREES: A PROMSING STEP TOWARDS ENERGY SECURITY OF OUR COUNTRY

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Demand for fuel has surpassed its production worldwide due to increasing development. This increasing demand has been primarily met by fossil fuels. Fossil fuels are exhaustible and responsible for environmental pollution. Therefore, to find an alternative source of fuel from the available resources is a need of the hour. Thus, biofuel is gaining much more importance in today's context (D. Agarwal and A.K. Agarwal, 2007). So, we can say that this increasing oil demands, depleting oil reserves and negative effects on environment have created a renewed interest in fuels from biological origin (Azam et al., 2005). Biofuels are defined as organic primary and/or secondary fuels derived from biomass which can be used for the generation of thermal energy by combustion or by other technology. In India there are about 300 oil bearing tree species that can be used as raw material for biodiesel production. The non edible oil seed plants can be grown in non fertile land and waste lands (S. N. Bobade and V. B. Khyade, 2012). Ornamental trees like Mesua ferrea, Simarouba glauca, Pongamia pinnata, Madhuca indica, Thevetia peruviana etc. bear seeds that have high percentage of oil and are potential feedstock for biodiesel production which can be grown without much care and most of them are indigenous to India. India also has the capacity to compete with countries like Brazil and the USA which are the leading producers of biofuel which will require increased plantation and technological intervention.

Keyword: Biofuel, ornamental trees

References

Agarwal, D. and Agarwal, K.A. (2007). Performance and emission characteristics of Jatropha oil (preheated and blends) in a direct compression ignition engine. Applied Thermal Engineering, 27(13):2314–2323.

Azam, M.M.; Waris, A. and Nahar, N.M. (2005). Prospects and potential of fatty acid methyl esters of some non-traditional seed oils for use as biodiesel in India. Biomass and Bioenergy :293-302.

Bobade, S.N. and Khyade, V.B. (2012). Detail study on the Properties of Pongamia pinnata (Karanja) for the production of Biofuel. Research Journal of Chemical Sciences, 2(7):16-20.

Studies on the cellular roles of Ca2+ ATPases TRM-9 and NCA-2 in Neurospora crassa

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Calcium is a ubiquitous second messenger molecule in eukaryotic cells. The free cytosolic calcium (Ca^{2+}) concentration is strictly regulated by transmembrane proteins. In Neurospora crassa, trm-9 and nca-2 encodes for Ca^{2+-} ATPases which hydrolyses ATP to catalyse Ca^{2+} efflux across biological membranes to maintain the Ca^{2+} homeostasis. The NCA-2 and TRM-9 are P-type transmembrane proteins with three main cytosolic loops, one of them being the catalytic centre. In filamentous fungi, Ca^{2+} is involved in controlling numerous physiological processes such as growth, hyphal branching, sporulation circadian clock etc. In this study, we have investigated the role of trm-9 and nca-2 in various cellular functions and their putative genetic interactions in N. crassa.

SILICA IN PLANT INSECT INTERACTION

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Silica is the oxide form of silicon. It is most abundently found in nature. Naturally it is found as quartz. Plants uptake Silicon as Silicic acid. Some plants like rice, wheat etc. uptake Silicon actively and some plants like cucumber, melon etc. uptake passively. Silicon is mostly uptaken by the plant from Gramineae and Cyperaceae families. Silicon that is uptaken by the plants is deposited in different parts of the plants as silica gel. This silica gel gives rigidity and strength to the plants. There are many roles of silica in plant which include resistance to plant diseases caused by fungi, bacteria, viruses and nematodes, resistance to herbivores ranging from phyto-phagous insects to mammals and resistance to abiotic stresses. Silica in plant- insect interaction, gives the plant resitance against insect herbivores. This resistance generated by silica is mainly based on trophic level viz. Bi-trophic interaction and Tri-trophic interaction. In Bi-trophic intraction, two trophic levels are involved. This defense may occur by two mechanisms - Physical mechanism and Bio-chemical mechanism. In physical mechanism,silica produce some mechanical barrier in the plant body due to which insect become unable to invade the plant easily. In Bio-chemical mechanism, silica induces some defensive chemicals in plants. In Tri trophic interaction natural enemies are also involved along with plants and insect-pests. Among natural enemies, entomopathogenic microorganisms become more viable when plant is treated with silica. Again, predators are attracted towards the plant after induction of defensive respons by silica and attack the pests . Though some studies have been done on silica in plant-insect interection, but it is not sufficient. Many questions are still unsolved and so there is vast scope to protect the plants by iducing different defensive mechanism by silica.

Keywords: Silica; Bitrophic interaction; Tritrophic interaction

Cloning, expression, purification and biochemical characterization of first α-L-arabinofuranosidase (PsGH43) from Pedobacter saltans

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Arabinoxylans have the backbone of β-(1→4)-linked xylose residues with the substitution of one or more L-arabinofuranosyl residues, at position 2 or 3. The α-L-arabinofuranosidase are accessory enzymes that cleave α-L-arabinofuranosidic linkages and act synergistically with other hemicellulases and pectic enzymes for the complete hydrolysis of hemicelluloses and pectins. The action of α-L-arabinofuranosidase alone or in combination with other lignocellulose degrading enzymes represents a promising biotechnological tools as alternative to some of the existing chemical technologies such as chlorination in pulp and paper industry sourdough fermentation and pretreatment of lignocelluloses for bioethanol production. In present study, the gene (1.7 kb, Genbank Acc. No. ADY53124.1) encoding α-L-arabinofuranosidase, a family 43 glycoside hydrolase (PsGH43) was cloned into pET-28a(+) vector and expressed in E. coli BL21 (DE3) cells with His-6 tag as a soluble protein. PsGH43 on purification by His GraviTrap column and analysis by SDS-PAGE the protein gave single band displaying the molecular mass approximately, 65 kDa. The optimum pH for enzyme activity was 6.5 and the optimum temperature was 50°C. The PsGH43 enzyme displayed activity against rye arabinoxylan and wheat arabinoxylan with specific activity 88.7 U/mg and 78.9 U/mg, respectively, at 50°C and pH 6.5. The K_m and V_{max} for PsGH43 were 3.02 mg/ml and 103 μmole/min/mg, respectively, with rye arabinoxylan.

Silicon: The Most Under-appreciated Element in Horticultural Crops and its role in abiotic stress tolerance

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"Abiotic stress can be defined as any external condition, apart from the activities of other organisms, that reduces the plant growth, survival and/or fecundity" (Journal of ecology, 2006). The potential yield loss due to drought is (40%) is found highest. The major abiotic stresses are drought, flood, heat stress, freezing, salinity, nutrient. The drought and salt salinity are related to Physiological Drought and accumulation of ions. To mitigate the abiotic stress in floricultural crops certain approaches are considered such as screening for tolerance, exogenous application of compounds, molecular technique in tolerance. Silicon is accumulated the soil in the form of silicic acid which forms a defence mechanism against transpiration loss by forming a hard amorphous physical barrier. After the exogenous application of silica ,the leaf concentration of silica in Petunia spp increases from 20% to 146% however there are no changes observed in Begonia spp. It was also found that cultivars within a species can vary in Si accumulating ability(Mattson and Leatherwood, 2010). It has been reported that Si may act to mitigate salt stress in plants by decreasing permeability of plasma membranes, lipid peroxidation and maintaining the membrane integrity and function. The most debatable and studied element over decades contributing to the betterment of agricultural as well as horticultural crops is silicon (Si). Soilless cultures used in horticultural plant production are devoid of this under-appreciated element (Si). It reinforces the plants and makes them tolerant to environmental stresses such as salt, drought and frost and protects them against pathogens and insects. Hence, addition of Si to the nutrient solution of plants has been an added advantage to the horticultural industr
y.

Keywords: Abiotic stress, silicic acid, floriculture crops

Reference:

Mattson, Neil S. and Leatherwood, W. Roland (2010). Potassium Silicate Drenches Increase Leaf Silicon Content and Affect Morphological Traits of Several Floriculture Crops Grown in a Peat-based Substrate. Hortscience. 45(1): 43–47.
Gonzalo, H. Villarino Pizarro and Mattson, Neil S. (2011). Assessing tolerance to sodium chloride salinity in Fourteen floriculture species. M.Sc. Thesis, Cornell University.

Jatropha oil alongwith microbial antagonists in suppressing Bacterial wilt pathogen, Ralstonia solanacearum

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Jatropha oil (Jatropha curcas) have been found to possess insecticidal, anti-bacterial and fungicidal properties. Bacterial wilt caused by Ralstonia solanacearum is one of the most serious diseases of solanaceaous crops like tomato, brinjal, chilli, etc., in Assam and other North-Eastern states causing significant yield loss. The present study was made to evaluate the enhanced efficacy of microbial bioagents by Jatropha oil leading to better suppression of R. solanacearum in vitro. The studies revealed that Jatropha oil at 3 different concentrations, viz., 5000 ppm, 10000 ppm & 50000 ppm could suppress the pathogen upto an extent of 25.3 %, 64.0 % and 66.2 % respectively. A positive interaction among Jatropha oil with five potentially effective microbial antagonists, viz., Pseudomonas fluorescens, Bacillus thuringiensis, Beauvaria bassiana, Metarhizium anisolpliae and Trichoderma viride was recorded. Amongst these, T. viride showed highest compatible interaction followed by P. fluorescens, B. thuringiensis, B. bassiana and M. anisopliae respectively. Thus, the prospect of combined application of jatropha oil and such microbial antagonists seems to have a bright prospect for management of bacterial wilt caused by R. solanacearum in solanaceaous crops like tomato, brinjal and chilli in this region. Further study can be made to evaluate the combined efficacy of different plant oils and microbial antagonists for managing such destructive diseases of plants.

Key words : bacterial wilt, compatibility, Jatropha oil, microbial antagonists, Ralstonia solanacearum,

Immuno-informed Islet-encapsulating Silk Scaffold Mediates M2 Macrophage Polarization and Enhances Insulin Production

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Islet transplantation is considered the most promising treatment for Type 1 diabetes. However, the clinical success is limited due to the islet dysfunction during long-term culture and post-transplantation. Also, transplant-associated inflammatory responses create an unfavourable microenvironment for islet survival. The current study delineates the development of cell-encapsulating immunomodulatory 3D silk scaffolds as bioartificial pancreas (BAP) systems for sustained insulin release. Insulin producing cells were encapsulated inside the silk scaffolds with either alginate or agarose for immunoisolation to augment islet survival and function. The scaffolds were extensively characterized for pore architecture, porosity, swelling index, water uptake, and density. Further, suitability of these scaffolds was assessed through diverse in vitro tests, including cell adherence, viability, proliferation, 3D spheroid like pancreatic structures development, glucose stimulated insulin secretion, and macrophage polarization. Rat insulinoma (RIN-5) cells were metabolically active and remained viable for a prolonged period within the macroencapsulates and proliferated up to 2.5-fold over 5 week's culture. Cultured RIN-5 cells formed 3D islet-like spheroids spontaneously as evident from live/dead assay. Primary islets maintained their function (glucose sensitivity) in macroencapsulates with enhanced glucose stimulation index when compared to non-encapsulated islets, 1.2 vs 1.7. RT-qPCR with islet functional genes (insulin I, insulin II, glucagon and somatostatin) and immunohistochemistry (insulin and glucagon) results supported the results obtained from glucose challenge assay. Controlled release profiles of antiinflammatory cytokine interleukine-4 (IL-4) and dexamethasone evinced their prospective application in reducing local foreign body response and immunosuppression. Released IL-4 was biologically active and polarized M0 macrophages to the M2 phenotype. Significant upregulation in CD206 and CD209 surface marker with downregulated CCR7 (inflammatory marker) expression advocate the immunosuppressive function, without affecting normal physiology of the rat islets. Reduced inflammatory responses illustrated the biocompatibility of these scaffolds. In conclusion, this novel biomaterial system was successfully used to encapsulate insulin-producing cells with enhanced cell functions. Further development of the system may have potential BAP applications.

Keywords: Silk; Type 1 Diabetes; Islet macroencapsulation; Bio-artificial pancreas; Immunomodulation
References:
1. Davis NE et al., Biomaterials, 2012; 33: 6691-6697.
2. Mandal BB et al., Biomaterials, 2009; 30: 5170-5177.
3. Kumar M et al., ACS Applied Materials & Interfaces, 2016; 8:29310-29322.

Development of Bio-intensive module against Late Blight of Potato incited by Phytophthora infestans (Mont.) de Bary

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Late blight of potato is one of the major biotic constraints causing reduction in yield and quality of the potato crop in North-East India. The disease is managed through application of multiple toxic chemical sprays affecting both human health and environment. Now a days, methods of biological control are gaining importance as these are nontoxic and also environment friendly. A field experiment was carried out in ICR (Instructional Cum Research) Farm, Assam Agricultural University, Jorhat to evaluate the comparative efficacy of six different forms of organic treatments comprising of three copper fungicides viz., copper sulphate, copper oxy-chloride, copper hydroxide and three bio-formulations viz., Bioveer, Biotime and Biogreen-5 against late blight of potato incited by Phytophthora infestans (Mont.) de Bary under the same spray schedule (one prophylactic spray at canopy closure followed by two more sprays after appearance of late blight) with a view to select the most effective treatments for bio-intensive management of the disease. Field experiment performed during 2015-16 revealed that all the treatments could control late blight to a varying extent. Among the treatments, copper hydroxide proved to be the best in reducing the attack of late blight. This treatment not only gave highest tuber yield (4.75 t/ha) with a corresponding minimum (10.87%) tuber infection but also provided highest protection (22.78%) against late blight. Moreover this treatment also provided maximum net return of Rs. 43,818.00 along with a corresponding incremental benefit-cost ratio of 4.64:1.

Keywords: Phytophthora infestans, Potato Late Blight, Bio-formulations

In Vitro Models to Study Mechanisms and Circumvention Approaches to Radioresistant Pancreatic Cancer Cells

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Research Idea: Radiotherapy has been widely used for the pancreatic cancer (PC) treatment. Despite numerous efforts in the cure of pancreatic cancer in the last decade the overall survival rate (< 5 years) has not significantly improved. The poor success in the management of pancreatic cancer is due to frequent late diagnosis of pancreatic cancer, scarcity of effective therapeutic agents and most significantly the frequent occurrence of chemo and radioresistance in pancreatic cancer. The main purpose of the research project is to develop and characterize radioresistant human pancreatic cancer cell lines, to identify genes which are differentially expressed (mRNAs and miRNAs) and proteins which play key roles in conferring the radioresistance behavior in pancreatic cancer radiotherapy. The human pancreatic cancer cells Panc1, BxPc-3, Pk-1 and MiaPiaCa2 will be treated with fractionated irradiation to establish radioresistant pancreatic cancer cells. The microarray and proteomics analysis followed by bioinformatics data processing will be employed to identify the key genes and their related functions in the complex mechanisms of radioresistance which will provide new insights into the development of potential strategies to overcome the radioresistance. The in vitro and in vivo functional analysis of identified genes will help to develop selective targeted treatments in combination with radiotherapy and to find novel combinations of existing chemotherapeutic agents with radiotherapy in treatment to prolong the survival rate in patients diagnosed with pancreatic cancer. The research project will also include concurrent in vitro chemoradiation treatment to investigate novel combinations of chemotherapeutic agents (Chk inhibitor, Akt inhibitors and gemcitabine) with radiotherapy which may radiosensitize the pancreatic cancer cell lines.

Key words: Pancreatic cancer, radioresistance, proteomics, gene expression analysis.

Uptake and intracellular fate of nona-arginine cell penetrating peptide in yeast

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Cell-penetrating peptides (CPPs) comprise a group of peptides of about 8 to 30 amino acids in length that can be efficiently taken up by cells and mediate the uptake of the conjugated cargo (Milletti, 2012). Different mechanisms of cellular uptake of CPPs depending on their nature, concentration and experimental conditions have been proposed in literature (Madani et al., 2011). However the two most common uptake mechanisms are direct entry/energy-independent pathway and various endocytosis mechanisms (Madani et al., 2011).
In this study we analyzed the uptake of nona-arginine CPP in Saccharomyces cerevisiae cells using two methods: fluorescence microscopy and flow cytometry. The effect of different conditions like pH, temperature, and peptide concentration was studied. In addition to this we also report the subcellular localization of the peptide after internalization. Furthermore we investigated the influence of endoosmolytic agents and endocytic inhibitors on the entry of the peptide into the cell. Our results suggest that the efficiency of internalization of the peptide in yeast depends on conditions like pH, temperature and media compositions. However, no significant alteration in fluorescence intensity after a particular time point also suggests a probable saturation point for the entry of the peptide. These findings will enable us to understand in detail the mechanism of entry of arginine CPP in yeast cells which can be used as a promising tool for several cell biology related studies.

REFERENCES

Madani, F., S. Lindberg, Ü. Langel, S. Futaki, and A. Gräslund. 2011. Mechanisms of cellular uptake of cell-penetrating peptides. Journal of Biophysics. 2011:414729.
Milletti, F. 2012. Cell-penetrating peptides: classes, origin, and current landscape. Drug discovery today. 17:850-860.

Bioactive silk based in vitro liver construct assisting hepatocyte clusters towards functional liver recapitulation

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Liver, a highly regenerative organ performs crucial functions and regulates physiological homeostasis of human body. Cirrhosis, an end stage liver disease perturbs the self-healing ability and physiological functions of liver. Typical treatment strategy like orthotopic liver transplantation, is often challenged by the paucity of healthy liver leading to around 50 million deaths annually, as stated by World Health Organization. Alternate approaches with functional hepatocytes loaded three-dimensional (3D) liver construct acts as a 'clinical bridge' by accomplishing hepatocyte specific functions and convalescence of damaged liver. Existing in vitro 3D liver models are limited in terms of simulating micro-environmental niche of native liver and long term functionality which confines their utility in bioartificial liver and cell based tissue engineering. The present study focuses on fabrication of a novel bioactive 3D silk scaffolds by incorporation of both mulberry (Bombyx mori, BM) and non-mulberry (Antheraea assamensis, AA) silk fibroin. Blend scaffolds owning unique amino acid sequence, hydrophobicity and crystallinity offered suitable physicochemical attributes (porosity, mechanical compliance, hemocompatibility and diffusional characteristics) to the 3D matrix. Biological investigation of developed scaffolds using human hepatocarcinoma cells (HepG2) and primary neonatal rat hepatocytes witnessed long-term functionality over 21 days in terms of attachment, morphology and functionality facilitating both cell-cell and cell-matrix interactions. Further, subcutaneous implantation of scaffolds demonstrated minimal macrophage infiltration in blend scaffolds. Our findings revealed that integral biochemical property of blend scaffolds as an exciting biomaterial environment influencing spheroidal growth with enhanced expression of hepatic markers and metabolic activities (albumin

synthesis, urea synthesis and cytochrome P450 enzyme activity). Taken together, the present study provides a new 3D biomatrix niche for supporting long-term growth of functional hepatocytes concluding its future application in bioartificial liver, drug screening and liver tissue engineering.

Keywords: Silk fibroin, primary hepatocytes, 3D scaffolds, bioartificial liver, tissue engineering

References:

1. Nishida, Y. and Taniguchi, A., 2016. A three-dimensional collagen-sponge-based culture system coated with simplified recombinant fibronectin improves the function of a hepatocyte cell line. In Vitro Cellular & Developmental Biology-Animal, 52(3), pp.271-277.
2. Xu, L., Wang, S., Sui, X., Wang, Y., Su, Y., Huang, L., Zhang, Y., Chen, Z., Chen, Q., Du, H. and Zhang, Y., 2017. Mesenchymal Stem Cell-Seeded Regenerated Silk Fibroin Complex Matrices for Liver Regeneration in an Animal Model of Acute Liver Failure. ACS Applied Materials & Interfaces, 9(17), pp.14716-14723.
3. Liu, Z., Takeuchi, M., Nakajima, M., Hu, C., Hasegawa, Y., Huang, Q. and Fukuda, T., 2017. Threedimensional hepatic lobule-like tissue constructs using cell-microcapsule technology. Acta biomaterialia, 50, pp.178-187.
Milletti, F. 2012. Cell-penetrating peptides: classes, origin, and current landscape. Drug discovery today. 17:850-860.

Understanding the role of PLC-δ, sPLA2 and CPE-1 in regulating various cellular processes in Neurospora crassa

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In eukaryotes, a minute change in the intracellular calcium concentration is detected by various calcium sensor proteins. The calcium signaling proteins play multiple roles in fungi including cell survival, DNA repair, growth, pathogenesis, and sexual development. The Neurospora crassa is an excellent model organism to study calcium signaling proteins and their cellular roles. N. crassa calcium (Ca^{2+})-signaling system is unique and differs significantly from those in plants and animals, especially, in relation to the secondary messenger involved in Ca^{2+} release from the internal stores. The complex Ca^{2+} signaling machinery of N. crassa consists of 48 Ca^{2+} signaling proteins including four novel phospholipase C-δ subtype proteins PLC-δ, a $Ca^{2+}$and/or CaM binding protein sPLA2 and a Ca^{2+}/H^{+} exchanger CPE-1. In this study, we have shown the various cellular roles of these proteins and the signal transduction pathways regulated by the genetic interactions of PLC-δ, sPLA2 and CPE-1 in N. crassa.

Satellite Farming with special reference to India

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Satellite Farming is defined as an information and technology based farm management system to identify, analyze and manage variability within fields for optimum profitability, sustainability and protection of the land resource. It is also known as Precision Agriculture (PA) or Site Specific Crop Management (SSCM). The goal of precision agriculture research is to define a decision support system (DSS) for whole farm management with the goal of optimizing returns on inputs while preserving resources. Precision agriculture highlights the increased efficiency that can be realized by understanding and dealing with the natural variability found within a field. The goal is not to obtain the same yield everywhere, but rather to manage and distribute inputs on a site specific basis to maximize long term cost/benefit, input costs and decreasing commodity prices, the farmers are looking for new ways to increase efficiency and cut costs (Ram et.al,2014). "Green revolution" led to increased productivity of existing land by increasing number of crops or improving the input utilization like fertilizer, herbicides, pesticides and water. But it also yielded several negative ecological consequences such as decline in soil fertility, soil salinization, soil erosion, deterioration of environment, health hazards, degradation of biodiversity and poor sustainability of agriculture. Since the sustainable agriculture in the context of development efforts has to meet production efficiency, sensitivity to ecosystems, appropriate technology, maintenance of the environment, cultural diversity and satisfaction of the basic needs. Hence, modern agricultural management practices are changing from assuming homogenous fields to attempting to address field variability by dividing the field into smaller zones and managing these zones separately (Frazier et.al,1997). Satellite farming is one of the most scientific and modern approaches to sustainable agriculture that has gained momentum in 21st century. The concept of precision agriculture first emerged in the United States in the early 1980s. The various components of satellite farming are-i) Computers ii) Remote sensing iii) Geographic information system (GIS) iv) Differential global positioning system (DGPS) v) Variable rate applicator.(Clark et.al,1996) There are many obstacles to adoption of precision farming in developing countries in general and India in particular like i) Culture and perceptions of the users ii) small farm size iii) lack of success stories iv) heterogeneity of cropping systems and market imperfections v) land ownership, infrastructure and institutional constraints vi) lack of local technical expertise Knowledge and technical gaps vii) data availability, quality and costs. Despite the many obstacles listed here, business opportunities for precision farming technologies including GIS, GPS, RS and yield monitor systems are immense. Punjab and Haryana states in India, where farm mechanization is more common than in others, may be the first to adopt satellite farming on a large scale.(Srinivasan,2001) It is believed that progressive Indian farmers, with guidance from the public and private sectors, and agricultural associations, will adopt it in a limited scale as the technology shows potential for raising yields and economic returns on fields with significant variability, and for minimizing environmental degradation. It must be remembered that not all elements of precision farming are relevant for each and every farm. For instance, introduction of variable rate applicators is not always necessary or the most appropriate level of spatial management in Indian farms. Likewise, not all farms are suitable to implement precision farming. The adoption of precision farming also depends on product reliability, the support provided by manufacturers and the ability to show the benefits. Effective coordination among the public and private sectors and growers is, therefore, essential for implementing new strategies to achieve fruitful success.

REFERENCES :

Clark, R.L. and McGucken, R.L. (1996). Variable rate application technology: An overview. In "Proceeding of the third international conference on precision agriculture, MN, June 1996" (P.C. Robert., R.H. Rust and W.E. Larson, Eds.). ASA Miscellaneous publication, pp. 855-862, CSSA and SSSA, Madison, WI., pp.23-26.

Frazier, B.N., Walters, C.S. and Perry, E.M. (1997). Role of remote sensing in site- specific management. In "The state of site-specific management for agriculture". ASA Miscellaneous publications, pp. 149-160.

Ram, T., Lahan, S.K., Singh, R., and Singh, P., Precision Farming-A new approach, (2014) Daya Publishing House. pp: 1-12

Srinivasan. (2001), Precision farming in Asia: Progress and prospects, Geospatial Analysis Center, Regional Science Institute, Hokkaido, Japan.

Enhancing the water use efficiency through alternate wetting and drying technology in rice

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With increasing demand for rice all over the world and decreasing availability of water resources, there is a need to manage water use in crops and increase water use efficiency. Moreover, irrigation has gained importance in Assam in view of weather extremities like flood and drought, frequently occurring as a result of climate changes. A field experiment was conducted in the Instructional-cum-Research (ICR) Farm of Assam Agricultural University, Jorhat during the Ahu season of 2016, to study the impact of alternate wetting and drying irrigation technology in transplanted autumn rice. The experiment was laid out in randomized block design (RBD) and replicated thrice. The rice variety used was 'Dishang'. The treatments consisted of eight irrigation regimes: Irrigation at 5 cm, 10 cm, 15 cm, 20 cm, 25 cm, 30 cm depletion of water from soil surface, irrigation at 3 days after disappearance of ponded water and continuous flooding. Experimental findings revealed that the highest field water use efficiency (23.4 kg/ha-cm) was recorded by irrigation at 15 cm depletion of water from soil surface. Similarly, this treatment also recorded the highest crop water use efficiency (151.2 kg/ha-cm). This was due to the adequate use of irrigation water under alternate wetting and drying where water was applied as and when required unlike farmers' practice of continuous flooding, where increased evaporation resulted in highest consumptive use of water (221.6 cm) due to continuous submergence. Likewise, irrigation at 15 cm depletion of water from soil surface also gave the highest yield in terms of grain (4.28 t/ha) and straw (6.28 t/ha).

In situ Instituting Silk Hydrogels for Drug Delivery and Tissue Regeneration

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The approach of partial mastectomy followed by local chemotherapy is a common curative strategy for long term breast cancer management. Clinical efficacy of mastectomy is still limited due to side-effects of systemic drug administration, use of harmful cross-linkers in drug delivery vehicles and expensive implantable materials. In the present study, we fabricated an RGD enriched silk (Antheraea assamensis) based 3D in vitro breast metastasis model to mimic lumpectomy conditions. Cytocompatibility assays revealed enhanced cell attachment and growth of MDA-MB 231 cells onto the mechanically robust and porous scaffolds. Further, a novel minimally invasive injectable anti-cancer drug loaded silk fibroin hydrogel was employed to target the cancer cells grew 3D in vitro. Through physicochemical characterization assessment, it was confirmed that the hydrogels would beneficially allow the slow and sustained release of drug at targeted site. The cytotoxic effect of the released drug was further appraised through gene and protein marker analysis. Additionally, the regenerative potential of hydrogels was further confirmed through replenishing the lump cavity using ADSCs.

Keywords: Silk, Hydrogels, 3D breast model, Targeted drug delivery, Sustained release

In silico and CD based structural characterization of endo-β-1,3-glucanase (CtLam81) of family 81 glycoside hydrolase from Clostridium thermocellum

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Family 81 glycoside hydrolases (GH) are known for their endo-β-1,3-glucanase activity and are widely distributed in plants, yeast, fungi, bacteria, archaea and viruses. The sequence of CtLam81 (GenBank accession number: ABN51485.1) was

accessed from CAZY data base. The PsiPred analysis for secondary structure prediction of CtLam81 showed the presence of α-helices (23.10%), β-strands (23.24%) and random coils (53.66%), which was also confirmed by Circular Dichroism analysis. The 3D model structure of CtLam81 was generated by using the Swiss-Model server and this modelled structure was energy minimized by Swiss-PDB viewer. Quality assessment of energy minimized structure by Ramachandran plot displayed 94% residues in favoured region, 4.6% in allowed region and 1.6% in outlier region. The modelled structure of CtLam81 consists of an N-terminal β-sandwich domain, a C-terminal (α/α)6 domain and an additional domain between them. Superposition of CtLam81 model structure with its closest homologue BH0236 (PDB ID: 5t4a) from Bacillus halodurans indicated that Asp415 acts as a catalytic acid while, Glu515 acts as a catalytic base. Multiple sequence alignment showed that these catalytic residues are conserved within the family 81 glycoside hydrolase. The binding interaction study of laminaripentose with CtLam81 showed that Tyr363, Lys 367, Tyr430, Asn437, Asn513, Glu519, Trp588 and Trp589 create the binding site pocket around the catalytic residues.
The 2151 bp gene encoding the CtLam81A protein (Gen Bank Accession No: ABN51895.1) was already amplified, cloned and expressed (1).
1. krishan et al. Novel insights into the degradation of β-1,3-glucans by the cellulosome of Clostridium thermocellum revealed by structure and function studies of a family 81 glycoside hydrolase (submitted-).

Multi channel tarnish resistant surface plasmon resonance (SPR) biosensor for biosensing applications

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Over the years surface plasmon resonance based biosensors have been widely used because of real time and label free detection of biomolecular interaction. This work presents a tarnish resistant surface plasmon resonance biosensor enabling multiple detection of biological analytes. Silver, which is usually the most preferred choice for the metal surface in SPR based biosensors faces the problem of tarnishing when it comes in contact with air, degrading its sensing properties. Therefore the goal of the paper is to design a tarnish resistant biosensor surface such that the lifetime of the biosensor is improved. Further the work aims to immobilize an array of antibodies on the biosensor surface in order to achieve multiple detection of analytes. Proteins for example avidin, calmodulin, lysozyme and BSA can be detected separately by making microfluidics channel using PDMS. The biosensor will be optimized by immobilizing different concentration of various antibodies on the biosensor surface for different incubation time and the SPR response will be analysed.

REFERENCE

1. Homola J; Surface Plasmon resonance sensors for detection of chemical and biological species. Chemical reviews 2008 Feb 13;108(2):462-93
2. Jordan Louis, Grenell L.H., Herschman H.K; Tarnish Resisting Silver Alloys; United States Government Printing Office, Washington; 1927
3. Abdulhalim I, Zourob M, Lakhtakia A. Overview of Optical Biosensing Techniques. In Marks RS, Lowe CR, Cullen DC, Weetall HH, Karube I (ed): Handbook of Biosensors and Biochips. Wiley, Weinheim 2007. 4. Federica Rusmini, Zhiyuan Zhong,*,† and Jan Feijen*Protein Immobilization Strategies for Protein BiochipsDepartment of Polymer Chemistry and Biomaterials (PBM), Institute for Biomedical Technology (BMTI), Faculty of Science and Technology, University of Twente, Enschede, 7500 AE, The Netherlands Received December 19, 2006; Revised Manuscript Received February 21, 2007 5. Nicholas G. WelchJudith A. Scoble and Benjamin W. MuirPaul J. Pigram , Orientation and characterization of immobilized antibodies for improved immunoassays (Review),Published by the American Vacuum Society Citation: Biointerphases 12, 02D301 (2017); doi: 10.1116/1.4978435

Efficiency Of New Visual Biofeed Back Device – Synchronized Breathing Trainer – For Training Breathing Control

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AIM:To devise an instrument to help train breathing control.

Objectives: Designing a new device to evaluate the efficacy of the device in lung functions and physical performance for patients with respiratory problems and to construct reliability for the device.

Design: Experimental study , cross-sectional design with constructional validity.

Setting: Dr. D.Y.Patil Vidyapeeth Pimpri, Pune.

Participants: Patients with obstructive and restrictive respiratory conditions.

Intervention: Patients were selected through purposive sampling. Patients were selected based upon the set inclusion and exclusion criteria of the study. Patients were first of all screened using their medical reports(PFT reports) and lab investigations showing that he/she have respiratory disorders. A double blinded study was adopted for the study. Pre and Post assessments were taken for each of the 30 subjects. Respiratory rate, Inspiratory:Expiratory ratio , chest expansion(upper and lower), 6 minute walk test(laps and distance covered) and ERV was assessed pre and post training with the new breathing control device. Breathing retraining was given for each patient for 15-20 minutes. Thus the individual synchronized his breathing cycle with the visual clues of the instrument and thus corrected his/her incorrect breathing cycle. Thus the individual was trained for the correct breathing.

Results: Respiratory rate(Pvalue<0.001), Inspiratory : Expiratory ratio(Pvalue-0.001), chest expansion(upper: Pvalue<0.001 and lower:Pvalue-0.002) and 6MWT(Laps covered:Pvalue-0.0009080; distance covered- Pvalue:<0.001) showed significant improvements after breathing with the new breathing control device. ERV did'nt showed any significant improvement with P value-0.083. Conclusions: Breathing retraining with the new breathing control device is effective in patients with respiratory disorders. The device showed functional improvements amongst the patients but there was no physiological improvements amongst the patients.

Key Words: Obstructive and Restrictive respiratory conditions, Breathing retraining, Lung functions.

Abstracts (Poster)

Chemical

Ionic Oxygen Sensor Devices: Gas sensors

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The search for oxide materials with high oxygen ion conductivity has attracted much attention owing to both technological application(eg:fuel cell,oxygen separarion membrane) and the fundamental interest of high ionic mobility in inorganic solids. When a solid conductor is connected to a source, suppose in a Cu conductor Kernels releases the last electron due to low ionization energy(IE).As a result sea of electrons are formed. Those free electrons occupy each void between the Kernels and diffuse either through solution or conduction plate from cathode to anode. Focusing on oxygen ion conductivity, current flow occurs by the movement of oxide ions through the crystal lattice .This movement is a result of thermally activated hopping of the oxygen ions moving from crystal lattice side to crystal lattice side with a super imposed drift in the direction of electric field. The ionic conductivity is consequently strongly temperature dependent, but at high temperatures 1S/cm comparable to ionic conductivity found in liquid electrolytes.Fig.1 shows a schematic outline of a fuel cell such as sofc&sensors can be implemented including planar, tubular or some hybrid of the two each design has its inherent merits and choice of geometry depends upon the device and its operating regime. The thin ceramic layers can be self supporting but very thin layers interest for low temperature must be supported in somewhere, device design must be complex and it must be stress that the choice of composition for this multi layer ceramic must be taken into account of chemical compatibility and durability in addition to need for high ionic conductivity. Semiconductor gas sensors(O2 sensors) utilize porous polycrystalline resistors made of semiconducting oxides. The working principle involves the receptor function played by the surface of each oxide grain and the transducer function played by each grain boundary. In addition, the utility factor of the sensing body also takes part in determining the gas response. Therefore, the concepts of sensor design are determined by considering each of these three key factors. The requirements are selection of a base oxide with high mobility of conduction electrons and satisfactory stability (transducer function), selection of a foreign receptor which enhances surface reactions or adsorption of target gas (receptor function), and fabrication of a highly porous, thin sensing body (utility factor). Recent progress in sensor design based on these factors is described.

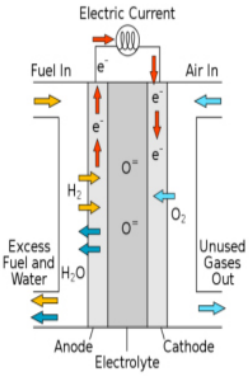

Fig1:diagram of sofc.

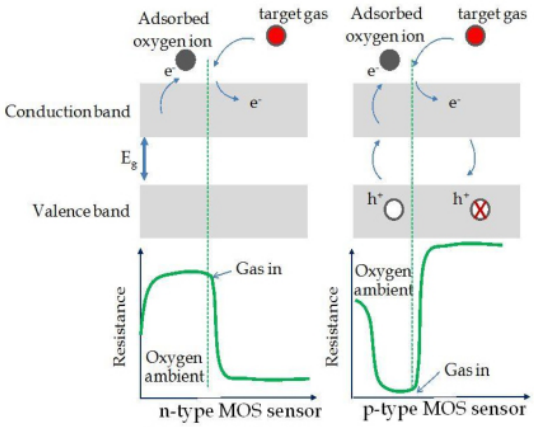

Fig1:Schematic diagram of gas sensor

Characterization of crude oil for enhanced oil Recovery: study with anionic surfactant

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Chemical enhanced recovery technique is used where thermal recovery is not feasible. It reduces the interfacial tension by forming microemulsion. In this paper characterization of crude oil in terms of chemical bonds present is investigated by Fourier transform infrared spectroscopy (FTIR). The peaks at different wave number shows saturated groups such as nalkane –CH, -CH2, -CH3 and short chain of n-alkane C-C bond present in the oil samples. Since the crudes are collected from anionic reservoir, therefore Sodium Dodecyl Sulfate (SDS) of 0.4% Critical micelle concentration is suitable. It has been seen that the particle size is increased in case of surfactant solution with oil compared to without oil indicating entrapment of oil components inside the surfactant micelle. The larger absorptions of SDS from UV Spectroscopy are caused by electrons moving between π and π^* orbitals due to the presence of more unsaturated groups in the solution.
Keywords: Enhanced Oil Recovery, FTIR, SDS, UV Visible spectroscopy, Absorption, Critical micelle concentration, interfacial tension.

Reference:

1. Chatzis, I., Morrows, N. R., (1989) "Correlation of capillary number relationship for sandstone". SPE Journal, Vol 29, pp 555-562

2. Singh S., Saha B., Sinha S.S. and Pal S.K., (2012) "Construction of a low- cost laser-based multiplexed spectrometer: a potential probe for environmental pollution monitoring" Int. J. Environment and Waste Management, Vol. 9, PP 388-395.

3. Katepalli H., (2014), "Formation and stability of emulsions: Effect of surfactantparticle interactions and particle shape" Open Access Dissertations University of Rhode Island.

4. Arzensek D., Podgornik R., Kuzman D., "Dynamic light scattering and application to proteins in solutions" presented in seminar at University of Ljubljana, May ,2010

5. Puerto, M., Hirasaki, G., Miller, C., and Barnes, J. (2010) "Surfactant Systems for EOR in High-Temperature, High-Salinity Environment" presented at SPE Improved Oil Recovery Symposium held in Tulsa Oklahoma, pp 1-9.

6. Erle, C., George, V., and Yen, F. (1985) Enhanced oil recovery, Fundamental and analyses, 8th edition, Elsevier science publishing company inc., pp 47-71.

7. Kumar, R., Dao, E., and Mohanty, K. (2010) "Emulsion Flooding of Heavy Oil" presented at SPE Improved Oil Recovery Symposium held in Tulsa Oklahoma, pp 1-13.

8. Stuart, B. (2004) Infrared Spectroscopy: Fundamentals and Applications, 7th edition, John Wiley & Sons, Ltd, pp 71-93.

9. Zetasizer Nano User Manual, Malvern Instruments Ltd., (2013), Enigma Business Park, Grovewood Road, Malvern UK

10. Smith B.C. (2011)Fundamentals of Fourier Infrared Spectroscopy. 2nd ed. CRC Press, Taylor & Francis Group; Boca Raton, FL, USA.

11. Griffiths, P.R., Haseth J.A.(2007) Fourier Transform Infrared Spectrometry. 2nd ed. John Wiley & Sons, Inc.; New York, NY, USA.

Aerobic biodegradation study of PLA based biocomposites under composting conditions

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The use of plastic products leads to problems associated with landfills and littering during improper waste disposal. On the other hand, biodegradable plastics which are commonly available on the shelf in western countries have significant potential to replace the conventional petroleum-based plastics with inherent composting characteristics after its service life. These plastics mainly include polylactide [PLA], polycaprolactone [PCL], polyhydroxybuterate [PHB], etc. This study demonstrates the biodegradation behavior of melt extruded (15-18 cm wide) PLA based biocomposites film under composting condition by monitoring online CO2 evolution using gas chromatography. The aerobic biodegradation under controlled composting conditions is monitored according to ASTM standard. Aerobic composting tests were conducted under laboratory conditions at 58 ± 2 °C and 60% RH. PLA/Chitosan samples evolved 70% of CO2 during first 100 days, followed by NPLA, PLA/CNC-SO4 (~1%) and PLA/Gum Arabic 5% in ascending the number of days. Further, PLA/Chitosan 5% biodegraded ~97% in 113 days, which is followed by NPLA> PLA/CNC-(SO4) (~1%) > PLA/Gum Arabic 5% taking 136, 138 and 146 days, respectively as shown in figure 1. Further, in the case of NPLA, 94.2 % biodegradation is observed in 136 days, whereas, 88.3% biodegradation is observed in 138 days for PLA/CNC and 80.5% biodegradation for PLA/Gum based bionanocomposites films. PLA chitosan biocomposite is showing higher degradation which indicates that the enhancement of degradation may be due to the presence of readily degradable organic biomass consisting of more nitrogen source for the microbes to assimilate. Some of the samples were observed for morphological changes under Field Emission Scanning Electron Microscope (FESEM). Results showed that due to biodegradation samples got disintegrated under composting condition, which confirms molecular chain scission of the biopolymers, which facilitates microbial assimilation. Molecular weight of PLA/Chitosan sample decreased from 109 kda to 49 kda over the time of biodegradation, and this kind of behaviour was also observed for all the test samples. From GPC analysis, reduction in Mn or molecular weight confirms biodegradation. Figure 2 shows molecular weight kinetics data. These results also confirms biodegradation due to chain scission of the biopolymers. It was observed that colony formation in the test samples incubated at 55 ^{0}C for 72 h further confirms that degradation in molecular weight was due to microbial presence.

Keywords: Biodegradation, poly(lactic acid) (PLA), biocomposites, composting, assimilation

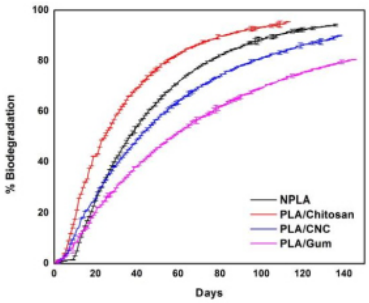

Figure 1: Percentage biodegradation of the test samples under aerobic composting condition (the bar is standard error).

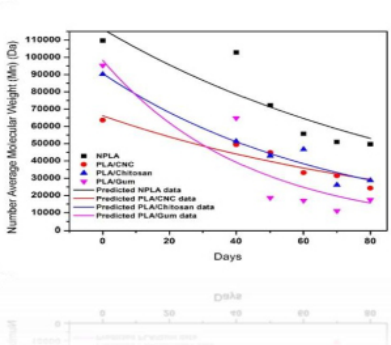

Figure 2: Molecular weight analysis of the test samples and their predicted data according to the first order reaction $M\_(w,t)=M\_(w,0).e^{\wedge}(-ut)$ where M(w,t) and M(w,0) (Dalton) are final and initial number average MW at time t, and t = 0, respectively. Parameter u (day^{-1}) is the rate constant.

Magnetic-tea waste composite as nano-catalyst for pollutant degradation

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The objective of this study is to investigate As (III) removal using nano-catalyst which is economical, as well as easy to synthesize. In the present study, tea waste (which generates lots of biomass waste) was magnetized through a facile nano-synthesis method of chemical co-precipitation. The product TW-Fe_3O_4 is in-corporated with ultrasound cavitation method to degrade As (III). Here it can be mentioned that to date there is no reported study on the Tea waste-Fe_3O_4 composite assisted oxidation of As (III) using the sonochemical method.

The synthesized nano-particles were characterized using BET, SEM, TEM, VSM etc. The composite was found to be highly magnetized with a value of around 58.1 emu/g. As (III) was also found to be successfully removed using ultrasound and TW-Fe_3O_4.

Fig. Lipton green tea packet, ground green tea and green tea inside the pouch before grinding.

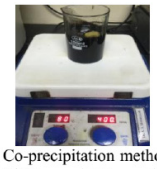
Fig. Co-precipitation method of preparing iron based nanoparticles with green tea.

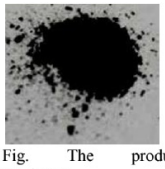
Fig. The product, TW/Fe_3O_4.

Synthesis of hydrogel for agriculture application using cellulose nanoparticle

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Hydrogel is a macromolecular cross-linking network in polymeric monomer. Hydrogel are absorb and retain water and also reversible manner.The cellulose based hydrogel sources are largely avilable in nature and its biodegradeble , biocompatible. Cellulose nanoparticle are large surface area and good mechanical strength which are uniform distributed in large area in hydrogel and improve hydrogel property. Cellulose are large amount of natural resources such as cotton, rice starw, wood chip, banana stem .Hydrogel are used in differents field of application, In agriculture area, hydrogel are increase water holding capacity of soil . Agriculture field (muddy & desert) hydrogel are applied than holding capacity of water are increase upto 300 times. when the cultivation is watered by either irrigation & rain, the hydrogel absorbs retain the water and avoid loss of drainage & evaporation method water loss. After the time when root need water in dry period that time hydrogel release water as per needed. On other profit used of hydrogel in agriculture field, mixing of soil & hydrogel make a granule which increase soil porosity & provide good oxidation in plant root. cellulose based hydrogel are very strong capable of water holding capacity. In further investigation has been done to determine the water retention property of soil and effect on the growth of plants with hydrogel modified growth media.

Keyword: cellulose , nanoparticle, hydrogel , agriculture area.

Characterization of some Assam crude oil using ASTM D-86 methods

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The focus in oil industry is to carryout exploration and exploitation and to develop hydrocarbon prospects and commercially produce oil and natural gas in an environmentally harmonious manner. The petroleum is a homogeneous mixture consisting of saturated compounds like alkanes and ring structures like napthanes and aromatics which can be separated by distillation. To characterize a petroleum fuel, one should know the API or specific gravity and the boiling point distributions of the fuel. The ASTM D-86 method covers the atmospheric distillation of petroleum products by using a laboratory batch distillation unit to determine quantitatively th e boiling range characteristics. In this study, five crude oil samples from a particular oil field Geleki have been taken for analysis with water content of 94%, 92%, 90%, 84% and 82% which are from barail reservoirs.

The API gravity of the samples are above 30 by which indicates that they belong to Key fraction I having a boiling range of 250-275oC at atmospheric pressure. The pour point of the samples was also determined which indicated the waxy nature of oil. The Universal oil product characterization constant (K) was basically towards mixed base crude. The determination of correlation index (CI) inclined towards the paraffinic side. The class of the crude oil was obtained as class C, A, E, A and A.

The distillation process was further extended and the True Boiling Point(TBP) and Equilibrium Flash Vaporization(EFV) was also plotted against all the samples of the field and the result obtained is as follows :

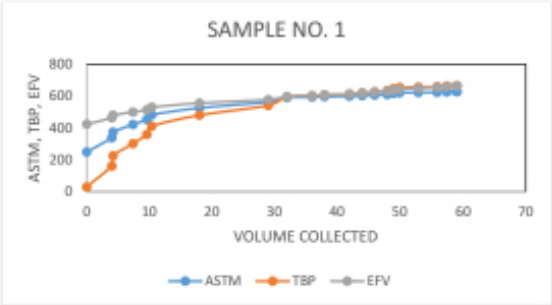

Figure 1: Combined ASTM, TBP, and EFV Distillation Curves for crude oil sample with water cut of 90%

The products of petroleum obtained from the crude oil was also estimated from the distillation method. The table obtained is as follows

Table 1: Products of Petroleum

Name	Carbon No.	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5
GASOLINE (PETROL FRACTION)	C5-C8	7%	52%	28%	26%	50%
GASOLINE (NAPTHA FRACTION)	C7-C13	11%	41%	17%	34%	36%
KEROSENE	C11-C16		7%	22%	16%	10%
DIESEL OIL	C15-C18			16%	9%	4%
LUBRICATING AND FUEL OILS, PARAFFIN WAXES	C16-C40	15%		18%		

Studies on influence of power ultrasound on Solubility limit of sparingly soluble solids

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In this work salicylic acid is used as a solute and solubility limit of salicylic acid in a different solvent (water and aqueous glycerol) is calculated experimentally. Salicylic acid is sparingly soluble solute and It is difficult to dissolve sparingly soluble solids in a solvent even when they are dispersed as fine particles. The dissolution rate of a solute in a solvent is a function of its saturation limit in that solvent, state of aggregation, prevailing hydrodynamics created by the mixing device used, temperature and solvent characteristics.
Here our main objective is to find out whether occurrence and nonoccurrence of supersaturation taking place when ultrasound (20 kHz) is introduced to given system.
Ultrasound waves consist of cycles of compression and expansion. Compression cycles exert a positive pressure on the liquid, pushing the molecules together and expansion cycles exert a negative pressure that pulls the molecules away from one another. During the expansion cycle, a sound wave of sufficient intensity can generate cavities. A liquid is held together by attractive forces which determine the tensile strength of a liquid. In order for a cavity to form a large negative pressure associated with the expansion cycle of the sound wave is needed to overcome the liquid tensile strength. The amount of negative pressure needed depends on the type and purity of the liquid.
The rate of dissolution of a solute in a solvent depends upon the intrinsic mass transfer coefficient, the interfacial area, and the driving force. The purpose of present study is to figure out how the use of ultrasound affects the driving force for mass transfer, intrinsic mass transfer coefficient, and the interfacial area.

Keywords: sparingly soluble solute; Ultrasound; Supersaturation; Dissolution; Particle breakage;

References:

1. L.H. Thompson, L.K. Doraiswamy, The rate enhancing the effect of ultrasound by inducing supersaturation in a solid-liquid system, Chemical Engineering Science 55 (2000) 3085–3090.
2. D.K. Sandilya, A. Kannan, Effect of ultrasound on the solubility limit of a sparingly soluble solid, Ultrasonics Sonochemistry 17 (2010) 427–434.

Optimization of the extraction parameters in a channel-based packed extraction device

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The present study aims to investigate the effect of copper ion concentration in the solution, extractant concentration in the solvent, solution pH, mixture actual velocity of the phases and temperature on copper extraction process from a copper-laden solution. Copper is extracted from the aqueous phase to the organic phase using a commercially available extractant D2EHPA [Bis-(2-ethylhexyl) phosphate] dissolved in the organic phase (benzene). The effect of pH and the other parameters on the extraction process of copper from the aqueous phase to the organic phase has also been studied introducing a rectangular serpentine packed millichannel as a novel extracting device. The performance study of the packed and unpacked serpentine channel reveals that extraction efficiency of the packed channel is higher (85-99%) than the unpacked channel (80-91%). The equilibrium constant for the copper extraction by D2EHPA has also been incorporated in the study. The present work may be helpful for further understanding about the separation and extraction of copper from a mixture of metal ions solution and also may be useful for the development of the serpentine packed channel extracting devices.

Keywords: Serpentine millichannel, extraction, stripping, packed channel, equilibrium constant, volumetric mass transfer coefficient.

References:

1. Darekar, M., Singh, K.K., Mukhopadhyay, S., Shenoy, K.T., 2016. Single-stage micro-scale extraction: Studies with single microbore tubes and scale-up. Sep. Purif. Technol. 158, 160–170.

2. Jha, M.K., Gupta, D., Choubey, P.K., Kumar, V., Jeong, J., Lee. J.C., 2014. Solvent extraction of copper, zinc, cadmium and nickel from sulphate solution in mixer settlerunit (MSU). Sep. Purif. Technol. 122, 119–127.

3. Dehkordi. A.M., 2002. A novel two-impinging-jets reactor for copper extraction and stripping processes. Chem. Eng. J. 87, 227–238.

4. Su, Y., Zhao, Y., Chen, G., Yuan, Q., 2010. Liquid–liquid two-phase flow and mass transfer characteristics in packed microchannels. Chem. Eng. Sci. 65, 3947–3956.

Abstract

The frequent occurrence of pharmaceuticals in the aquatic environment as well as in drinking water has raised a concern about their potential impact on environmental and public health. However, their elimination using conventional treatment methods has not been an easy task. The aim of this research was the assessment of the kinetics of ozonation of four pharmaceutical drugs: carbamazepine, ibuprofen, methylisothiazolone and ranitidine at temperature 298 K. The results showed that at pH 5, the ozonation of carbamazepine in aqueous solution reduced the concentration to about half of its initial value. A model allowed an estimate of the rate constant for carbamazepine is 5.638×10-1 M-1s-1. From model the estimated value of second order rate constant for ibuprofen is 11.58 M-1s-1 at pH 6 and in case of methylisothiazolone the value of second order rate constant is 138.12 M-1s-1at pH 7. In case of ranitidine the value of pseudo first order rate constant 'kobs' is increasing with increasing inlet ozone concentration while the value of second order rate constant 'k' is decreasing with increasing inlet ozone concentration.

Comparative analysis of effects of cmc & Rice husk on mud properties

Drilling fluids are used in rotary drilling method which generally consists of an aqueous clay suspension containing weighting agents to increase the hydrostatic head and frequently also contains concentrated colloidal suspending and conditioning agents. Drilling fluids play a vital role in hole cleaning, suspension of cuttings, prevent caving, and ensure the tightness of the well wall. Moreover they also help in cooling and lubricating the drilling tool, transfer the hydraulic power and carry information about the nature of the drilled formation by raising the cuttings from the bottom to the surface, using a simple mixture of water and clays, to complex mixtures of various specific organic and inorganic products as additives. These additives improve fluid rheological properties and filtration capability, allowing bits to penetrate heterogeneous geological formations. In this study fresh water based drilling fluid is used and initially an attempt is made to determine the variation of properties of drilling fluids with varied concentrations of the most common additives of drilling fluids i.e. bentonite which is used as a viscosifier and barite, used as a weighing material. It is seen that the measured drilling fluid properties are directly proportional to the concentration of drilling fluid additives. This study tries to compare a local waste product with a commercial product for economic efficiency of drilling operation, which is done by experimental investigation of the effect of different concentrations of carboxymethyl cellulose (CMC) and a local waste product i.e. rice husk on fluid properties. It is seen from the experiments that with the increase in the concentration of CMC and rice husk, the amount of filtrate loss and filter cake thickness decreases.

Development of Thin Polymeric Film for Detection of Ethanol

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In recent years, polymeric substances have occupied a major portion of market in various applications such as packaging, biomaterials, tissue engineering, cosmetics, paint, due its light weight, low cost, and easy processability. Polymer based composites having conductive nature are presently utilized for several advance applications. Electrochemical sensor and bio sensor application are the lucrative area where polymeric material are tested and applied for different cases. Thin film based sensor element has the excellent features like easy to cast in different dimension, low cost, easy to operate. Thus, many researchers are started working towards polymeric system with some advance applications in view of the remarkable properties of polymeric substances. However, solid waste disposal and less sensitivity are the issues associated with the polymeric system in the time of application for different stimuli. Polylactic acid (PLA) which is a bio based and biodegradable polymer, is utilized to make conductive composites by several groups for different sensor applications like organic solvent, vapors, gases etc. In this present work, Iron loaded cellulose nanocrystal (Fe-CNC) was utilized to fabricate novel active composite along with exfoliated graphene(GR) and PLA. Firstly, thermal, crystallization, impedance measurement and morphological investigation were carried out to optimize the composition of the thin film. Then the optimized composite film was tested for the detection of ethanol. It is found that the incorporation of Fe-CNC stabilizes the sensor response towards ethanol. Thin film has sensitivity towards different concentration of ethanol and has more stabilized response.

Keywords: Electrochemical sensor; ethanol; PLA

An overview: Conventional and nonconventional water purification systems

Pure drinking water or portable water is the water that is safe to drink or to use for food preparation. The amount of drinking water requirement is varying according to physical activity, age, health issues, and environmental conditions. Now a day's, different types of conventional as well as non-conventional purification systems are available. The design, use of less space, functions independent of outdoor conditions make conventional water purification systems more popular among the people. Again, non-conventional water purification systems occupy a huge area, sensitivity and functioning dependent on outdoor conditions which in turn such systems are less popular among the people. But, considering the increase in demand of more pure drinking water, non-conventional water purification systems can be modified in some ways to proof to be better than the present convenient ones. Therefore, a study is carried out on the overview of different conventional and nonconventional water purification systems for the purpose of pure drinking water.

Development of novel functionalized ceramic membrane for the capture of CO_2 from Natural Gas

Bhargavi Talla, Prof. B. P. Mandal

The main aim of this work is to study the separation of CO_2 from Natural Gas by membrane based technology. Membrane technology constitutes an increasingly important, convenient and versatile way of separating gas mixtures. Compared with other approaches, membranes reduce energy and other operational cost for gas separation and moreover, membrane operations are more scalable than conventional separation unit operations in the chemical industry. The development of new membranes with improved separation properties, high mechanical and thermal stability using inexpensive and naturally abundant materials is of utmost importance for sustainable development and environmental applications. Ceramic materials due to their high chemical, mechanical and thermal stability in combination to their surface functionalization have inspired material scientists to design innovative low-cost ceramic-based membrane supports. In this work α-alumina supports were prepared by two different methods namely dry compaction method and the extrusion method. The supports obtained by these methods were characterized for support properties. A thin γ- alumina film coating was done on the supports by sol-gel technique. It involves preparation of boehmite solution followed by dip coating of supports in the boehmite solution. These supports are further characterized to see whether there is reduction in pore size or not. It was observed that the pore size of the disk shaped supports reduced to 290 nm from 380 nm and for tubular supports the pore size reduced to 300 nm from 540 nm after γ- alumina coating. This will help us to coat silica layer on the surface of these supports. Functionalization will be done by grafting method using amine functional group on these membranes.

Gas holdup and bubble size distribution In microstructured flotation column

Ritesh Prakash[1], Subrata Kumar Majumder[1] and Anugrah Singh[1]

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In the present work gas holdup, bubble size and its distribution in two and three phase system are investigated in a microstructured flotation column. Effect of the particle, its concentration, and size on the gas holdup and bubble size distribution with and without surfactants are studied. From the experimental results, it is seen that the size distribution of bubbles was followed asymmetric distribution according to the system properties. The addition of particle in the twophase system decreases the gas holdup while increasing particle concentration it increases. The solid particle used is coal with an average diameter of 177.7 and 366.19 μm. Size distribution of bubbles become wider after solid loading. Analysis of gas holdup has been done by drift flux model and an attempt has been made to develop the empirical correlation to predict the gas holdup and bubble size.

References

1. Banisi, S., Finch, J., Laplante, A., Weber, M., 1995b. Effect of solid particles on gas holdup in flotation columns-II. Investigation of mechanisms of gas holdup reduction in presence of solids. Chemical Engineering Science, 50, 2335-2342.

2. Grau, R., Hesikanen, K., 2005. Bubble size distribution in laboratory scale flotation cells. Minerals engineering, 18, 1164-172.

3. Li, S., Huang, S., Fan J., 2017. Effect of surfactants on gas holdup in shear thinning fluids. International Journal of Chemical Engineering, 2017, 1-7.

TiO_2-AMPS nanocomposite based hydrophilic and antibacterial polysulfone ultrafiltration membranes

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Polysulfone (PSF) membranes modified with a TiO2-AMPS based polymer nanocomposite are presented in this study. Non-solvent induced phase inversion technique was used for membrane preparation by using Poly(ethylene glycol) and N-methylpyrrolidone as pore former and solvent, respectively,. The synthesized polymer nanocomposites were blended in the PSF membranes in different wt%. The membranes were characterized by using techniques like Field emission scanning electron microscopy and Fourier transform infrared spectroscopy. The permeation tests were carried out to analyze the pure water flux and hydraulic permeability of the prepared membranes. The presence and stability of the hydrophilic and antibacterial nanocomposite in the membranes was confirmed by the Fourier transform infrared spectroscopy. Antibacterial studies of the membranes were carried out by using E. coli. The hydrophilicity, depicted from the water contact angles of the prepared membranes, increases with the amount of the polymer nanocomposite. Similarly, the antibacterial nature of the membranes increases with the amount of the polymer nanocomposite in the membranes.

Materials and Methods:

Table 1. CONTENTS OF THE NANOCOMPOSITE

S. No.	TiO_2-AMPS Nanocomposite	TiO_2 to AMPS Ratio
1	R1	1:1
2	R2	1:2
3	R3	2:1

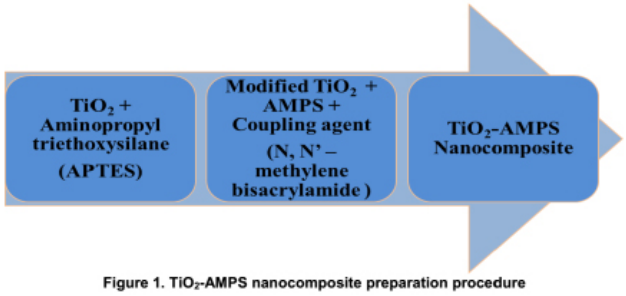

Figure 1. TiO_2-AMPS nanocomposite preparation procedure

References:

1. R. Singh and M. K. Purkait, Evaluation of mPEG effect on the hydrophilicity and antifouling nature of the PVDF-co-HFP flat sheet polymeric membranes for humic acid removal, Journal of Water Process Engineering, 14 (2016), 9-18.

2. M. K. Sinha and M. K. Purkait, Preparation and characterization of novel pegylated hydrophilic pH responsive ultrafiltration membrane, Journal of Membrane Science, 464 (2014), 20-32.

An overview: Conventional and nonconventional water purification systems

Pure drinking water or portable water is the water that is safe to drink or to use for food preparation. The amount of drinking water requirement is varying according to physical activity, age, health issues, and environmental conditions. Now a day's, different types of conventional as well as non-conventional purification systems are available. The design, use of less space, functions independent of outdoor conditions make conventional water purification systems more popular among the people. Again, non-conventional water purification systems occupy a huge area, sensitivity and functioning dependent on outdoor conditions which in turn such systems are less popular among the people. But, considering the increase in demand of more pure drinking water, non-conventional water purification systems can be modified in some ways to proof to be better than the present convenient ones. Therefore, a study is carried out on the overview of different conventional and nonconventional water purification systems for the purpose of pure drinking water.

Environment Friendly Biobased Dispersant for treatment of Oil Spills

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World still relies on petroleum as a primary source of energy. Therefore, a large scale exploration, drilling, enormous production, tremendous processing and massive transportation is being carried out which sometimes lead to hazardous oil spills, occurs predominantly due to release or leakage of crude oil from tankers, vessels and pipelines accidents, offshore petroleum exploration and production operations, drilling rigs and wells, as well as spills of refined petroleum products and their by-products. This is a major problem that pose serious threat to aquatic and land environment. This requires a sustainable strategy for oilspill cleanup. So the problem could be overcome by using naturally available biopolymers such as xanthan gum (XG) and nanoamphiphilic modified chitosan (MCH) as a biodispersant for the stabilization of oil spill droplets. A highly stable oil-in-seawater emulsions based on the synergy of biopolymer XG and MCH have been studied. The particle size analysis and optical microscopic image shows the stability of the emulsion for 20 days. The application of xanthan gum increases viscosity of the dispersed phase significantly through increased cross-linking and restrict the movement of oil droplets and hydrophobic part of the nanoamphiphilic chitosan preferentially attached to the oil droplets, thereby forming a polymer layer around the droplets, to form micelle like structure. Our recent studies on emulsion droplets stabilized by XG and MCH shows higher degradation for the time period of 7 days which was confirmed from GC-MS analysis. Such synergistic effects of natural biopolymers and modified dispersants for oil spill remediation could result in a novel environment friendly oil spill remediation technology for treating future oil seeps and spills. Which can also reduce the toxicity effects of chemical agents that has been widely used.

References:
[1] Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling; National Commission on the BP Deepwater Horizon Oil Spilland Offshore Drilling (U.S.): Washington, DC, 2014

[2] Novel and Environmentally Friendly Oil Spill Dispersant Based on the Synergy of Biopolymer Xanthan Gum and Silica Nanoparticles, Guilu Pi, Yiming Li, Mutai Bao, Lili Mao, Haiyue Gong and Zhining Wang, ACS Sustainable Chem. Eng., 2016, 4, 3095, DOI:10.1021/acssuschemeng.6b00063

[3] Nanoamphiphilic Chitosan Dispersed Poly (lactic acid) Bionanocomposite Films with Improved Thermal, Mechanical, and Gas Barrier Properties, Akhilesh Kumar Pal and Vimal Katiyar, Biomacromolecules 2016 17 (8), 2603-2618, DOI: 10.1021/acs.biomac.6b00619

Stability of Colloidal Microbubble in Presence of Fine Particle with Different Surfactants

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Microbubbles are miniature gas bubbles of less than 100 μm in diameter [1]. The microbubbles are created by intense stirring of surfactant solution [2]. The characterisation of microbubbles can be carried out by studying the effect of process parameters on stability and gas hold-up of microbubble dispersions. Stability of microbubbles play very important role in its application for fine particle separation. Stability of microbubble depends on type of surfactant, concentration of surfactant, temperature and pH. Knowledge of the stability would enable us to use these colloidal microbubble more efficiently for their distinct applications. In this present work stability of microbubbles is studied using saponin surfactant by drainage mechanism in presence of fine mineral particles. The effects of concentration of surfactant, temperature and pH on the stability of the non-ionic microbubble are interpreted based on drainage mechanism. A model has been developed to interpret the stability of the microbubble based on drainage kinetics. The study may be useful for fine particle separation in batch and continuous mode with the help of microbubble flotation.

Keywords: Microbubble; stability; surfactants; fine particles; drainage kinetics; separation.

References

[1] F. Sebba, Separations using aphrons, Sep. Purif. Methods 14 (1985) 127-148.

[2] F. Sebba, Foams and Biliquid Foams: Aphrons, Willey, New York, 1987.

A Novel Green EOR process for Upper Assam Basin, India

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In Alkaline Surfactant Enhanced Oil Recovery (ASEOR) an alkali and surfactant/surfactants are used to recover the residual oil that remains after secondary brine flooding. The alkali, which is Sodium Hydroxide (NaOH) in this case, reacts with acidic components in the crude oil to form surface-active substances. A GC-MS spectrum of Upper Assam crude oil reveals the presence of carboxylic acid groups leading to insitu formation of surfactants, which in turn decreases the interfacial tension (IFT) between the oleic and aqueous phases for better oil recovery. While the anionic surfactants used were Black Liquor (BL) and Sodium Dodecyl Sulphate (SDS). The Critical Micellar concentration (CMC) of BL and SDS one at a time was added to NaOH to enhance the effectiveness of NaOH in further decreasing the IFT of the lkaliSurfactant (AS) slugs. The paper also make an attempt to study the adsorptive nature of the AS slugs. The best fit adsorption isotherm was derived by using SciDAVis scaled Levenberg - Marquaradt algorithm regression co-efficient.

Keywords: Chemicals, EOR, Adsorption

Flow through porous media for EOR application : A review

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In oil and gas industry, the flow of reservoir fluids through subsurface rocks is very crucial for achieving beneficial production of hydrocarbons at the surface. The fluids present in the rocks comprise of crude oil, gas phase and water which can be in free form or in emulsions. The aim is to produce crude oil and gas phase with minimum water production. Various studies have been carried out to study the flow pattern, behaviour and fluid phase interactions. This paper will try to understand and present the laboratory studies carried out worldwide to understand fluid flow through underground porous media. In macro scale, core sample are used to simulate the subsurface rocks. Taking help of Darcy's Law, the flow volumetric rate of injected fluids can be studied. There are steps of injections starting with water injection, sample injection, water reinjection and then utilising various EOR flooding methods like surfactant and polymer flooding. These are done in a confined and controlled environment to give an impression of the underlying rocks. A step further utilises microscale, the micromodels. They help not only in understanding the flow rates but also due transparency of the micromodels, visualisation can be done for flow experiments. Micromodels are chips made of glass, polymer or silicon wafer which mimic the pore structure of the rocks under investigation.
Micromodels are helping researchers and industries in understanding fluid flow pattern occurring inside the chips from point of injection to point of exit. Fronts and fingering structures developed can be studied for, analysed, identifying causes of occurrence, reviewed and analysed. Also the competition among the fluid can be observed and according decisions can be made to modify flow according to the requirements like changing chemistry of injected chemicals and fluid velocities. The rocks and chips can have various pore structures from similar pore sizes and paths to highly heterogeneous pathways. The Crude oil trapped after primary recovery can be recovered by chemicals like surfactants. They help in understanding the effectiveness of the chemicals in driving out the remaining oils. Soo and Radke, 1986 [A Filtration Model for the Flow of dilute, stable emulsion in Porous Media-I. Theory. Chemical Engineering Science]; proposed mechanism of interception and straining of emulsion droplets while flowing inside a rock.
The displacement behaviour occurring in the chips can be photographed and video graphed by utilisation of microscopes and camera to create still images and videos. The sequence of flow with time can then be studied and analysed. Also the time required to complete a sample flooding can be calculated. This also included the number of pore volume injections done to achieve a desired rate of production at secondary and enhanced recovery stages.

Keyword: EOR, Surfactants, Water flooding, Micromodels

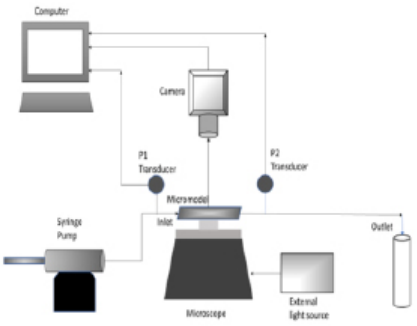

Figure 1: Typical schematic Microfluidic setup for carrying out flooding experiments

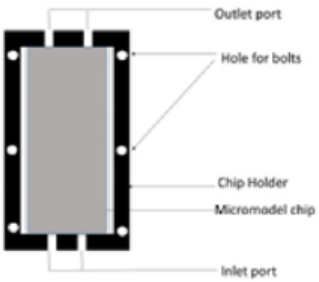

Figure 2: A schematic micromodel sample with its holder

Polylactic Acid/functionalized gum nanobiocomposite for food packaging: A reactive extrusion study

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The present study deals with the fabrication of crosslinked/branched poly (lactic acid) (PLA) with different loading of functionalized gum Arabic (*f*GA) using reactive extrusion process. Grafting of *f*GA on PLA is confirmed by Fourier transform infrared spectroscopy (FTIR) and 1H-nuclear magnetic resonance (NMR) techniques. DSC result confirmed that stable crystal is formed and also percentage crystallinity is improved in addition of *f*GA along with DCP in PLA matrix. Further, Polarized optical microscope (POM) investigates to understand the influence of fCH into PLA matrix with or without DCP. Hyphenated TGAfourier transform infrared spectroscopy (FTIR) confirms the release of volatile species during the thermal decomposition of GA, *f*GA and PLA/fGA.

Keywords: Functionalized Gum arabic, Polylactic acid, Dicumyl peroxide

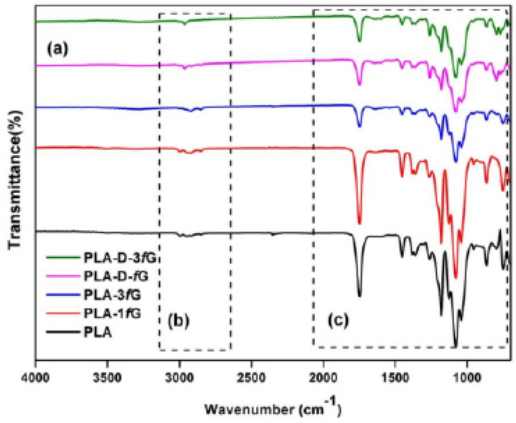

Fig. 1 FTIR profiles of PLA, PLA-fG with or withot DCP.

Equilibrium entropy of gas hydrate Formation in gas-enriched pipeline

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The increasing demand for fossil fuels and diminishing natural energy reserves have necessitated the exploration of gas hydrates. Gas hydrates find importance in oil and gas industries where the formation and dissociation of gas hydrate become important. Thus, the proper understanding of formation, decomposition and properties of gas hydrates is very crucial. A model is derived using crystallization process. All microscopic complications are neglected for simplicity. The driving force for the crystallization process be given by the difference in the fugacity of the dissolved gas and the three-phase equilibrium fugacity at the experimental temperature. By using various data from others researches, a modified model is developed. With the help of previous experimental data and model value of parameters is obtained. Parameter is estimated by the fitting according to the model developed. For validation of model, as set of data is again extracted from the model by substitution of estimated parameter in model. Thus experimental and model data are obtained and fitting of model is analyzed. Then the model is modified by the modification of one assumption and the best fit model has been found for various compound and various thermodynamic conditions. The fitting of model has been studied for different compound for specific range of parameter. Different models are obtained for different compound and thermodynamic condition. These models are tested by the error calculation.

Nonlinear Dynamics at Fluid–Fluid Interfaces

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Soft colloid materials, such as foams and emulsions, are of great importance in industry and our daily life. These are the dispersions of air (or oil) into aqueous phase. When two such dispersed phases (bubbles or droplets) approach each other, a thin-liquid film is formed. The film consists of two air (or oil)–water interfaces. The properties of such colloids strongly depend on the thin-liquid film, and therefore the fluid–fluid interfaces.

Under the influence of gravity, drainage occurs resulting with decreasing the film thickness. As the film thickness continues to decrease, the two interfaces approach each other across the aqueous phase. At very close proximity (less than 30 nm), surface forces start operating between the two fluid–fluid interfaces. These forces are responsible for the stability of the thin-liquid film, and consequently foams and emulsions. In the present study, we have focused on the surface forces that operate between the two fluid–fluid interfaces across the thin-liquid film.

Formation and Stabilization of Aqueous Foams in a Binary Cationic/Zwitterionic surfactant System in presence of Multivalent Salts

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Surface tension, foaming and zeta potential studies were performed at different combinations of cationic and zwitterionic surfactant namely, Cetyl trimethylammonium bromide (CTAB) and zwitterionic surfactant N-Dodecyl-N,Ndimethyl-3-ammonio-1-propanesulfonate (DDAPS). The studies were performed in presence of mono-, di-, and trivalent salts (i.e., NaCl, CaCl2, and AlCl3). The binary mixture of CTAB and DDAPS present a non-ideal behaviour with weak interactions between the surfactants, as a consequence to the positions held by the positive and negative charge cores on the zwitterionic surfactant. The spacer group present in the zwitterionic surfactant holding the two head-groups plays a significant role on the surface tension and CMC. The addition of salts favours the interactions between the ionic and zwitterionic surfactants, as more ionic surfactants are accommodated at the interfaces in presence of these salts [1]. Surface tension, interfacial tension, and CMC decreased upon salt addition, signifying an increase in adsorption of the surfactant molecules at the interface (Figure 1).

The quantity of salt required for reducing the surface tension and CMC followed the sequence: NaCl > CaCl 2 > AlCl3. CTAB generated higher foam volume than DDAPS at all the premicellar concentration. The stability of foams is significantly affected by the interaction between the surfactants and salts (Figure 2). Stability of foams was improved upon salt addition as they screen the charge at the foam lamellae and Plateau border and form a densely packed monolayer of surfactant molecule at the interface [2]. The electrical properties of the interface were also investigated.

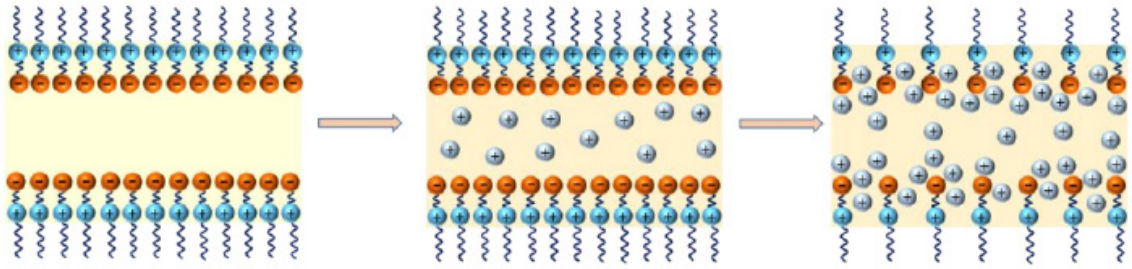

Figure 1. Adsorption of zwitterionic surfactant at the air–water interface in presence of monovalent salt.

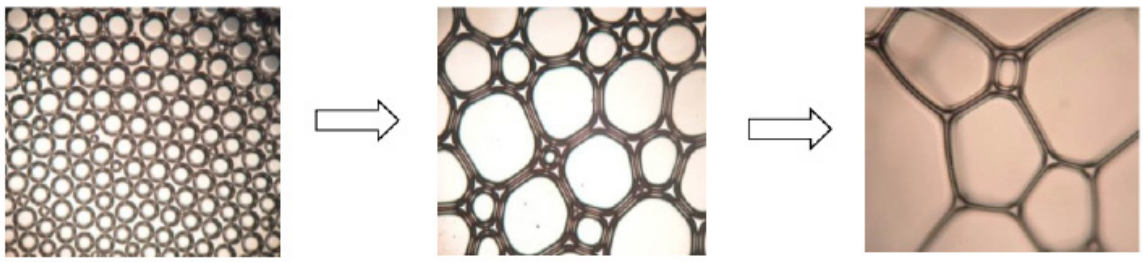

Figure 2. Coalescence of spherical shaped foam to a polyhedral shape by Ostwald's ripening.

References:

[1]Bera, A. Ojha, K. & Mandal, A. 2013. Journal of Surfactants Detergents 16: 621–630.

[2] Shiloach, A. & Blankschtein, D. 1997. Langmuir 13: 3968–3981

Electric field mediated actuation of droplets laden with micro/nano particles for micro reactions

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We report a micro system exploiting the droplet/particle actuation under non uniform DC electric field for potential applications of micro reactions. The system is built on a PDMS platform containing a micro well engraved on it. Two aluminum electrodes enclose the well from two sides. The well is filled with dielectric silicone oil and a deionized water droplet (~500 μm) laden with micro/nano particles is then dispensed into the well. On application of DC voltage the droplet first moves towards one of the electrodes due to dielectrophoretic force, and upon contact with the electrode is repelled from it due to charge transfer. This phenomenon creates droplet oscillation, which in turn causes actuation of the particles inside the droplet. This phenomenon of particle actuation inside droplets can be harnessed for enhancement of reaction rates inside droplet microreactors, for potential synthesis of compounds using nanoparticle catalyst inside reactant droplets, for selective removal of compounds from droplets by adsorption on the nanoparticles, forming solid-liquid micro extraction system.

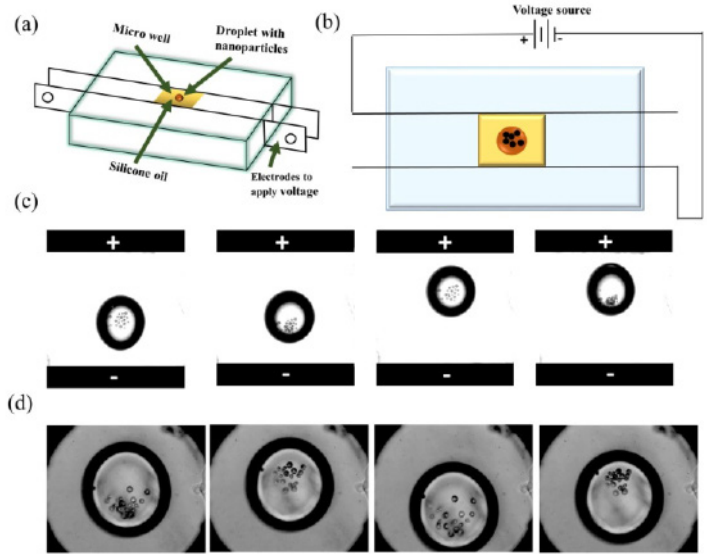

Fig. 1. (a) Schematic representation of the experimental setup. (b) Top view of the experimental set up. (c) Experimental micrographs showing droplet oscillation along with actuation of laden micro particles (glass spheres). (d) Magnified view of the actuation of particle laden droplet.

A new empirical correlation for prediction of Gas hydrate dissociation Equilibrium

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Formation of gas hydrate in the form of solid like ice crystal inside a pipeline is a very common issue today in oil and gas industries. The phenomena may occur in pipeline well below the sea level where the pressure is high or in the cold regions where the temperature is at freezing point for hydrate formation. In order to prevent the plug of hydrate in pipelines, it is important to study the relationship between temperature and pressure at which hydrate form and dissociate. The formation condition can be predicted either by developing empirical correlation or thermodynamic modeling. The purpose of this study is to develop new correlation for predicting the hydrate dissociation pressure at a temperature for single gas in pure water and in presence of inhibitors. Overall 600 data points of three-phase equilibrium experimental data points have been used to obtain the empirical correlations. The overall average absolute percentage deviations AAPD are found to have good agreement with the experimental data. The present study may be helpful for further understanding the correlation of gas hydrate formation equilibrium condition.

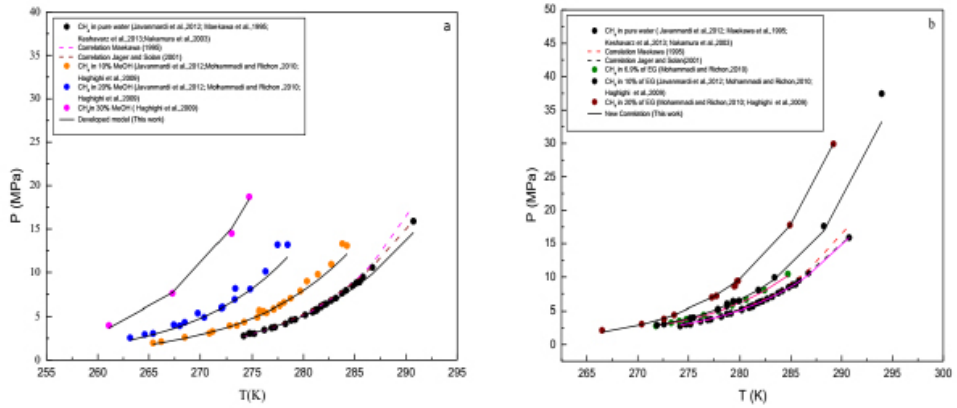

Fig. 1 Comparison of experimental data with predicted hydrates dissociation data. a. Methane in presence of pure water and methanol solution. b. Methane in presence of pure water and ethylene glycol aqueous solution

The proposed correlation to predict the hydrate equilibrium pressure for methane in methanol and ethanol is as follows:

$$P = a + b^{T} \quad (1)$$

$$P = c + d\exp\left(\frac{T}{f}\right) \quad (2)$$

Key words: Gas Hydrate; Methanol, Ethylene glycol inhibitors; Hydration dissociation pressure; Empirical correlations; Gas hydrate equilibrium

References:

[1] Maekawa, T., 2008. Equilibrium condition of propane hydrates in aqueous solutions of alcohol, glycol, and glycerol. J. Chem. Eng. 53, 2838-2843.

[2] Ostegrgaard, K., Masoudi, R., Tohidi, B., Danesh, A., Todd, A., 2005. A general correlation for predicting the suppression of hydrate dissociation temperature in the presence of thermodynamic inhibitors. J. Pet. Sci. Eng. 48, 70-80

Methods for preparation and characterization of biomass for producing synthesis gas using a biomass gasifier

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A detailed study was conducted to investigate various lignocellulosic biomass, such as saw dust, forest residues, agricultural residues and house waste (tea waste) for producing synthesis gas. Synthesis gases have been emerged as better clean energy source in present scenario of rising global warming and pollution. Biofuels are considered better in comparison to fossils liquid fuels or coals. In the present investigation, characteristics data of seven forest wood residues(Melocanna baccifera, Hevea brasiliensis, Tectona grandis, Dipterocarpus turbinatus, Magnifera indica, Boehmeria nivea. Schima wallichi), one agricultural residue(rice straw) and one household waste(tea waste) have been analysed. Proximate analysis have been carried out. The biomasses were analysed by various physical and chemical methods to characterize their composition and structure. Major composition of biomass are carbohydrates and lignin. Carbohydrate can be structural or non-structural .Further the high heating value (HHV) of these biomass have been evaluated experimentally and comparative study has been attempted. The characterization helps to choose the best biomass samples which will be very efficient and favourable for getting high heating value or calorific value and producing synthesis gases using fixed bed gasifier. After gasification produced synthesis gases will be analysed by Gas chromatography(GC).

Molecular Simulation of Adsorptive Separation of Natural Gas using Nanoporous Carbon

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Nanoporous carbons, also called carbon molecular sieves, are amorphous carbon material having irregular and disordered pore geometry with typical average pore size in the range 4–5 Å. In this work, grand canonical Monte Carlo (GCMC) simulations have been used to study the adsorption and separation of constituents of natural gas, namely methane (CH_4), ethane (C_2H_6) and hydrogen sulfide (H_2S) over a wide pressure range using realistic molecular models of nanoporous carbon. The non-bonded interactions between the gases and the carbon framework were modeled using Lennard-Jones potential (for van der Waals interactions) and Coulomb's law (for electrostatic interactions). We have examined the adsorption of pure gases as well as the separation of binary C_2H_6/CH_4, H_2S/CH_4 mixtures and ternary CH_4/C_2H_6/H2S mixtures. The adsorptive selectivities have been calculated for the binary and ternary mixtures. At low pressures, adsorption of C_2H_6 is significantly higher than that of CH_4 because of the stronger dispersion interaction of C_2H_6. In the case of H_2S/CH_4 mixture, CH_4 is preferentially adsorbed by the carbon adsorbent. It is expected that the results of this work can help evaluate the performance of nanoporous carbon adsorbents for natural gas sweetening.

Synthesis and characterization of Chitosan biopolymer nanocomposites with layered double hydroxide as Nano filler

Mritunjoy Roy and G. Pugazhenthi

Biopolymer nanocomposites (BNCs) are a class of nano-structured materials, which are composed of biopolymers, and nano-fillers which are dispersed in the polymer phase. BNCs are similar to polymer nanocomposites but differ in the methods of production, material properties such as mechanical, thermal, and others, along with functionalities, biodegradability, biocompatibility, and applications. Biopolymer blends and their nanocomposites are nvironmentalfriendly materials which has attracted interest towards them due to environmental concerns. Chitosan is a linear polysaccharide composed of randomly distributed β-(1→4)-linked D-glucosamine (deacetylated unit) and NAcetyl-D-glucosamine (acetylated unit). The most important derivative of chitin is chitosan, obtained by (partial) deacetylation of chitin in the solid state under alkaline conditions or by enzymatic hydrolysis in the presence of a chitin deacetylase. Layered double hydroxide(LDH) are synthetic or natural lamellar hydroxides having two or more kinds of metallic cations in the main layers and hydrated interlayers spaces containing anionic species. They are also known as anionic clays. Organic and inorganic anions are often intercalated between the layers in order to maintain charge balance, and water of crystallization is generally found in the interlayer galleries.
Chitosan being a polymer with a wide range of applications such as water treatment have been used from a very long time. The use in the present day have been targeted in pharmaceutics and other biomedical applications. Chitosan uses in biomedicine have primarily been based on drug delivery as well as a few works on adsorption of oil particles. The use of LDH is also very rare for uses in drug delivery and not all the different types of LDH have been used in the research works. Hence the objectives of this study are finding suitable solvent, for solvent blending coupled ultrasonication technique, for better dispersion of filler in the chitosan matrix, Synthesis of Chitosan(CH)– Layered double hydroxide (LDH) loaded nanocomposites and morphological characterizations of the nanocomposites by various characterization techniques.

In this work, the stress is to understand the effect of the nanofiller in chitosan nanocomposite on the rheological properties. The influence of change in content of Ni-Al layered double hydroxide (LDH) on chitosan (CH) matrix was investigated. Ni-Al LDH was modified organically with Sodium Dodecyl Sulfate to increase the gallery space in the structure of LDH. The nanocomposite films were then formed with the modified LDH by solvent casting method with sonication. Characterization such as XRD, FTIR and TGA of the nanofiller were recorded which showed the successful synthesis of LDH. It was also observed that there was small increase in d-spacing of LDH after modification. The interaction between chitosan(CH) and nanofiller (LDH) was analyzed by rheology of the film forming solutions The melt rheological measurements gave an understanding on the dispersion of nanofillers over the chitosan matrix in the form of various rheological parameters like storage modulus, loss modulus and complex viscosity.

Keywords: Bionanocomposite(BNC), Chitosan(CH), Layered Double Hydroxide(LDH)

Carboxymethyl Chitosan Mixed Matrix Membrane For CO_2 Separation

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Global warming is one of the serious issues which is occurring due to increase in the level of carbon dioxide in the atmosphere. Various technologies has been developed to lessen the unwanted concentration of CO_2 in the atmosphere. The development of new polymeric membrane is one of the most important step for the glorious journey of separation technology. Mixed matrix membranes are recently developed membranes having various improved properties over polymeric or inorganic membranes. In our study synthesis and characterization of carboxymethyl chitosan (CMCs) membrane blended with amine functionalized zinc oxide nano fillers for CO_2 separation from CO_2/N_2 gas mixture has been carried out. Fourier transform infra-red spectroscopy, nuclear magnetic resonance spectroscopy, X-ray diffraction, field emission scanning electron microscopy and thermogravimetric analysis has been used for characterization of the synthesized membrane. Also the gas permeation study ensures that the proposed modified chitosan membrane can be a potential candidate for flue gas separation.

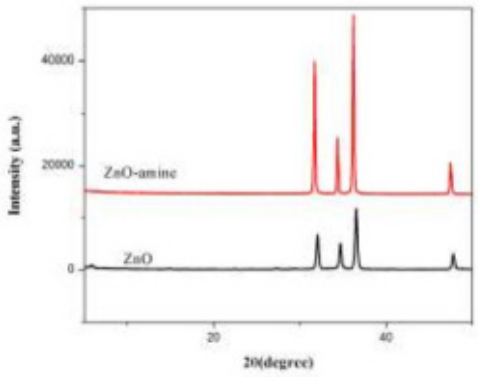

Figure 1 XRD spectra of pure zinc oxide and amine functionalized zinc oxide

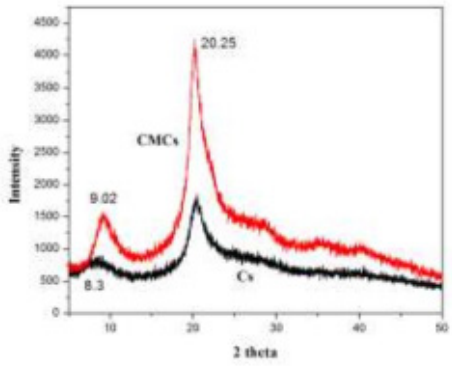

Figure 2 XRD spectra of pure chitosan and carboxymethyl chitosan

References:

1. J.N., Shen, C.C., Yu, G.N. Zeng, B v d., Bruggen, Preparation of a Facilitated Transport Membrane Composed of Carboxymethyl Chitosan and Polyethylenimine for CO2/N2 Separation, Int. J. Mol. Sci. 2013, 14, 3621-3638

2. B., Prasad, B., Mandal, CO2 separation performance by chitosan/tetraethylenepentamine/poly (ether sulfone) composite membrane, J. Appl. Polym. Sci. 2017

A Review on Membrane technology for CO_2 gas separation studies

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Global warming, a subject of increased emphasis in the recent years, is caused by the emission of greenhouse gases such as CO_2 in the atmosphere. Greenhouse gases (GHGs) trap the heat radiating from the surface of earth when solar energy is being transmitted through the atmosphere thus increasing the global surface temperature. As a result of global warming, melting icebergs in polar oceans is causing the sea level to rise globally. The Intergovernmental Panel on Climate Change (IPCC) has predicted that the sea level will rise by 0.09 to 0.88 meters from 1990 to 2100, which is a matter of serious concern. CO_2 is the primary anthropogenic greenhouse gas, accounting for 77% of the human contribution to the greenhouse effect in recent decade (26 to 30 percent of all CO_2 emissions). Carbon capture and storage (CCS) as a major strategy is being used to reduce GHGs emission. There are three methods for CCS: pre-combustion capture, oxy-fuel process, and post-combustion capture. Among them, post-combustion capture is the most important one because it offers flexibility and it can be easily added to the operational units. Conventional separation techniques such as absorption, cryogenic distillation and adsorption have huge applications. However, advanced technologies such as membrane separation technology have advantages of less energy consumption, light weight, space efficiency and compact modular design over these conventional techniques. Hence, membrane technology serves as clean, compact, energy management alternative thus amplifying its future scope as a very efficient technique for industrial application.[1,2]

1. CO_2 Capture technologies

1.1.Pre-Combustion Technique

For pre-combustion capture, the carbonaceous fuel is first converted to a form amenable to CO_2 capture. The synthesis gas stream, syngas, is composed of mainly H_2 and CO_2 with a trace amount of H_2O and H_2S gases. The high concentration of CO_2 (20–40%) in the fuel gases needs to be removed before the combustion. The high temperature (around 400°C) of the syngas is generally quenched to 40°C before the CO_2 separation process.

1.2.Post-Combustion Technique

Post combustion capture of CO_2 refers to CO_2 capture from flue gases (a mixture of gases such as CO_2, O_2, N_2, H_2O, SO_x and NO_x etc.) generated by combusting by product of fossil fuels or other carbonaceous materials. As the post combustion technologies can be retrofitted to low pressure (1 bar) and low CO_2 content (3-20%) gas stream, existing fossil fuelled power plants presents this technology as the greatest potential for reduction of CO_2 emissions.[3]

1.3. Oxy-Fuel Combustion

Oxy-combustion technology is a new approach and concept to reducing CO_2 emissions, originally developed in 1982 to produce high purity CO_2 (>99%) for enhanced oil recovery (EOR). It involves burning fossil fuel with pure O_2 as opposed to ordinary air. Due to the concerns over global climate change and CO_2 emissions, this technology is again in the point of interest.

2. Membrane technologies used for CO_2 gas separation

Membrane processes are frequently used for gas separation due to its light weight and space efficiency as well as compact modular design. Also, it does not require a separating agent and hence no regeneration is required.[5] Membrane systems can be basically classified into 3 categories (1) Organic Membrane (2) Inorganic Membrane (3) Mixed Matrix Membrane. The challenge imposed by the long term usability of organic membrane for industrial application is restricted by the instinctive trade-off limitation between permeability and selectivity as depicted by Robeson's curve.[1,2]

On the other hand; inorganic membrane materials exhibit high separation properties even at high temperature. However, its large scale potential industrial usage is restricted by its high cost and lack of processability. On the other hand, the high separation properties of inorganic membranes even at high temperature are restricted by its high cost and lack of processability.[3,4] Hence, to address these limitations, mixed matrix membranes (MMMs) have been intensively studied and analysed in the recent years. To address these issues, mixed matrix membrane (MMMs) which combine the advantages of inorganic filler and polymer matrix have been extensively studied. In the synthesis of MMMs, inorganic filler is dispersed into the polymer matrix thereby inheriting the advantages of both organic and inorganic materials.[4] Thus, in my work; intensive studies has been carried out to study the effect of CO_2 gas separation abilities by the use of mixed membrane technology.

References:

1. A. Mondal and B. Mandal, J. Membr. Sci., 2013, 446, 383–394.
2. A. Mondal and B. Mandal, J. Membr. Sci., 2014, 460, 126–138.
3. A. Mondal, M. Barooah and B. Mandal, Int. J. Greenh. Gas Control., 2015, 39, 27-38.
4. S. D. Kenarsari, D. Yang, G. Jiang, S. Zhang, J. Wang, A. G. Russell, Q. Wei and M. Fan, RSC Advances., 2013, 3, 22739-22773

Experimental Study of Alkali- Surfactant Flooding in Enhanced Oil Recovery

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Alkaline-Surfactant flooding is one of the most promising methods of enhanced oil recovery, where residual oil is produced by injecting alkaline-surfactant solution into the reservoir. In addition to surfactant, alkali is also added to the reservoir, which greatly improves its (surfactant) performance in IFT reduction. Further enhancement in the reduction of IFT can be achieved in presence of salt ions at optimum salinity. Proper knowledge and information regarding phase behaviour and interfacial tension is required for more efficient production of residual oil in the application alkali-surfactant EOR.
In this study, sand pack flood tests were performed for oil sample with a viscosity 33.4 mPa-s at 25^0C. Interfacial tension measurements were carried out with various concentration of alkali and surfactant to find the optimum concentration of the same. However optimum salinity is evaluated by phase behavior studies. The result shows that, a combine application of alkali and surfactant gives a better IFT reduction as compared to individual application of alkali or surfactant. The effect of salt (NaCl), with varying concentration, in alkali-surfactant activity is measured by phase behavior studies so as to determine the optimum salinity. Finally after evaluating the optimum concentration of alkali, surfactant & NaCl (on the basis of lowest IFT and phase behavior studies), core flood test were performed, which revealed that addition oil i.e. of about 27.32% OOIP can be obtained as tertiary oil recovery.

Experimental and Theoretical Investigations of Dehydrogenation of Amine Boranes facilitated by Thiocyanate Ionic Liquids

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The present investigation reports the thermal dehydrogenation and mechanistic investigation of ammonia borane (AB) and ethylene diamine bisborane (EDAB) at 105°C in 1-ethyl-3-methyl imidazolium thiocyanate ([EMIM][SCN]). [EMIM][SCN] was chosen on the basis of a-priori prediction of infinite dilution activity coefficient using quantum chemical based COSMO-SAC method. Fifteen ionic liquids (ILs) based on thiocyanate anion comprising cations from imidazolium, pyrrolidinium, ammonium family were used in the **CO**nductor like **S**creening **MO**del – **S**egment **A**ctivity **C**oefficient (COSMO-SAC) model. The IL with the highest predicted solubility converged to [EMIM][SCN] which was then used for dehydrogenation reactions. Dehydrogenation of AB/[EMIM][SCN] was found to produce ~1.64 equivalent of hydrogen with an induction period of 60 min, while EDAB/[EMIM][SCN] released ~2.37 equivalent of hydrogen having an induction period of 30 minutes. However, the composite system of AB and EDAB in [EMIM][SCN] does not release hydrogen upto 240 min. DFT optimized geometries followed by natural bond orbital (NBO) analysis revealed the formation of hydrogen bond between IL and amine borane moiety. Further, the presence of the stronger dihydrogen bond among protic and hydridic hydrogens was also observed in AB+EDAB/[EMIM][SCN] system resulting in longer induction period for dehydrogenation.

Utilization of Silk for Packaging, Wound Healing and Cancer Therapy facilitated by Thiocyanate Ionic Liquids

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In the present study we have utilized silk fibers obtained from waste pierced Muga (antheraea assama) silk cocoons. The silk fibers upon degumming are subjected to acid hydrolysis to prepare crystalline silk nano-discs (CSNs) which are discotic in shape with a diameter ~50 nm and thickness of ~3 nm. CSNs are highly crystalline (~97%), hydrophobic in nature, and comparatively less explored material for packaging, wound healing and cancer therapy. CSNs are melt compounded with poly(lactic acid) (PLA) using twin-screw extruder and the fabricated PLA/CSN bionanocomposites show promise in the field of packaging with good mechanical strength (~63 MPa), improved barrier properties: oxygen permeability (OP) ~70% and water vapor permeability (WVP) ~30%. Apart from packaging the nanofibrous scaffolds prepared using electrospinning, we found that PLA/CSN scaffolds show improved fibroblast (BHK-21) proliferation, required moisture permeability for wound healing. We also prepared magnetic CSNs for preparation of scaffolds which showed hyperthermia effects and can have huge potential in cancer therapy.

References:

[1] P. Dhar; A. Kumar; V Katiyar, ACS Applied Materials & Interfaces 8, 18393-18409 (2016).
[2] R. B. Valapa, G. Pugazhenthi; V. Katiyar, International Journal of Biological Macromolecules 89, 70-80 (2016)
[3] M. Tesfaye; R. Patwa; A. Gupta; M. J. Kashyap; V. Katiyar, International Journal of Biological Macromolecules 101, 580-594(2017)

Bi-metallic Catalyst for CO-free Hydrogen Production with High Temperature Steam Reforming of Methanol

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Hydrogen fed to fuel cell is a potential alternative to burning of fossil fuels for power generation. Hydrogen can either be fed using compressed cylinders which poses a safety hazard due to its low volumetric density or it can be produced on-site. The most commonly used technology for hydrogen production is, steam reforming. Catalytic steam reforming of resources such as methane, methanol, and ethanol produces hydrogen along with CO, CO_2 and other hydrocarbon gases. However, proton exchange membrane (PEM) fuel cells require hydrogen of high purity as feed, with CO levels below 10 ppm [1- 3]. The impurities if present will poison the Pt-catalyst loaded on the fuel cell anode. Amongst the available sources methanol is considered as an optimal choice due to its high H/C ratio, no C/C ratio, low tendency for soot formation and easy storage at room temperature.Hydrogen can be effectively generated from methanol through steam reforming, which is an endothermic reaction [1]. However, formation of CO at relatively high temperature requirement (250-350 °C) of steam reforming of methanol poses main challenge. Therefore, the primary aim of the present study is to synthesize a catalyst that sustain high temperature and minimize CO formation without affecting the hydrogen production rate. The current work investigates bi-metallic catalysts supported on Al_2O_3-Zn-ZrO_2 to determine a catalyst with minimal CO selectivity at higher temperatures for methanol steam reforming. Using incipient wetness impregnation, mono-metallic catalysts with Cu, Ni, Fe, Pd and Ru as active metal were synthesized and compared with bi-metallic catalysts having Fe as the second metal. Bi-metallic catalysts such as Cu-Fe, Ni-Fe and Ru-Fe were synthesized, characterized and tested along with Ni-Cu and Cu-Ru supported on Al_2O_3-Zn-ZrO_2. For all catalysts, metal support interactions were characterized in detail using temperature programmed reduction (TPR). Activity testing was performed in a fixed bed reactor at 350°C, GHSV 9000h-1 and S/M 3 (molar ratio). Lastly, reaction mechanism was proposed in assistance with in situ DRIFT IR analysis.

References:

1. Farsi, A.; Mansouri, S. S., Arabian Journal of Chemistry 2016, 9, S28-S34.
2. Freni, S.; Cavallaro, S.; Mondello, N.; Spadaro, L.; Frusteri, F., Catalysis Communications 2003, 4, (6), 259-268.
3. Guan, G.; Kaewpanha, M.; Hao, X.; Abudula, A., Renewable and Sustainable Energy Reviews 2016, 58, 450-461.

Isolation and Characterization of Cellulose Fibres and Cellulose Nanocrystal from Jute Fibre by Acid Hydrolysis

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Chemically purified cellulose were extracted from jute fibre by bleaching and alkali treatment and cellulose nanocrystals were isolated by sulphuric acid hydrolysis at different concentration (30, 45 and60 wt.%) and hydrolysis time (30, 45 and 60 min). Morphological investigation such as FESEM, FETEM was performed. CNC had a rod like shape which was confirmed by FESEM and FETEM. FTIR analysis shows removal of non-cellulosic compound in successive chemical treatment. Increase in crystallinity with successive chemical treatment was confirmed by XRD analysis. Thermal stability of the fibre and CNC was also investigated. Particle size distribution and zeta potential was measured by dynamic light scattering analyser.

Metal Oxide Promoted Porous Materials for Drug Delivery

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In this work, the emphasis is on various metal oxide promoted porous materials such as silica (SiO_2) and metal organic frameworks (MOFs) for the transportation of anticancer drug doxorubicin hydrochloride. In the health domain, one of the daunting challenges is the efficient delivery of the anticancer drugs to the targeted cells, as conventional anticancer medicines cannot differentiate between cancerous and normal healthy cells. In this work, MIL-100 (MOF) and MCM-41 (silica) was chosen as porous materials. Magnetite (Fe_3O_4), a low-toxic magnetic nanomaterial of 10- 25 nm was synthesized and further developed to Fe_3O_4@SiO_2 and Fe_3O_4@MIL100 carriers. Magnetite was prepared by conventional chemical co-precipitation method using of Fe 2+ and Fe 3+ aqueous salt solutions. Fe_3O_4@SiO_2 was prepared by sol-gel procedure, upon addition of tetraethyl orthosilicate (TEOS) as a silica precursor, where Fe_3O_4@MIL100 was synthesized by solvothermal route through heteronucleation of MIL-100 networks on the outer surface of Fe_3O_4 particles. Doxorubicin hydrochloride (DOX), a well-known anticancer drug for the treatment of various cancer diseases like leukaemia, lymphoma, and carcinoma was chosen as a model drug for present study. The loading experiments were carried out by mixing of DOX aqueous solution with above described carriers at a fixed concentration. For release study, DOX loaded carriers were dispersed into simulated phosphate-buffered saline (PBS) solution of pH 7.4 at 37 °C. The mass percentage of loaded DOX and DOX release profile for different carriers were estimated through analysis of the solution phase by UV-Vis spectrophotometer.

Abstract

Alkaline-Surfactant flooding is one of the most promising methods of enhanced oil recovery, where residual oil is produced by injecting alkaline-surfactant solution into the reservoir. In addition to surfactant, alkali is also added to the reservoir, which greatly improves its (surfactant) performance in IFT reduction. Further enhancement in the reduction of IFT can be achieved in presence of salt ions at optimum salinity. Proper knowledge and information regarding phase behaviour and interfacial tension is required for more efficient production of residual oil in the application alkali-surfactant EOR.
In this study, sandpack flood tests were performed for oil sample with a viscosity 33.4 mPa-s at 25^0C. Interfacial tension measurements were carried out with various concentration of alkali and surfactant to find the optimum concentration of the same. However optimum salinity is evaluated by phase behavior studies. The result shows that, a combine application of alkali and surfactant gives a better IFT reduction as compared to individual application of alkali or surfactant. The effect of salt (NaCl), with varying concentration, in alkali-surfactant activity is measured by phase behavior studies so as to determine the optimum salinity. Finally after evaluating the optimum concentration of alkali, surfactant & NaCl (on the basis of lowest IFT and phase behavior studies), core flood test were performed, which revealed that addition oil i.e. of about 27.32% OOIP can be obtained as tertiary oil recovery.

Characterization of some Assam crude oil using ASTM D-86 methods

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The focus in oil industry is to carryout exploration and exploitation and to develop hydrocarbon prospects and commercially produce oil and natural gas in an environmentally harmonious manner. The petroleum is a homogeneous mixture consisting of saturated compounds like alkanes and ring structures like napthanes and aromatics which can be separated by distillation. To characterize a petroleum fuel, one should know the API or specific gravity and the boiling point distributions of the fuel. The ASTM D-86 method covers the atmospheric distillation of petroleum products by using a laboratory batch distillation unit to determine quantitatively th e boiling range characteristics. In this study, five crude oil samples from a particular oil field Geleki have been taken for analysis with water content of 94%, 92%, 90%, 84% and 82% which are from barail reservoirs.

The API gravity of the samples are above 30 by which indicates that they belong to Key fraction I having a boiling range of 250-275°C at atmospheric pressure. The pour point of the samples was also determined which indicated the waxy nature of oil. The Universal oil product characterization constant (K) was basically towards mixed base crude. The determination of correlation index (CI) inclined towards the paraffinic side. The class of the crude oil was obtained as class C, A, E, A and A.

The distillation process was further extended and the True Boiling Point(TBP) and Equilibrium Flash Vaporization(EFV) was also plotted against all the samples of the field and the result obtained is as follows :

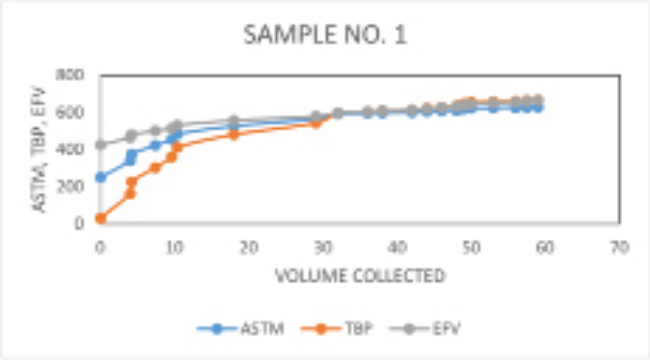

Figure 1: Combined ASTM, TBP, and EFV Distillation Curves for crude oil sample with water cut of 90%

The products of petroleum obtained from the crude oil was also estimated from the distillation method. The table obtained is as follows

Table 1: Products of Petroleum

Name	Carbon No.	Sample No. 1	Sample No. 2	Sample No. 3	Sample No. 4	Sample No. 5
GASOLINE (PETROL FRACTION)	C5-C8	7%	52%	28%	26%	50%
GASOLINE (NAPTHA FRACTION)	C7-C13	11%	41%	17%	34%	36%
KEROSENE	C11-C16		7%	22%	16%	10%
DIESEL OIL	C15-C18			16%	9%	4%
LUBRICATING AND FUEL OILS, PARAFFIN WAXES	C16-C40	15%		18%		

Kaolin based tubular ceramic membranes: Optimization of additive

Dr.G Pugazhenthi, Preeti Singh

Separation and purification have always been important for industrial as well as daily life. With the increase in demand of the purity at low cost and capital, membrane separation came into existence. There are many types of membranes available. Out of these various membranes, the ceramic membranes are common in use. In this work, the composition used for the preparation of tubular ceramic membranes was kaolin, quartz and calcium carbonate. Carboxymethyl cellulose has been used as the binder for this composition of the tubular membranes. The present research works basically focus on the fabrication of the tubular type ceramic membranes by the method of extrusion. The characterization of the ceramic membranes includes the porosity, FESEM analysis, chemical stability, mechanical stability, and pure water permeation test. The ceramic membranes with 1, 2 and 3 wt% of CMC content were characterized and the results were compared with the previous work. The optimized weight % of carboxymethyl cellulose that resulted in almost straight tubes, along with better mechanical stability and other characteristics is found to be 3wt%. The porosity of the membranes decreased with the increase in the weight percent of the carboxymethyl cellulose (CMC) binder. The mechanical stability of the ceramic membrane was evaluated by measuring its compressive strength. It has been observed that the compressive strength was highest for 3wt% CMC membranes. The compressive strength of 3 wt% CMC membranes was found to be 36MPa, whereas for the membranes without any additive, the compressive strength was 20.87MPa. The membranes synthesized using CMC are more chemically stable than the membranes synthesized without CMC. The weight loss for 3wt% CMC membranes was about 1% and 0.1% for acidic and alkaline media respectively. Water flux is reported to increase with increasing pressure as well as increasing weight percent of CMC binder, being highest for 3wt% CMC membranes.

Slurry formulation for Chemical Mechanical Polishing of Copper and Ruthenium

Chetana Patil, R. Prasanna Venkatesh

The continuous shrinkage in device feature size and increment in current density have prompted substantial prerequisites for ultra-smooth and ultra-flat surface in integrating chip (IC) fabrication process. Chemical mechanical polishing (CMP) is the key preparing venture in the planarization technique. It is required to enhance the CMP performance for reducing generation time and quality improvement of IC chips as well. During CMP process, the surface of the copper is planarized by means of both mechanical and chemical actions using a pad and slurry.

The development of slurry for polishing Copper (Cu) interconnects with Ruthenium (Ru) as a barrier material is still of greatest interest among microelectronics fabrication industries. So the objective of this study is to identify suitable slurry (abrasive, complexing agent and oxidizer) that could yield the desired polishing characteristics of Cu substrate and effect of various pH chemicals and additives on polishing performance of Cu substrate and selectivity between Ru and Cu.

In present work, chemical mechanical polishing of copper using fumed silica as an abrasive particle and potassium persulphate as oxidizer was investigated by means of Labopol-20/Laboforce- 50 polisher. The result reveals that potassium persulphate gives higher removal rate among the selected oxidizers. Slurry performance for CMP can be determined by using different parameters such as the effect of pH, the effect of abrasive and effect of the complexing agent.The removal rate is higher at pH 5(~788 nm/min). and it decreases as pH increases or decreases. Removal rate increases as the pH increases due to the addition of the complexing agent and it is higher at pH 9 (~1167 nm/min).

Keywords: Chemical Mechanical Polishing; Copper; Potassium Persulphate

Removal and recovery of surfactant by foam fractionation

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Water pollution has become a global concern due to its impact on human health as well as aquatic life. There are numerous sources of water pollution where surfactants and detergents are considered as major pollutants. A huge amount of detergents are released from laundries, chemical industries (e.g. soaps and detergents, sugar industry, personal care products, food, fabric, and pulp and paper), household washing, and cleaning operation. Some detergents are biodegradable, but many of them are resistant to biodegradation. Treatment of wastewater for reuse is necessary because pure water is the ultimate resource for life. Detergents have the poisonous effect on aquatic life if their concentration is high. They can destroy the external mucus layers, which protect the fish from bacteria and parasites. For removal of nonbiodegradable surfactants, standard oxidation methods are not effective. To remove such surfactants from wastewater, one of the promising methods is foam fractionation. In this method, surfactant solution is bubbled with air in a column to adsorb the surfactant molecules at the gas–liquid interface, which are then carried along the column to its top in the form of foam. By foam fractionation method surfactant can be recovered as well as treated.

Soot Oxidation, a brief introduction, and catalysis using perovskites

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Guiding faculty - Dr. Harshini Dasari

Due to better fuel efficiency, lower operating cost, higher durability and reliability diesel engines have increased in popularity compared to gasoline engines all around the world in the last decade. Diesel engines produce particulate matter in extremely tiny and toxic form, termed as Soot. Soot is characterized by tiny black particles consists mainly of carbon. When carbonaceous fuels are burned under normal reducing conditions soot is formed. Following reaction of soot can control pollution in industrial flames, diesel engine etc. Oxidation or gasification can be achieved with O_2, CO_2, NO or water vapor. In the presentation, the experimental techniques to oxidize soot are briefly discussed and catalysis is mainly highlighted. Perilous Environmental impact of soot and necessity of soot oxidation is also discussed. The chemistry of soot oxidation is discussed for both non-catalytic and catalytic conditions. The oxidation is combination of adsorption and desorption processes, which yields the primary products, the order of reaction and the activation energy. Perovskites (ABO3) are one of the mainly rising catalysts these days, due to their low cost and high effectiveness, research on the use of various perovskites for soot oxidation is going on. Preparation and analysis of perovskites are my research goals & it's still in progress.

Ionic Oxygen Sensor Devices; Oxygen ion conductors

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The review of oxygen ion sensor fabricated by using conducting polymers as the active layers .The search for oxide materials with high oxygen ion conductivity has attached much attention awing to both technological application(eg:fuel cell,oxygen separarion membrane) and the fundamental interest of high ionic mobility in inorganic solids. When a solid conductor is connected to a source suppose in a Cu conductor Kernels releases the last electron due to low IE.As a result sea of electrons are formed. Those free electrons occupy each void between the Kernels and diffuse either through solution or conduction plate from cathode to anode. Focusing on oxygen ion conductivity current flow occurs by the movement of oxide ions through the crystal lattice .This movement is a result of thermally activated hopping of the oxygen ions moving from crystal lattice side to crystal lattice side with a super imposed drift in the direction of electric field. The ionic conductivity is consequently strongly temperature dependent, but at high temperatures 1s/cm comparable to ionic conductivity found in liquid electrolytes.fig.1 shows a schematic outline of a fuel cell such as sofc&sensors can be implemented included planar, tubular or some hybrid of the two each design has its inherent merits and choice of geometry depends upon the device and its operating regime. The thin ceramic layers can be self supporting but very thin layers interest for low temperature must be supported in somewhere, device design must be complex and it must be stress that the choice of composition for this multi layer ceramic must be take into account chemical compatibility and durability in addition to need for high ionic conductivity.

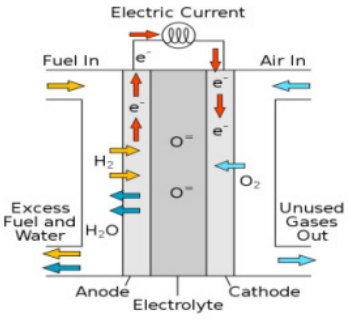

Fig1:diagram of sofc.

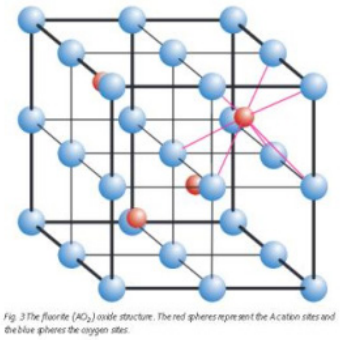

Fig. 3 The fluorite (AO_2) oxide structure. The red spheres represent the A cation sites and the blue spheres the oxygen sites.

Electrochemical reduction of CO2 into formic acid using Sn electrocatalyst as a cathode: A study on pH effect

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Carbon dioxide (CO_2) is one of the most significant greenhouse gasses. Increasing concentration of CO_2 in the environment causes global climate change. So transformation of CO_2 into value added products has grabbed much attention in the recent years. There are several methods[1-2] to convert CO_2 to value added products and electrochemical reduction is one of them. This electrochemical reduction has been referred as a promising method for producing some value added products from CO_2. This current work focuses on studying the effect of electrolyte pH on the Faradaic Efficiency (FE) values of formic acid production by electrochemical reduction of CO_2. The entire experiments were performed in a batch reactor where tin (Sn) embedded graphite rod was used as the cathode whereas a graphite rod was used as an anode. The electrocattalyst was prepared by electrodeposition[3-4] method from a dihydrate tin chloride ($Sncl_2.2H_2O$) solution. This electrocatalyst was characterized by XRD, FTIR and FESEM, which confirmed the formation of Sn nanoparticles. 0.5 M $KHCO_3$ was used as the electrolyte solution. The experiments were conducted at different applied voltages (2.5 V, 3 V, 3.5 V, 4 V and 5 V) and time intervals (5, 10, 15 and 20 min) for three different pH values (5.5, 7 and 8.5) of the electrolyte. For detection of the end product, ultra-fast liquid chromatography (UFLC) was used and it was observed that HCOOH was the only product formed for all the conditions. The experimental results show that the FE has a decreasing trend with the reaction time. Dependency of the FE on pH was also observed and it was found that the FE was increasing as the pH of the electrolyte solution was decreasing. The maximum FE value was observed at 5.5 pH electrolyte solution.

Keywords: CO2, Formic acid, Faradaic Efficiency, pH.

References:

1. Hu, B.; Guild, C.; Suib, S. L. Thermal, electrochemical, and photochemical conversion of CO2 to fuels and value-added products. J. CO2 Util. 2013, 1, 18-27.

2. Anpo, M. Photocatalytic reduction of CO2 with H2O on highly dispersed Ti-oxide catalysts as a model of artificial photosynthesis. J. CO2 Util. 2013, 1, 8-17.

3. Yadav, V. S. K.; Purkait, M. K. Electrochemical reduction of CO2 to HCOOH on a synthesized Sn electrocatalyst using a Co3O4 anode. RSC Adv. 2015, 5, 68551–68557.

4. Yadav, V. S. K.; Purkait, M. K. Electrochemical reduction of CO2 to HCOOH using zinc and cobalt oxide as electrocatalysts. New J. Chem. 2015, 39, 7348-7354.

Ionic Oxygen Sensor Devices: Gas sensors

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The search for oxide materials with high oxygen ion conductivity has attracted much attention owing to both technological application(eg:fuel cell,oxygen separarion membrane) and the fundamental interest of high ionic mobility in inorganic solids. When a solid conductor is connected to a source, suppose in a Cu conductor Kernels releases the last electron due to low ionization energy(IE).As a result sea of electrons are formed. Those free electrons occupy each void between the Kernels and diffuse either through solution or conduction plate from cathode to anode. Focusing on oxygen ion conductivity, current flow occurs by the movement of oxide ions through the crystal lattice .This movement is a result of thermally activated hopping of the oxygen ions moving from crystal lattice side to crystal lattice side with a super imposed drift in the direction of electric field. The ionic conductivity is consequently strongly temperature dependent, but at high temperatures 1S/cm comparable to ionic conductivity found in liquid electrolytes.Fig.1 shows a schematic outline of a fuel cell such as sofc&sensors can be implemented including planar, tubular or some hybrid of the two each design has its inherent merits and choice of geometry depends upon the device and its operating regime. The thin ceramic layers can be self supporting but very thin layers interest for low temperature must be supported in somewhere, device design must be complex and it must be stress that the choice of composition for this multi layer ceramic must be taken into account of chemical compatibility and durability in addition to need for high ionic conductivity. Semiconductor gas sensors(O2 sensors) utilize porous polycrystalline resistors made of semiconducting oxides. The working principle involves the receptor function played by the surface of each oxide grain and the transducer function played by each grain boundary. In addition, the utility factor of the sensing body also takes part in determining the gas response. Therefore, the concepts of sensor design are determined by considering each of these three key factors. The requirements are selection of a base oxide with high mobility of conduction electrons and satisfactory stability (transducer function), selection of a foreign receptor which enhances surface reactions or adsorption of target gas (receptor function), and fabrication of a highly porous, thin sensing body (utility factor). Recent progress in sensor design based on these factors is described.

Detection of melamine in milk using silver nanoparticles

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Economically motivated adulteration, a subset category of food fraud, was defined in 2009 by the Food & Drug Administration (FDA) as "the fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production," and can often encompass public safety effects through the unknown addition of allergens, toxins, and hygienic risks (Wheatley & Spink, 2013). According to the FDA database which tracks scholarly records of adulterated foods, dairy products are the second most reported category of adulterated food products (Moore, Spink, & Lipp, 2012). Melamine Adulteration is an economically motivated adulteration by means of dilution with milk or milk powder. It is of interest to consumers, manufacturers and governing bodies to have a simple, fast, accurate, and sensitive method to detect adulteration by melamine. Several methods have been developed to detect melamine adulteration in dairy products including immunological, chromatography, and molecular methods (Mayer, 2005). In this a method is developed to analyse milk adulteration in milk by visual inspection. The method works on the principle that in the presence of melamine AgNPs gets aggregated and show a visual colour change from yellow (due to unaggregated silver nanoparticles) to Ruby Red(due to aggregation of AgNPs). In the presence of melamine, aggregation of AgNPs are due to the amino group and ring nitrogen of melamine which strongly bind to the surface of citrate stabilized AgNPs by the ligand-exchange and this ligand-exchange decreases the electrostatic repulsion between individual AgNP and finally results in the aggregation of AgNPs. Change in diameter before and after addition of melamine is evaluated. AgNPs based surface plasmon resonance probes can be used to detect melamine in milk.

Key words: AgNP's, Melamine, Surface Plasmon Response

Modified Internal Model Control With PID Controller for Stable and Time Delayed Processes

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Internal Model Control (IMC) is a commonly used technique that provides a transparent mode for the design and tuning of various types of process. Mathematically an exactly modelled process can result perfect control. PID controllers are widely used in many process industries and they provide satisfactory results for set-point tracking as well as for disturbance rejection but their responses are generally oscillatory, which interns result mechanical fatigueness. The parameters of the physical system vary with operating conditions and time, hence it is essential to design a control system that shows robust performance and better set-point tracking. In this present study, we propose modified IMC controller which is based upon traditional controller technique such as IMC and PID. Several transfer functions are taken into account for the model of the actual process or plant(Exothermic CSTR, Four tank interacting systems) as we have exactly little or no knowledge of the actual process. The proposed method incorporates the effect of model uncertainties and disturbances entering into the process. The proposed method has been compared with other works of IMC, PID(Ziegler Nicholas), PID(Shamsuzzoha and lee) presented in the same field. Conclusively, simulated results shows that the proposed method provides better set-point tracking and disturbance rejection compare to methods.

Keywords: Internal Model Control, PID Controller, Exothermic CSTR, Four tank interacting system

Stability of Colloidal Microbubble in presence of fine particle with different surfactants

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Microbubbles are miniature gas bubbles of less than 100 μm in diameter [1]. The microbubbles are created by intense stirring of surfactant solution [2]. The characterisation of microbubbles can be carried out by studying the effect of process parameters on stability and gas hold-up of microbubble dispersions. Stability of microbubbles play very important role in its application for fine particle separation. Stability of microbubble depends on type of surfactant, concentration of surfactant, temperature and pH. Knowledge of the stability would enable us to use these colloidal microbubble more efficiently for their distinct applications. In this present work stability of microbubbles is studied using saponin surfactant by drainage mechanism in presence of fine mineral particles. The effects of concentration of surfactant, temperature and pH on the stability of the non-ionic microbubble are interpreted based on drainage mechanism. A model has been developed to interpret the stability of the microbubble based on drainage kinetics. The study may be useful for fine particle separation in batch and continuous mode with the help of microbubble flotation.

Keywords: Microbubble; stability; surfactants; fine particles; drainage kinetics; separation.

References

[1] F. Sebba, Separations using aphrons, Sep. Purif. Methods 14 (1985) 127-148.

[2] F. Sebba, Foams and Biliquid Foams: Aphrons, Willey, New York, 1987.

Molecular Dynamic Studies on the Extraction of Butanol from Aqueous Phase using Imidazolium based Ionic Liquids

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In our work, Molecular Dynamic Studies were performed to recover butanol from aqueous phase using four different Ionic Liquids (ILs). The ILs are based on 1-alkyl-3- methylimidazolium bis(trifluoromethylsulfonyl) imide ([RMIM][Tf_2N]), where R=ethyl, butyl, hexyl and octyl chain. The hydrophobicity of these ILs is known to be controlled by the alkyl chain length. In the Liquid Liquid Experimental studies, two clear phases were observed with each of these solvents. Initially MD simulation was performed with [OMIM][Tf_2N] to validate the reported experimental results. Results from extract and raffinate phases were then compared with the Liquid-Liquid Equilibrium (LLE) experimental studies for [OMIM][Tf_2N]-butanol-water to explain the effectiveness of the solvent. Further the simulations were carried out for all the four solvents by varying the solvent molecules or the composition of the feed. Simulations were run for a time period of 40 ns using OPLS-AA force field. A type II phase behaviour with a large immiscible region was observed for all compositions at T=300 K. The selectivity value computed was the highest (3583.73) for [OMIM] [Tf_2N] among the different Ionic Liquids. The distribution coefficient was found to be greater than unity for all the ILs. It indicates an easier dispersion of solute from aqueous phase to extract phase. Greater hydrophobicity of [OMIM] and [Tf_2N] led to an absence of IL in aqueous phase. Radial distribution function and running coordination number computation were done to provide a microscopic structure of the extract phase. From these two computational analysis, it was confirmed that a higher cation concentration was found to solvate the butanol molecules.

Detection of melamine in milk using silver nanoparticles

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Economically motivated adulteration, a subset category of food fraud, was defined in 2009 by the Food & Drug Administration (FDA) as "the fraudulent, intentional substitution or addition of a substance in a product for the purpose of increasing the apparent value of the product or reducing the cost of its production," and can often encompass public safety effects through the unknown addition of allergens, toxins, and hygienic risks (Wheatley & Spink, 2013). According to the FDA database which tracks scholarly records of adulterated foods, dairy products are the second most reported category of adulterated food products (Moore, Spink, & Lipp, 2012). Melamine Adulteration is an economically motivated adulteration by means of dilution with milk or milk powder. It is of interest to consumers, manufacturers and governing bodies to have a simple, fast, accurate, and sensitive method to detect adulteration by melamine. Several methods have been developed to detect melamine adulteration in dairy products including immunological, chromatography, and molecular methods (Mayer, 2005). In this a method is developed to analyse milk adulteration in milk by visual inspection. The method works on the principle that in the presence of melamine AgNPs gets aggregated and show a visual colour change from yellow (due to unaggregated silver nanoparticles) to Ruby Red(due to aggregation of AgNPs). In the presence of melamine, aggregation of AgNPs are due to the amino group and ring nitrogen of melamine which strongly bind to the surface of citrate stabilized AgNPs by the ligand-exchange and this ligand-exchange decreases the electrostatic repulsion between individual AgNP and finally results in the aggregation of AgNPs. Change in diameter before and after addition of melamine is evaluated. AgNPs based surface plasmon resonance probes can be used to detect melamine in milk.

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Internal Model Control (IMC) is a commonly used technique that provides a transparent mode for the design and tuning of various types of process. Mathematically an exactly modelled process can result perfect control. PID controllers are widely used in many process industries and they provide satisfactory results for set-point tracking as well as for disturbance rejection but their responses are generally oscillatory, which interns result mechanical fatigueness. The parameters of the physical system vary with operating conditions and time, hence it is essential to design a control system that shows robust performance and better set-point tracking. In this present study, we propose modified IMC controller which is based upon traditional controller technique such as IMC and PID. Several transfer functions are taken into account for the model of the actual process or plant(Exothermic CSTR, Four tank interacting systems) as we have exactly little or no knowledge of the actual process. The proposed method incorporates the effect of model uncertainties and disturbances entering into the process. The proposed method has been compared with other works of IMC, PID(Ziegler Nicholas), PID(Shamsuzzoha and lee) presented in the same field. Conclusively, simulated results shows that the proposed method provides better set-point tracking and disturbance rejection compare to methods.

Keywords: Internal Model Control, PID Controller, Exothermic CSTR, Four tank interacting system

Effect of dimethylsulfoxide on naphthenic acid corrosion of carbon steel

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Carbon steel corrosion in naphthenic acid (NA) and NA containing dimethylsulfoxide (DMSO) was investigated through weight loss measurements and electrochemical measurements such as open circuit potential and electrochemical impedance spectroscopy (EIS). EIS was measured at various overpotentials to investigate the mechanistic reaction pathway. Both electrical equivalent circuit (EEC) and reaction mechanism analysis (RMA) were employed to analyze the impedance data, after KKT validation. The result shows that the total impedance decreases on addition of DMSO to NA system, implying a higher corrosion rate in presence of DMSO. While the decrease in impedance with overpotential in both the system indicates that, no passive layer forms on the carbon steel surface. Based on RMA analysis, a multi-step dissolution mechanism with two intermediate adsorbed species is proposed for both the systems. SEM measurements reveal that the corrosion is of pitting type, and both the pit depth and the diameter of the corroded area increases on addition of DMSO.

Keywords: Carbon steel, Naphthenic acid, DMSO, EIS, EEC, RMA

Abstracts (Poster)

Chemistry

Effect of poultry manure on growth, yield and nutritional values of pop corn (zea mays var praecox)

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Field trials have established at the local paddy fields at Jaberikuchi village of Darrang district of Assam during the 2016 cropping seasons to investigate the influence of poultry manure on the performance of Pop corn (Zea mays Var Praecox). The treatments consisted of five rates of poultry manure (0, 1.0, 1.5, 2.0 and 2.5 tones/ha) laid out in a randomized complete block design (RCBD) with 4 replications. Maize growth parameters measured are plant height, stem girth, days to 50 % tasseling, while the yield parameters are number of cobs per plant, cob weight per plot and grain yield per hectare. Analysis is done for total fats, proteins, starch, reducing sugar, iron, potassium, sodium and phosphorous and the results are compared with the control. Data collected were subjected to analysis of variance (ANOVA) and means are tested using least significant difference (LSD) at ($p \leq 0.05$). The result obtained indicated that poultry manure significantly ($p \leq 0.05$) increased plant height, stem girth, number of cobs, cob weight and grain yield. It also enhances the nutritional quality of the pop corn.

Key words: Poultry manure, Pop corn, Growth and yield & Nutritional value

Trapping Toxic Amyloid Oligomers by Ultrafast Antiaggregation Agents: An Insight into Nano-Bio Interface

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Alzheimer's disease (AD) is pathologically highlighted by the aggregation of intracellular neurofibrillary tangles shaped by tau proteins and extracellular feeble torment by amyloid β-proteins (Aβ) in the patient brain. Numerous studies have demonstrated that the aggregation of Aβ into amyloid fibrils containing trademark cross-β-sheet structure in the mind of AD patients is firmly connected to the pathogenesis of AD and dissolvable Aβ oligomers and/or protofibrils are the most poisonous species, in charge of neuron brokenness and death. Here, in this work, nontoxic, biocompatible water soluble polymeric conjugate have been used to modulate toxic amyloid aggregates in human CSF and as well as in preformed amyloid aggregates from commercial Aβ1-40. This modulation strategy leads to the formation of nanoparticle- protein co-aggregates instead of toxic amyloid aggregates which is responsible for plaque formation and is related to disease progression. The intriguing prospect of amyloid fibrils using plasmonic materials technique as a scaffold for nanoparticle-protein hybrid materials is well delineated as this technique provides a direct link between spectral signal and protein conformation and can further be used to gain more information concerning the morphology of the protein deposits and facilitate a greater understanding of the conformational phenotype encoded in the native protein aggregates.

References

(1) Yankner, B. A.; Duffy, L. K.; Kirschner, D. A. Science 1990, 250, 279–282.
(2) Hardy, J.; Selkoe, D. J. Science 2002, 297, 353–356.
(3) Chowdhury, S. R.; Agarwal, M.; Meher, N.; Muthuraj, B.; Iyer, P. K. ACS Appl. Mater. Interfaces, 2016, 8 (21), 13309–13319.

Nutritional evaluation of some common dry fruits: a comparative study

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Dry fruits have been recognized as an abundant source in providing essential nutrients which supplies good amounts of proteins, fat, minerals like iron, phosphorous, potassium, sodium etc. An investigation aimed at determining the proximate composition and mineral content present in the dry fruit 'Dry coconut' (Cocos nucifera) and comparing it with nutritional values of other dry fruits viz. Peanut (Arachis hypogaea), Walnut (Juglans regia), Raisins (Vitis vinifera), Cashew nut (Anacardium occidentale) and Date palm (Phoenix dactylifera) was carried out in the department of Biochemistry and Agricultural Chemistry. Assam Agricultural University, Jorhat, during June-July, 2017.
The study revealed that the coconut was rich in fat (58.95%), protein (10.67 %). It also contained other nutrients like starch (4.75%), reducing sugar (0.05%), iron (5.07%), potassium (0.0032%), sodium (0.0009%) and phosphorous (0.11). Comparing these nutritional values of coconut with other 5 different dry fruits; viz. raisin, cashew nut, date palm, walnut and ground nut shows that coconut had greater amounts of potassium compared to some other dry fruits while it is intermediate in phosphorous content.

Keywords: Dry fruits, Coconut, Nutritional value etc.

Hydrothermal synthesis of carbon dot from rice water

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Fluorescent Carbon dots are an emerging class of nanomaterials made from carbon sources that have been hailed as potential, non-toxic replacement to traditional semiconductor quantum dots. Due to their water solubility, low toxicity, and photochemical stability they possess diverse properties. Various applications of carbon dots have been observed in various fields like bioimaging, sensing, drug delivery etc. Carbohydrates are readily available chiral bio-molecules in nature which offer an attractive and cheap starting material from which to synthesize carbon dots with distinct features and interesting applications. Thus, the present project work demonstrates facile synthesis of carbon dot from rice water as a waste carbohydrate source.

Keywords: Carbon Dots, Fluorescent, Rice water etc.

Application of Humic Acid to Tune Nanofluidic Transport of Lamellar Graphene Oxide Membrane

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The chemical similarity of graphene oxide (GO) and humic acid has been exploited to fine-tune ionic and molecular transport properties of lamellar GO membrane. Introduction of humic acid (in 10, 15 and 20 %) found to improve nanofluidic transport characteristics, such as ionic mobility, molecular selectivity, diffusivity and permeability of the GO membrane. Remarkably, membrane prepared with 15 % humic acid displayed superior proton mobility (μH =1.04 × 10-4 cm2.V-1.s-1), in- plane diffusivity (D =3.3 × 10-5 cm2.s-1), and cross-plane permeability (of liquid water (PL) =2.03 × 10-4 mm.g.cm-2.s-1.bar-1 and water vapor (PV)=1.02 × 10-6 mm.g.cm-2.s-1.bar-1) than that of pure GO and other composite membranes. Correlation of nanofluidic parameters with XRD data suggests that slight deviation of the channel structure from perfect 2D geometry is advantageous for the nanofluidic transport. The activation energy values (~ 0.07 to 0.1 eV) suggested that in all the GO- HA membranes the proton transport occurs through a Grotthuss-like hoping mechanism. Introduction of humic acid into two-dimensional GO channels was also found to augment solution stability and mechanical robustness of the pristine membrane.

Bio-inspired Robust Underwater Extreme Oil-wettability: A solution to Aqueous-oil Contamination

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Bioinspired underwater super-oil-wettability (superoleophilic/superoleophobic) properties are always important being a potential avenue in different aspects related to healthcare, environment, energy, etc.1-2 However, the inherent poor durability of the materials that are mostly developed using polymeric hydrogel3-4, metal oxide coatings5-6 and electrostatic multilayers often in concern of these wettability properties in practical scenarios. Here, 'amine-reactive' polymeric multilayers of nano-complex7 were developed to fabricate 'internal' underwater superoleophobic/superoleophilic coatings with impeccable physical/chemical durability. This allows the super- wetting properties to exist beyond the surface of the material and remain intact even after severe physical damage including erosion of the material and continuous exposure to an artificial-marine environment for more than 80 days. Besides, the wettability is highly useful for any kind of oil-aqueous contamination either by protection /prevention or separation process. Moreover, this current design allowed us to attempt for a surface-independent modification having unprecedented durability with direct experimental demonstrations, and provided a basis to develop highly durable super-oil-wettability properties under water8. It is believed that this contemporary study will make a worthwhile contribution on developing multifunctional materials for widespread practical applications by exploiting these super-oil-wetting properties.

1. Z. Chu, Y. Feng and S. Seeger, Angew. Chem., Int. Ed., 2015, 54, 2328.
2. Y. Wu, B. Su, L. Jiang and A. J. Heeger, Adv. Mater., 2013, 25, 6526.
3. M. J. Liu, S. T. Wang, Z. X. Wei, Y. L. Song and L. Jiang, Adv. Mater., 2009, 21, 665.
4. Y. Cai, Q. Lu, X. Guo, S. Wang, J. Qiao and L. Jiang, Adv. Mater., 2015, 27, 4162.
5. X. Liu, J. Zhou, Z. Xue, J. Gao, J. Meng, S. Wang and L. Jiang, Adv. Mater., 2012, 24, 3401.
6. F. Zhang, W. B. Zhang, Z. Shi, D. Wang, J. Jin and L. Jiang, Adv. Mater., 2013, 25, 4192.
7. A. M. Rather and U. Manna, Chem. Mater., 2016, 28, 8689.
8. D. Parbat and U. Manna, Chem. Sci., 2017, 8, 6092.

Search for Natural Pigments as Potential Universal Indicators

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Natural indicators with the pigments extracted from natural sources like plants, animals, minerals, etc. have been grown in the past decades due to its potential applicability over a wide range of applications and the availability of the resources. Although, these natural dyes have been used for centuries, its durability is considered as the main drawback for their applicability. However, they are eco-friendly, biodegradable, and non-carcinogenic in comparison to synthetic pigments. In this research work, the pigment was extracted from numbers of indigenous flowers in Assam, fruits, and other plant parts, and the extracts were used as an indicator over a wide range of acid-base titrations. The colourS of the extracts in pH ranging from 1-14 were recorded and a spectrum of different colours obtained for all the indicators. Anthocyanins from the flowers and fruits are isolated and characterized by UV and IR spectra.

Key Words: Natural indicator, flowers, fruits, pH, universal indicator

Acceptorless alcohol dehydrogneation by bifunctional molecular catalyst

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Alcohols are unreactive and require strong inorganic oxidants to convert to synthetically useful carbonyl compounds. Acceptorless dehydrogenation of alcohol is a green and atom-economic alternative, which provides aldehyde (or ketone) without the use of sacrificial acceptor molecules and the side product is molecular hydrogen1. Bifunctional catalysts are attractive approach in this context as they activate alcohol without redox change on the metal. Furthermore, metal–ligand cooperation can facilitate substrate activation and cover a low-energy dehydrogenation pathway2. Efficiency and selectivity of the catalysis can be tuned via electronic diversity and structural flexibility of the cooperating ligands. Herein we have discussed the designing synthesis and characterisation of a tunable bifunctional catalyst, and tried to rationalise the possible non innocent behaviour of the ligands.

References:
1. Tseng, K.N.T.; Kampf, J.W. and Szymczak, N.K. ACS Catal. 2015, 5 (9), 5468–5485
2. Wang, Q.; Chai, H. and Yu, Z. Organometallics. 2017, 36 (18), 3638–3644

Self-Cleanable and Self healable Superhydrophobic Print of Water Soluble Agent

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Lotus leaf[1] is a well-known example of bio-inspired non-adhesive superhydrophobicity because of its ability to repel water extremely (advancing contact angle ≥150°) with a very low roll-off angle (≤10). The low-energy surface coated hierarchical and rough topography plays a important role in achieving superhydrophobicity. Any kind of physical damage to the hierarchical features may result in loss of anti-wettability. Therefore, self-healing ability is essential for the utility of this property in practical circumstances. However, the attempts to develop such material are rare in the literature. Very few materials have been recently introduced that are capable of recovering their micro/nano features, but only after application of appropriate external stimuli.2-3 In this work, we have reported a superhydrophobic material which is highly durable and can completely able to restore the lost non- adhesive property without application of any external stimuli4. This synthesized material exhibited simple, unique and reversible switching property between two bio-inspired special wettabilities—that are a) non-adhesive (lotus leaf) and b) adhesive (rose petal) superhydrophobicity. It was further strategically exploited in developing rewritable aqueous patterns on the extremely water-repellent polymeric coating. This synthesized material was capable of impregnating hydrophilic agents, directly from aqueous phase without sacrificing the embedded antifouling property of the polymeric coating, and which is of potential interest in many fundamental and applied contexts, including synthesis of smart drug delivery systems, catalysis, self-assembly of colloids, cell culture chip, robust open microfluidic system, reusable chemical sensing etc.

References
1. Barthlott, W.; Neinhuis, C. Purity of the sacred lotus, or escape from contamination in biological surfaces. Planta, 1997, 202, 1-8.
2. Lee, W. K.; Jung, W. B.; Sidney R.; Nagel, T.; Odom, W. Stretchable Superhydrophobicity from Monolithic, Three-Dimensional Hierarchical Wrinkles. Nano Lett. 2016, 16, 3774-3779.
3. Manna, U.; Carter, M. C. D.; Lynn, D. M. "Shrink-to-Fit" Superhydrophobicity: Thermally-Induced Microscale Wrinkling of Thin Hydrophobic Multilayers Fabricated on Flexible Shrink-Wrap Substrates. Adv. Mater. 2013, 25, 3085-3089.
4. Das, A.; Deka, J.; Raidongia, K.; Manna, U. Robust and Self-Healable Bulk-Superhydrophobic Polymeric Coating. Chem. Mater., 2017, 29, 8720–8728

Removal of as and fe in household drinking water by arsiron nilogon process: a study in titabar area of jorhat, assam

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Arsiron Nilogon is one of the most efficient, low cost, safe, non requirements of power and user friendly process used for the removal of arsenic and iron from the contaminated groundwater. The paper depicts the installation and the complete working process of Arsiron Nilogon. Water samples were collected from various parts of Titabar sub division, Assam where the arsenic concentration is in the range 50-250 ppb. Following that, three Arsiron Nilogon units were installed and arsenic removal was studied. The concentration of arsenic, removed by this process is in the range 0-5 ppb. Thus this result successfully validated the high efficiency of Arsiron Nilogon and made the technique highly applicable for rural areas.

Keywords: Arsiron Nilogon, removal, ground water etc.

Biomimetic Crystallization of Zinc Phosphate in Gold Nanoclusters Assembly for Enhanced Cellular Imaging

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A new pathway to develop a luminescent probe for cellular imaging via biomimetic crystallization of zinc phosphate in peptide stabilised gold nanocluster (Au NC) assembly has been demonstrated. The nanocluster assembly was induced by complexation of peptide stabilising the Au NCs (obtained following enzymatic digestion of BSA Au NCs) with the zinc ions. The protein fragments acted as structure directing agent during the zinc phosphate formation via their consequent assembly with the zinc ions that acted as nucleation centre. The zinc phosphate formation led to the simultaneous recovery of initial luminescence of Au NCs, lost due to enzymatic degradation allowing it to be used for convenient fluorescence imaging probe. The as-developed hybrid organic-inorganic nanostructure offered clustering of the Au NCs in one platform for efficient internalization by cancer cells (HeLa). In addition, its effective resistance towards protease activity (without any additional protease inhibitor), mesoporous nature and excellent stability in human blood serum made the present nanocomposite ideal for imaging mammalian cells.

Reference

Dutta, A.; Dutta, D.; Sanpui, Pallab.; Chattopadhyay, A. Biomimetically Crystallized Zinc Phosphate decorated with Gold Atomic Clusters for Protease-Resistant Imaging. Chem. Commun. 2017, 53, 1277-1280.

Grafting of Corn starch-PLA (polylactic acid) by Simple Hydrochloric acid Catalysis

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Starch-lactic acid copolymers found excellent degradability therefore, biodegradable polymers are with specialized applications. Thus, scientist turns their attention towards grafting of biopolymer with biodegradable material or natural polymers. Biodegradable could be made by grafting with natural biodegradable polymer, thus the researcher has been reported methods of grafting on natural starch with PLA (poly lactic acid) catalyzed by ammonia, water (Y. Yung and Tang, 2015). And also by using stannous2-ethyl-hexanoate (Xie, Shi, Xie, & Zhou, 2006), initiation by tBuOK (You, Shen, Jiao, Li, & Zhu, 2002) and even the NaOH (Wang Q and co- workers, 2012) and HCL also found effective in grafting with

different starch.
A convenient and simple, method for crone starch-PLA grafting catalyzed by Hydrochloric acid will be presented. The grafting was done in presence of K2S2O8 and DMF as a solvent. The characterization of the grafted material (Starch-PLA-HCL) by FTIR and SEM has been successfully done. The degree of percentage of the grafting was found to be 56%. For The comparison of starch-PLA grafting with NaOH catalyzed material has been prepared. The degree of grafting of HCL Catalyzed material comparatively found more.

Key word: Corn starch, polylactic acid, Hydrochloric acid, Catalysis etc.

Low molecular weight organogels and their application as dye adsorbant

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Low-molecular-weight (LMW) organogelators is trending nowadays as advanced functional materials because of their immense applications in various fields. These are a family of small molecules that can immobilize organic solvents through molecular self-assembly, and thus represent a novel class of supramolecular materials1 .Literature encompasses a number of low-molecular weight organogelators, and their study in various applications as templated materials, drug delivery agents, cosmetics, sensors, enzyme-immobilization matrices,as well as in phase selective gelation and water purification by dye adsorption2-3 .These gelators create a three-dimensional(3D) network in organic solvents by self-organizationof the monomeric species to higher-order structures,which are driven by specific noncovalent intermolecular interactions, commonly electrostatic, dipole–dipole, van der Waals, p–p stacking, and/or hydrogen bonding4. The emerging development of efficient low-cost organogelators is of great interest. In the past few years, a number of LMW organogelators like carbohydrates, amino acids, steroids, organometallic compounds etc. have been studied5 . Among these, amino acids have emerged as one of the potential organogelator molecules that are easy to avail and are cost effective. Also, amino acids are capable of forming gels in a wide variety of organic solvents. Understanding the fact that the behaviour of gelation is largely affected by molecular chemistry and the chemical environment such as solvents, in this report, we have focussed on the gelation behaviour of three amino acids derivatives under different experimental conditions and their application as dye adsorbant in water purification. The three amino acids chosen for this study are: γ-aminobutyric acid, L-phenylglycine and L-phenylalanine.The N-termini of all the three amino acids are protected by Fmoc- group and the C-termini are protected by by N,N' –Dicyclohexylurea.

References:
1. a) P. Terech, R. G. Weiss, Chem. Rev. 1997, 97, 3133 – 3159; b) J. H.van Esch, B. L. Feringa, Angew. Chem. 2000, 112, 1351 –1354;Angew. Chem. Int. Ed. 2000, 112, 2263 – 2266; c) D. J. Abdallah,R. G. Weiss, Adv. Mater. 2000, 12, 1237 – 1247; d) M. George, R. G.Weiss, Acc. Chem. Res. 2006, 39, 489 – 497
2. a) N. M. Sangeetha, U. Maitra, Chem. Soc. Rev. 2005, 34, 821 – 836; b) M. Suzuki, Y. Sakakibara, S. Kobayashi, M. Kimura, H. Shirai, K. Hanabusa, Polym. J. 2002, 34, 474 –477; c) R. J. H. Hafkamp, B. P. A. Kokke, I. M. Danke, H. P. M. Geurts, A. E. Rowan, M. C. Feiters, R. J. M. Nolte, Chem. Commun. 1997, 545 – 546; d) Y. Ono, K. Nakashima, M. Sano, Y. Kanekiyo, K. Inoue, J. Hojo, S. Shinkai, Chem. Commun. 1998, 1477 –1478; e) J. H. Jung, H. Kobayashi, M. Masuda, T. Shimizu, S. Shinkai, J. Am. Chem. Soc. 2001, 123, 8785 – 8789; f) E. D. Sone, E. R. Zubarev, S. I. Stupp, Angew. Chem. 2002, 114, 1781 –1785; Angew. Chem. Int. Ed. 2002, 41, 1705 – 1709
3. a) S. Kobayashi, N. Hamasaki, M. Suzuki, M. Kimura, H. Shinkai, K. Hanabusa, J. Am. Chem. Soc. 2002,124, 6550 –6551; b) C. Zhan, J. Wang, J. Yuan, H. Gong, Y. Liu, M. Liu, Langmuir2003, 19, 9440 – 9445; c) S. Kobayashi, K. Hanabusa, N. Hamasaki, M. Kimura, H. Shirai, S. Shinkai, Chem. Mater. 2000, 12, 1523 –1525; d) F. S. Schoonbeek, J. H. van Esch, B. Wagewijs, D. B. A. Rep, M. P. de Haas, T. M. Klapwijk, R. M. Kellog, B. L. Feringa, Angew. Chem. 1999, 111, 1486 – 1490; Angew. Chem. Int. Ed. 1999,38, 1393 –1397; e) F. Placin, J.-P. Desvergne, J.-C. Lassegues, Chem. Mater. 2001, 13, 117 – 121; f) A. Shumburo, M. C. Biewer, Chem. Mater. 2002, 14, 3745 – 3750; g) G. M. Whitesides, J. P. Mathias, C. T. Seto, Science1991, 254, 1312 –1319.

4. a) N. Mohmeyer, H. W. Schmidt, Chem. Eur. J. 2005, 11, 863 –872; b) M. Suzuki, M. Nanbu, M. Yumoto, H. Shiraib, K. Hanabusa, New J. Chem. 2005, 29, 1439 – 1444; c) M. Suzuki, T. Nigawara, M. Yumoto, M. Kimura, H. Shirai, K. Hanabusa, Org. Biomol. Chem. 2003, 1, 4124 –4131; d) H. Yang, T. Yi, Z. Zhou, Y. Zhou, J. Wu, M. Xu, F. Li, C. Huang, Langmuir2007, 23, 8224 –8230; e) M. Suzuki, T. Sato, H. Shiraib, K. Hanabusa, New J. Chem. 2006, 30, 1184 – 1191; f) N. Mohmeyer, H. W. Schmidt, Chem. Eur. J. 2007, 13, 4499 – 4509; g) M. Suzuki, Y. Nakajima, M. Yumoto, M. Kimura, H. Shirai, K. Hanabusa, Org. Biomol. Chem.2004,2, 1155 – 1159.
5. Gaikar. V.G et al., Ind.Eng.Chem.Res. 2012,51,15374-15385.

Preparation and Characterization of Photo-responsive TPCC4-Chitosan-PVA thin film for biomedical application

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With an objective to design biostable chitosan-PVA-TPCC4 film for the biomedical applications, we have prepared chitosan-PVA conjugate film with gallic acid (GA) with TPCC4 and have characterized their physicochemical properties, biostabilty and photostability. Scanning electron microscopic (SEM) analysis revealed a well ordered with properly oriented and well-aligned interconnected structure and fibrous network of these films. The diffraction patterns show broadens in the same region of the spectrum indicating the amorphous and crystalline characteristics. FT-IR results suggest that the structural integrity of film and PVA along with GA favours the molecular stability. The hydrophobic core of the GA molecules incorporates itself into the hydrophobic areas of the chitosan-PVA groups, whereas –OH and –COOH moieties of GA establish multiple H-bonds with neighboring chitosan molecules, thereby improving the swelling and water uptake properties. These may find use in the preparation of photoresponsive biomaterials for cardiac tissue engineering applications.

Key words: Photosensitivity, TPCC4, thin film, biomedical etc.

Assam Bora Rice Starch-Based Hydrogels for Biomedical Applications

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A novel biodegradable hydrogel composed of Assam Bora rice starch, polyvinylalcohol (PVA) and acryl amide(AM) have been prepared by free radical polymerization method using N,N1 - methylenebisacrylamide(MBA) as cross-linking agent and potassium persulfate (KPS) as initiator. The structure, morphology, and thermal nature of hydrogel are investigated by FT-IR (Fourier Transform Infrared Spectroscopy), SEM(Scanning Electron Microscopy), and TGA(Thermo gravimetric Analysis) respectively. The water sorption behaviour of the hydrogel is investigated under different conditions of the swelling medium. The Swelling study shows that the water uptake property of the hydrogel is dependent on composition of polymer, pH and ionic concentration of the medium. The drug release behaviour of the prepared hydrogels are also studied.

Key Words: Hydrogel, Assam Bora rice starch, PVA, AM, MBA, KPS, drug release

Nutritional evaluation of some common dry fruits: a comparative study

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Dry fruits have been recognized as an abundant source in providing essential nutrients which supplies good amounts of proteins, fat, minerals like iron, phosphorous, potassium, sodium etc. An investigation aimed at determining the proximate composition and mineral content present in the dry fruit 'Dry coconut' (Cocos nucifera) and comparing it with nutritional values of other dry fruits viz. Peanut (Arachis hypogaea), Walnut (Juglans regia), Raisins (Vitis vinifera), Cashew nut (Anacardium occidentale) and Date palm (Phoenix dactylifera) was carried out in the department of Biochemistry and Agricultural Chemistry. Assam Agricultural University, Jorhat, during June-July, 2017.
The study revealed that the coconut was rich in fat (58.95%), protein (10.67 %). It also contained other nutrients like starch (4.75%), reducing sugar (0.05%), iron (5.07%), potassium (0.0032%), sodium (0.0009%) and phosphorous (0.11). Comparing these nutritional values of coconut with other 5 different dry fruits; viz. raisin, cashew nut, date palm, walnut and ground nut shows that coconut had greater amounts of potassium compared to some other dry fruits while it is intermediate in phosphorous content.

Keywords: Dry fruits, Coconut, Nutritional value etc.

The dispute on monosodium glutamate: reality versus belief

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One of the most famous food ingredients whose safety has been disputed about for a long time is Monosodium glutamate (MSG). MSG is a flavour enhancer which is responsible for cracking up the sensation of Umami flavours (or savory taste) in our tongue. It carries a dreadful reputation of being very harmful to the human health and the root cause of many health problems like headaches, allergic reactions, Chinese Restaurant Syndrome, infantile obesity, development of Type 2 diabetes. However, many scientific studies have repeatedly stated that MSG is safe when taken at ordinary levels of consumption for common people. With all the hype that it has caused amidst people following the wide coverage by big press institutes and the myriad of varying opinions that different minds have on this substance, the question arises on what the truth is. This paper depicts a study on the root of MSG debate, the structure and functioning of MSG on human health, scientific evidences on its safety and danger, common products where it masquerades with other names and plausible alternatives to MSG.
Key Words: Monosodium glutamate (MSG), food products, diseases, safety etc.

Surface complexation assisted white light emission from Mn2+ doped ZnO quantum dots

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Herein, we report white light emission for a single wavelength excitation (lex 350 nm) from a quantum dot complex (QDC). The single-component QDC formed after the formation of a complex on the surface of Mn2+ doped ZnO quantum dot (QD) using 8-hydroxyquinoline (HQ). The white light emitted as a result from the combination of blue emission from Mn2+ doped ZnO quantum dot with broad yellow emission from the formation of a complex (Zinc quinolate, ZnQ2) mainly on the surface of quantum dot. The optimization of the successive products is performed to enhance the emission peaks and get the desired results.

Removal of as and fe in household drinking water by arsiron nilogon process: a study in titabar area of jorhat, assam

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Arsiron Nilogon is one of the most efficient, low cost, safe, non requirements of power and user friendly process used for the removal of arsenic and iron from the contaminated groundwater. The paper depicts the installation and the complete working process of Arsiron Nilogon. Water samples were collected from various parts of Titabar sub division, Assam where the arsenic concentration is in the range 50-250 ppb. Following that, three Arsiron Nilogon units were installed and arsenic removal was studied. The concentration of arsenic, removed by this process is in the range 0-5 ppb. Thus this result successfully validated the high efficiency of Arsiron Nilogon and made the technique highly applicable for rural areas.
Keywords: Arsiron Nilogon, removal, ground water etc.

Chemical tricks Arsenic and Fluoride removal from groundwater by OCOP and PACLT methods

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Long-term use of water with high level of arsenic can cause several health problems including cancer. Similarly, long-term drinking of water containing high fluoride content can lead to manifestations of skeletal, dental and soft tissue fluorosis. Groundwater of vast areas of India is contaminated with deadly arsenic and excess fluoride. Arsiron Nilogon, a simple, efficient, safe and low-cost method for arsenic removal from groundwater has been developed at Tezpur University.1 The method is based on oxidation-coagulation-adsorption at optimised pH (OCOP) and uses three common chemicals, viz., baking soda (NaHCO3), Potassium permanganate (KMnO4) and ferric chloride (FeCl3). Here, NaHCO3 acts as pH conditioner, KMnO4 acts as oxidising agent and FeCl3 as coagulant. On the other hand, Fluoride Nilogon, also a product of Tezpur University, is a simple, efficient and safe yet low-cost method for fluoride removal based on phosphoric acid-crushed limestone treatment (PACLT) operating in a plug-flow mode.2 The Fluoride Nilogon reactor is filled with crushed limestone where water is added with 0.68 mM phosphoric acid. All the relevant water quality parameters of the treated water by these two methods meet the requirements of the WHO for drinking water. Here we propose to present the chemical tricks played in these methods in the light of successful field experiences.

KEYWORDS- Arsenic, Iron, Fluoride, Phosphoric Acid

Reference

1. Bordoloi, S.; Nath, S.K.; Gogoi, S. and Dutta, R.K. (2013). Arsenic and iron removal from groundwater by oxidation-coagulation at optimized pH: Laboratory and field studies, J. Hazardous Materials 260, 618-626.
2. Gogoi, S.; Nath, S.K.; Bordoloi, S. and Dutta, R.K. (2015). Fluoride removal from groundwater by limestone treatment in presence of phosphoric acid, J. Environ. Manage. 152, 132-139.

Li-Intercalated Vermiculite: A Carbon Free Self-Healing Material

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Two dimensional (2D) nanosheets of vermiculite clay obtained by different exfoliation methods are rearranged to prepare free-standing lamellar membranes. The reconstructed membranes intercalated with Li+ ions, repairs the damages cause by external mediators in presence of moisture and re-implants its electrical and ionic conductivity along with its mechanical and structural properties. Bilayer membranes composed of vermiculite 2D nanosheets, obtained by different physio-chemical exfoliation processes are found to be extremely sensitive towards solvent vapors by morphing its shape in specific manner. Stripe cut from the bilayer membrane can detect the presence of solvents within 0.26 sec and even unperturbed after self-healing of the physical damages. Mechanistic studies suggested that Li+ plays the key role in the self-healing of these membranes.

Fabrication of Multifunctional Freestanding Membranes from Soil Components

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The work here demonstrates that naturally abundant soil components can be engineered to prepare advanced materials for futuristic applications. Multifunctional freestanding membranes are prepared by tuning the structure of ubiquitous soil components, viz. clay and humic acids. Crosslinking of exfoliated clay layers with purified humic acids conferred mechanical and chemical strength on the membranes. The percolated network of ultra-thin nanochannel exhibiting fascinating transport properties could find nanofluidic applications in the areas of selective molecular/ionic transport, catalysis, energy harvesting, and storage. Electrical conductivity is induced to otherwise insulating soil membranes by heating at an inert atmosphere, without affecting their nanofluidic ionic conductivity. The soil membranes also provided a new platform to prepare and study mixed conducting materials. Such materials could be ideal in the areas like the solid state fuel cell, battery, and supercapacitor, gas sensing and separation. Strips of heated membranes shown to exhibit excellent sensitivity towards NH3 gas under atmospheric conditions.

Hospital waste management: a case study in jorhat city of assam

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Hospital waste refers to all biological or non-biological waste generated in hospitals, clinical laboratories etc. which is discarded and not intended for further use. Inadequate management as well as improper disposal of these wastes can be associated with risk to heathworkers, patients and the environment. A study has been conducted in five selected hospitals of Jorhat city of Assam namely Sanjivani Hospital, Niramoy Nursing Home, Christian Mission Hospital, Jorhat Medical College and Hospital and A.G Nursing Home to assess the quantities, proportion of different constituents of waste and their handling, treatment and disposal methods. Field visits were conducted to provide information on different medical waste management aspects. The total number of beds in the hospitals is 1000 and the anticipated quantity of medical waste generated by these hospitals was about 5500 kg/day. The result shows that average of 150-200 patients are admitted in these hospitals daily. The survey reveals that segregation of all waste are not conducted according to prescribe rules and standards where some quantity of medical waste are disposed of with domestic waste. Study also reveals that it is prone to the possibility of association of health risk to the patients, health workers and the environment.
Key words: Hospital waste, health risk, management etc.

Poisons in our kitchen

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Food is one of the basic human needs. These foods contain carbohydrate, protein, minerals etc which helps us to growth and metabolism of our body. But now a day's these foods contains some chemicals which are harmful for our body. These chemicals cause various diseases in human being. From the cup of tea to the vegetables contains harmful chemicals. These are secretly invading our lives as a culture of infectious greed grips much of our food chain: from farm to fork.
India is the world's worst food violator, reports global food source monitoring company. More than a third of food fraud takes place due to excessive or illegal pesticides, pathogen contamination and filth or insanitary condition. Data collected by FSSAI from across the country shows a step rise in food fraud, with five states – UP, Maharashtra, Madhya Pradesh, Kerala and Andhra Pradesh- accounting for more than 90 percent of the total penalties livid. It is a very serious issue because the true extent of the impact of adulterated food on human health is not known. Adulteration methods are increasingly more sophisticated. Simple adulteration of fruit juice by addition of water or stones in rice are now giving way to deadly pesticides, non permitted synthetic colours, slapdash use of antibiotics and DNA altering carcinogens.
Keywords: Food poisoning, adulteration, health effect etc.

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Biomass is one of the most promising resources widely used for the remediation of various environmental issues. The present study aimed at investigating the efficacy of locally available plant-Tithonia diversifolia as an eco- friendly, economically effective and abundant precursor for the production of biochar and activated carbon. The effect of process parameters such as carbonization temperature, activation temperature and impregnation ratio on the chemical and textural properties of biochar and activated carbon were investigated. In this study, chemical activation process by ZnCl2 was employed for the production of activated carbon. The prepared biochar and activated carbon was characterized by using SEM-EDX, FTIR, XRD, TGA and BET surface area. The experimental results showed that activation temperature and impregnation ratio have significant effect on the yield and textural properties of activated carbon produced from Tithonia diversifolia. Under the optimal conditions, the BET surface area, pore volume and yield of biochar were found to be 36.64 m2/g, 0.041cm3/g and 23.17% respectively while that of activated carbon were 735 m2/g, 0.379cm3/g and 10.21 % respectively.
Key words: Biomass, Tithonia diversifolia, Biochar, Activated carbon

Applications of clay nanoflakes for chromatography applications

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Articles reporting trivial discrimination of clay minerals towards enantiomers of natural amino acids are scattered over a period of five decades. However, the diminutive selectivity values led to a great deal of confusion as many researchers failed to achieve enantioselectivity beyond the instrumental error limit. In order to clear the air, the interaction of amino

acid molecules with clay minerals are augmented by exfoliating them into nanometer size flakes. Studies performed with preheated clay nanoflakes by employing high-performance liquid chromatography (HPLC), digital polarimeter and circular dichroism (CD) spectroscopy confirm enantioselectivity as an inherent quality of clay layers. The exfoliated clay layers are here in us used for chiral technology. Vermiculite nanoflakes packed in a glass columns displayed 67.2 % enantioselectivity towards D-tryptophan. The unequal affinity of vermiculite clay towards amino acid enantiomers can also be utilized for thin-layer- chromatography-based-separation of enantiomers by coating them on a glass slides. Diastereomers of different physical characteristics are formed when optically pure amino acids interacted independently with clay nanoflakes.
In past, all the experiments investigating enantioselectivity of clay were performed with bulk particles for very limited periods of time. Therefore, substantial fractions of clay surfaces were unexposed or unutilised. Here, we have investigated enantioselectivity of exfoliated layers of natural clay minerals and found them to possess remarkable selectivity towards L-amino acids. Experiments with exfoliated clay layers not only provided new insight into the chemistry of clay minerals but also opened up the possibility of their application in chiral technology. As a proof of concept, we have demonstrated that exfoliated clay layers can be assembled into freestanding membranes or filled into columns to separate optical isomers. Clay nanoflakes can also be applied as stationary phase of TLC to resolve enantiomers.

Hydrogen: a fuel for future generation

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Hydrogen is an energy carrier that can transfer our fossil-fuel dependent economy into a hydrogen economy, which can provide an emmisions-free transportation fuel. Hydrogen storage and transport are issues of intense research due to hydrogen's characteristic low density. Hydrogen is notable for unique properties making it the most viable alternative fuel for electricity generation and engine power. This element is highly abundant and is being used in numerous applications industrially. But hydrogen can be an important source of fuel and with the proper knowledge of its different technologies, innovations for hydrogen fuel production can then be addressed.
Keywords- Hydrogen, fuel, economy etc.

Polymer-polymer scaffold tweaks pathological amyloid

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Alzheimer's disease (AD) is pathologically highlighted by the aggregation of intracellular neurofibrillary tangles shaped by tau proteins and extracellular feeble torment by amyloid β-proteins (Aβ) in the patient brain. Numerous studies have demonstrated that the aggregation of Aβ into amyloid fibrils containing trademark cross-β-sheet structure in the mind of AD patients is firmly connected to the pathogenesis of AD and dissolvable Aβ oligomers and/or protofibrils are the most poisonous species, in charge of neuron brokenness and death. Here, in this work, nontoxic, biocompatible water soluble polymeric conjugate have been used to modulate toxic amyloid aggregates in human CSF and as well as in preformed amyloid aggregates from commercial Aβ1-40. This modulation strategy leads to the formation of polymer-protein co-aggregates instead of toxic amyloid aggregates which is responsible for plaque formation and is related to disease progression. The intriguing prospect of amyloid fibrils using luminescent conjugate materials technique as a scaffold for polymer-protein hybrid materials is well delineated as this technique provides a direct link between spectral signal and protein conformation and can further be used to gain more information concerning the morphology of the protein deposits and facilitate a greater understanding of the conformational phenotype encoded in the native protein aggregates.

References
(1) Yankner, B. A.; Duffy, L. K.; Kirschner, D. A. Science 1990, 250, 279–282.
(2) Hardy, J.; Selkoe, D. J. Science 2002, 297, 353–356.
(3) Chowdhury, S. R.; Agarwal, M.; Meher, N.; Muthuraj, B.; Iyer, P. K. ACS Appl. Mater. Interfaces, 2016, 8 (21), 13309–13319.

Hydrothermal synthesis of carbon dot from rice water

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Fluorescent Carbon dots are an emerging class of nanomaterials made from carbon sources that have been hailed as potential, non-toxic replacement to traditional semiconductor quantum dots. Due to their water solubility, low toxicity, and photochemical stability they possess diverse properties. Various applications of carbon dots have been observed in various fields like bioimaging, sensing, drug delivery etc. Carbohydrates are readily available chiral bio-molecules in nature which offer an attractive and cheap starting material from which to synthesize carbon dots with distinct features and interesting applications. Thus, the present project work demonstrates facile synthesis of carbon dot from rice water as a waste carbohydrate source.
Key Words: Carbon Dots, Fluorescent, Rice water etc.

Nutritional evaluation of some common dry fruits: a comparative study

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Dry fruits have been recognized as an abundant source in providing essential nutrients which supplies good amounts of proteins, fat, minerals like iron, phosphorous, potassium, sodium etc. An investigation aimed at determining the proximate composition and mineral content present in the dry fruit 'Dry coconut' (Cocos nucifera) and comparing it with nutritional values of other dry fruits viz. Peanut (Arachis hypogaea), Walnut (Juglans regia), Raisins (Vitis vinifera), Cashew nut (Anacardium occidentale) and Date palm (Phoenix dactylifera) was carried out in the department of Biochemistry and Agricultural Chemistry. Assam Agricultural University, Jorhat, during June-July, 2017.
The study revealed that the coconut was rich in fat (58.95%), protein (10.67 %). It also contained other nutrients like starch (4.75%), reducing sugar (0.05%), iron (5.07%), potassium (0.0032%), sodium (0.0009%) and phosphorous (0.11). Comparing these nutritional values of coconut with other 5 different dry fruits; viz. raisin, cashew nut, date palm, walnut and ground nut shows that coconut had greater amounts of potassium compared to some other dry fruits while it is intermediate in phosphorous content.
Keywords: Dry fruits, Coconut, Nutritional value etc.

The dispute on monosodium glutamate: reality versus belief

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One of the most famous food ingredients whose safety has been disputed about for a long time is Monosodium glutamate (MSG). MSG is a flavour enhancer which is responsible for cracking up the sensation of Umami flavours (or savory taste) in our tongue. It carries a dreadful reputation of being very harmful to the human health and the root cause of many health problems like headaches, allergic reactions, Chinese Restaurant Syndrome, infantile obesity, development of Type 2 diabetes. However, many scientific studies have repeatedly stated that MSG is safe when taken at ordinary levels of consumption for common people. With all the hype that it has caused amidst people following the wide coverage by big

press institutes and the myriad of varying opinions that different minds have on this substance, the question arises on what the truth is. This paper depicts a study on the root of MSG debate, the structure and functioning of MSG on human health, scientific evidences on its safety and danger, common products where it masquerades with other names and plausible alternatives to MSG.

Key Words: Monosodium glutamate (MSG), food products, diseases, safety etc.

A Green Protocol to the Biginelli Reaction using Papaya Latex

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Papaya latex was tested as catalyst for the Biginelli reaction multicomponent reaction at room temperature under solvent free condition. Low catalyst loading, reduced reaction time and operational simplicity are the main highlights of this proposed protocol. Biginelli condensation reaction of aromatic aldehydes, β- ketoesters, urea or thiourea catalyzed by sundried papaya latex for the synthesis of a diverse set of physiologically active tetrahydropyrimidinones is reported here.

Key Words: Papaya latex, Biginelli reaction, Biocatalyst

Columnar Self-assembly of Electron deficient Dendronized bay-annulated Perylene Bisimides

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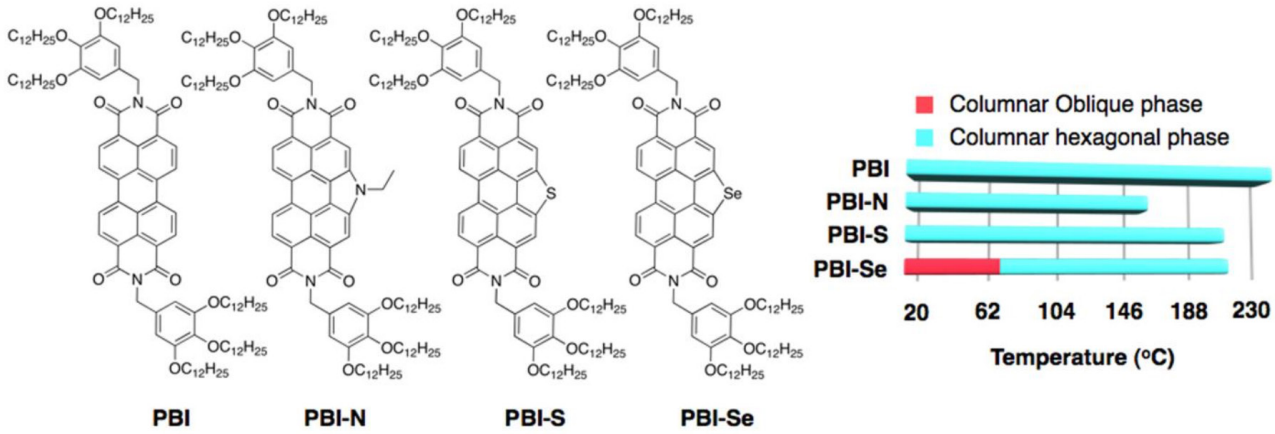
Three new heteroatom bay-annulated perylene bisimides (PBIs) have been synthesized by microwave-assisted synthesis in excellent yield. N-annulated and S-annulated perylene bisimides exhibited columnar hexagonal phase, while Se-annulatedperylene bisimide exhibited low temperature columnar oblique phase in addition to the high temperature columnar hexagonal phase. The cup shaped bay-annulated PBIs pack into columns with enhanced intermolecular interactions. In comparison to PBI, these molecules exhibited lower melting and clearing temperature, with good solubility. A small red shift in the absorption was seen in the case of N-annulated PBI, while S- and Se-annulated PBIs exhibited blue-



shifted absorption spectra. Bay-annulation increased the HOMO and LUMO levels of the N-annulated perylene bisimide, while a slight increase in the LUMO level and a decrease in the HOMO levels were observed in the case of S- and Se-annulated perylene bisimides, in comparison to the simple perylene bisimide. The band gaps of PBI and PBI-N were almost same, while an increase in the band gaps were observed in the case of S- and Se-annulated PBIs. The tendency to freeze in the ordered glassy columnar phase for PBI-N and PBI-S will help to overcome the charge traps due to crystallization, which are detrimental to one-dimensional charge carrier mobility. These solution processable electron deficient columnar semiconductors with good thermal stability may form an easily accessible promising class of n-type materials.

Reference: Gupta, R. K.; Rao, D. S. S.; Prasad, S. K.; Achalkumar, A. S. Chem. Eur. J. 10.1002/chem.201705290.

Enhanced Photovoltaic Performance 1D-ZnO Based Dye-Sensitized Solar Cell Using the Homoleptic Ru (II) Complex as a Photosensitizer

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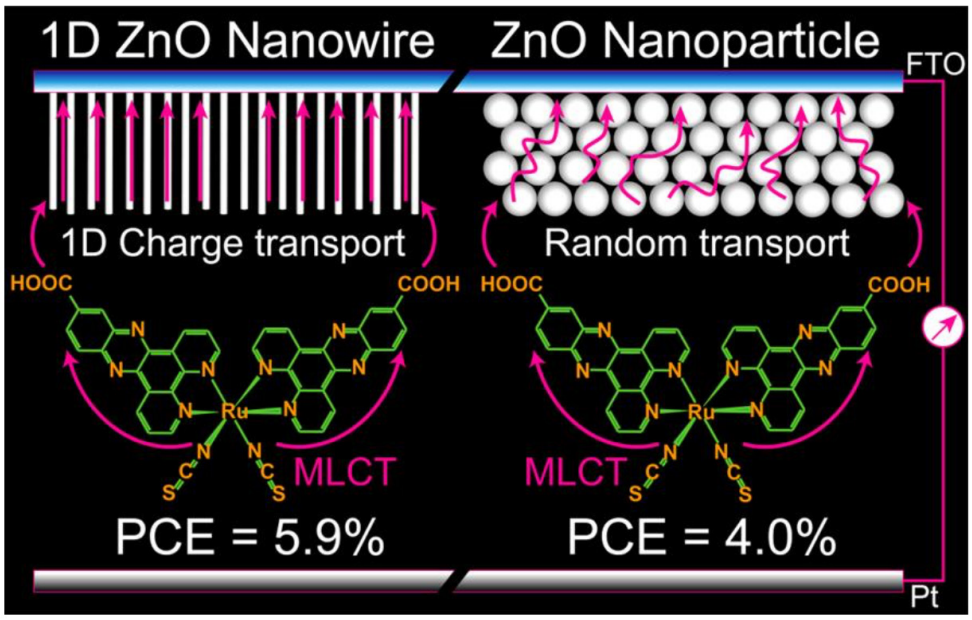
In the recent past, ZnO has reaped extensive applications as the electron transport layer in solar cells due to its higher electron mobility, faster electron transport, and ease of synthesis of diverse morphologies with high crystallinity. In particular, one-dimensional (1D) nanowires (NWs) have displayed intense interest in the fabrication of photovoltaic devices due to their unique geometry providing direct and effective pathways for charge transport, lower electron hopping, and higher interfacial area. For the practical applications, high band gap limitation of ZnO, to absorb the visible light, can be readily overcome by sensitizing with a suitable dye or semiconductor, which can transfer their photoexcited electrons to the conduction band (CB) of ZnO. Mimicking the properties of heteroleptic ruthenium dyes, a dipyrido[3,2-a:2',3'-c]phenazine-11-carboxylic acid (dppz-COOH) ligand based homoleptic complex,Ru(dppz-COOH) (NCS)2, with a molar extinction coefficient of 14.3 × 10 M -1 cm 2 has been demonstrated as an efficient photosensitizer for the one-dimensional (1D) ZnO nanowire (NW) and ZnO nanoparticle (NP) based dye-sensitized solar cells (DSSCs) Combining the advantageous effects of



ZnO NWs and a dipyridophenazine based dye, cis-Ru(dppz-COOH)2(NCS)2, we achieved an efficient photovoltaic performance with a maximum PCE of ~5.9% against the Pt counter electrode and cobalt complex as the redox shuttles.

References:

1. Anta, J. A.; Guille , E.; Tena-Zaera, R. ZnO-Based DyeSensitized Solar Cells. J. Phys. Chem. C 2012, 116, 11413.
2. Zhang, Q.; Cao, G. Nanostructured Photoelectrodes for DyeSensitized Solar Cells. Nano Today 2011, 6,91.
3. Zhang, Q.; Dandeneau, C. S.; Zhou, X.; Cao, G. ZnO Nanostructures for Dye-Sensitized Solar Cells. Adv. Mater. 2008, 21,4087.
4. Barpuzary. D, Banik. A, Panda. A. N and Qureshi, M., Mimicking the Heteroleptic Dyes for an Efficient 1D-ZnO Based DyeSensitized Solar Cell Using the Homoleptic Ruthenium(II) Dipyridophenazine Complex as a Photosensitizer, J. Phys. Chem. C, 2015, 119, 3892.

Removal of As (V) from water by using Hydroxyl-alumina activated Paddy Husk Ash and its sludge management

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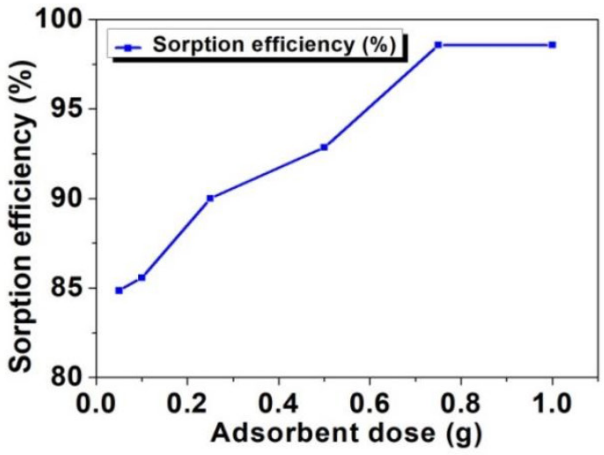
Arsenic (As) is present in the water in two different forms, as As (III) and As (V). Arsenic become harmful to human health as it crosses its permissible limit of 10 ppb (μg/L). It causes various health diseases including cancer. In this present approach a bio waste, such as Paddy Husk Ash (PHA) is used as an adsorbent for As (V) adsorption by surface modifying the PHA with a soluble aluminium oligomer called as hydroxyl-alumina (OH-Al). Coating of PHA surface with OH-Al provides a good composite adsorbent (A-PHA) for removal of As (V) from water. For characterization of the adsorbent various techniques like XRD, FT-IR, SEM-EDS were used. Also, the effects of various parameters like adsorbent dose, pH, initial arsenic concentration, contact time were carried out. Freundlich adsorption isotherm and pseudo second order kinetic models were found to be the best fitted adsorption isotherm and kinetic data models respectively for the present process. The main advantage of this approach is the ability to permanently immobilize the arsenic containing sludge in a cement clinker matrix.



Adsorption efficiency of the adsorbent

Photo of clinker produced

Keywords: Hydroxyl-alumina, sludge management, immobilization.

References:

1. Thomas S.Y. Choong, T.G. Chuah, Y. Robiah, F.L. Gregory Koay, I. Azni, arsenic toxicity, health hazards and removal techniques from water: an overview, Desalination. 217 (2007)139–166.
2. M. Ahmaruzzaman, V. K. Gupta , Rice Husk and Its Ash as Low-Cost Adsorbents in Water and Wastewater Treatment, I&EC. 50(2011), 13589- 13613
3. Md. N. Amin, S. Kaneco, T. Kitagawa, A. Begum, H. Katsumata, T. Suzuki, K. Ohta, Removal of Arsenic in Aqueous Solutions by Adsorption onto Waste Rice Husk, I&EC. 45(2006)8105-8110

Fluorescent polymer-bioconjugate coated magnetite nanoparticles as pH-sensitive and tumor-targeted theranostic agent for combination chemotherapy

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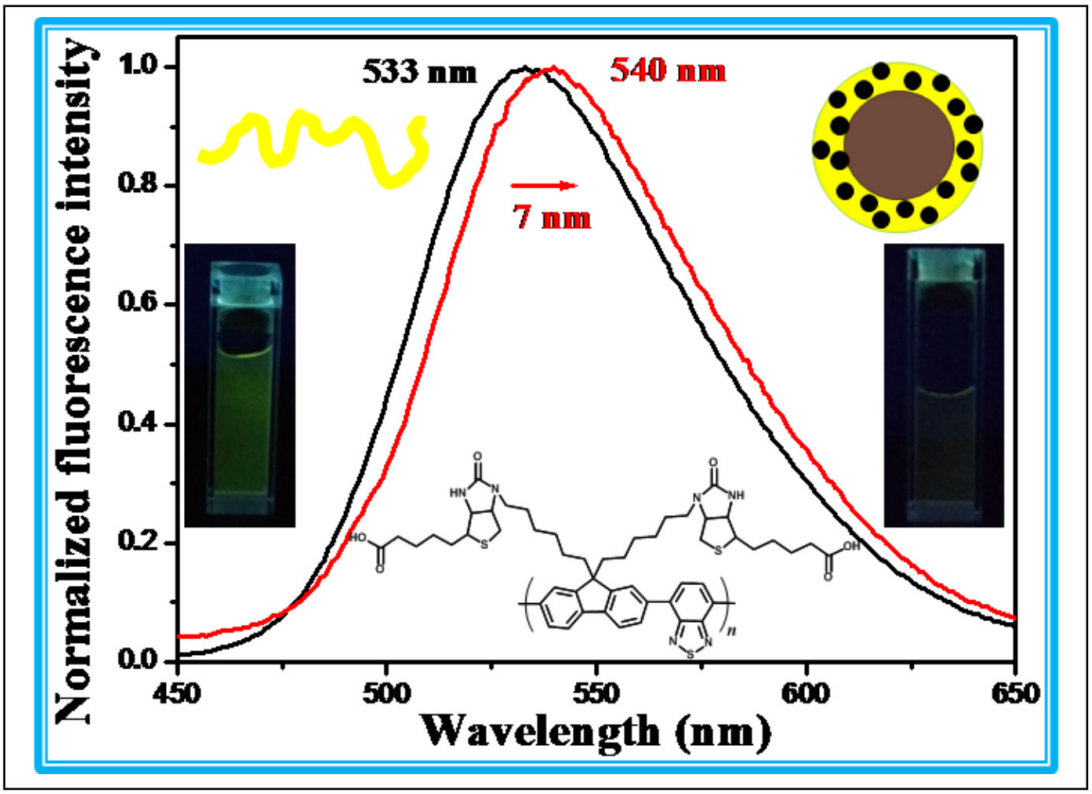
Polymer-bioconjugates have gained wide attention as promising candidates for promoting therapeutic benefits in various biomedica l fields. In addition to other biomedical applications, such polymer-biomolecule conjugates are also expected to be potential theranostic platforms for targeted chemotherapy involving the co-delivery of both chemotherapeutic and diagnostic agents to the target tumor sites. In the present work, a conjugated polymer poly[9,9-bis(6-bromohexyl)-fluorenyl-2,7-diyl-co-4,7-(2,1,3- benzothiadiazole)] (PFBT) was initially synthesized, and then modified with tumor targeted biomolecule biotin to obtain the p olymer- bioconjugate (PFBT-B). The polymer-bioconjugate, i.e. PFBT-B, displayed greenish-yellow fluorescence with an emission at 533 nm upon excitation at 420 nm, indicating its applicability for fluorescent cellular imaging. PFBT-B was subsequently used as a fluorescent non-toxic coating on pre-synthesized magnetite nanoparticles and finally loaded with anti-cancer drug 5-fluorouracil (5- FU). The magnetite nanoparticles exhibit a saturation magnetization of 56.28 emu/g at a magnetic field of 15 000 Oe, with a coercivity of 75.5 Oe, indicating its potential for magnetic hyperthermia treatment. TEM analysis of the PFBT-B coated magnetite nanoparticles (PFBT-BM NPs) showed an average shell thickness of 1.88 nm. Drug (i.e. 5-FU) loading studies for PFBT-BM NPs revealed a loading capacity of 6.64 μg/μg of PFBT-B, whereas releasing studies showed pH-sensitive drug release profiles with 90% release at pH 5 after 5 h in contrast to only 71% at pH 7.4. Thus, PFBT-B coated magnetite nanoparticles loaded with 5-FU



are expected to be potential theranostic agents for tumor targeted combination chemotherapy (both hyperthermia and chemotherapeutic effects) with pH-sensitive drug release profiles.

Keywords: Polymer-bioconjugates; theranostic; chemotherapy; tumor targeted; hyperthermia.

A Influence of Ligand Architecture in Tuning Reaction Bifurcation Pathways for Chlorite Oxidation by Non-Heme Iron Complexes

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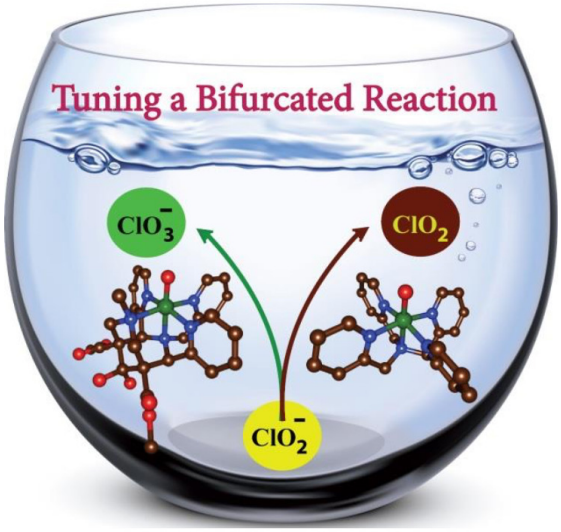
Reaction bifurcation processes are often encountered in the oxidation of substrates by enzymes and generally lead to a mixture of products. One particular bifurcation process that is common in biology relates to electron transfer versus oxygen atom transfer processes by high-valent iron(IV)-oxo complexes, which Nature uses for the oxidation of metabolites and drugs. In biomimicry and bioremediation, an important reaction relates to the detoxification of $ClOx^-$ in water, which can lead to a mixture of products through bifurcated reactions. We report the first three water-soluble non-heme iron(II) complexes that can generate chlorine dioxide from chlorite at ambient temperature and physiological pH. These complexes are highly active oxygenation oxidants and convert $ClO2^-$ into either ClO2 or $ClO3^-$ via high-valent iron(IV)-oxo intermediates. We characterize the short-lived iron(IV)-oxo species and establish rate constants for the bifurcation



mechanism leading to ClO2 and $ClO3^-$ products. We show that the ligand architecture of the metal center plays a dominant role by lowering the reduction potential of the metal center.

Storage capacity of clathrate hydrates for storing small molecules

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Density functional theory (DFT) based studies are carried out to understand the structure, stability and reactivity of clathrate hydrates with or without hydrogen encapsulation. All geometries of clathrate hydrates were fully optimized using B3LYP/6-31G(d), M06-2X/6-31G(d) and B97D/6-31G(d) level of theories. The storage capability of five standard clathrate hydrates (512, 435663, 51262, 512 64 and 51268) is systematically explored to store small molecules like Ar, CH4, CO2, H2, H2S, Kr, N2, O2 and Xe. The capability is depicted in the given Figure. The efficacy of trapping of small molecules inside

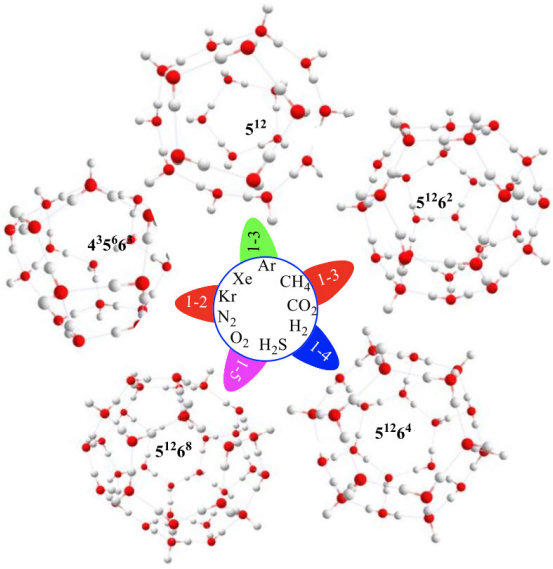

Figure: Capacity of five standard water cavities in the clathrate hydrates with various molecules

the cages of clathrate hydrates generally depends upon the cavity sizes and shapes. The interaction energy values indicate the formation of stable gust-host system.

References:
1. X. Cao, Y. Su, Y. Liu, J. Zhao, C. Liu. Storage capacity and vibration Frequencies of guest molecules in CH4 and CO2 hydrates by first-principles calculations J. Phys. Chem. A, 118 2014, pp. 215-222.
2. Chattaraj, P. K., Bandaru, S., Mondal, S. Hydrogen Storage in Clathrate Hydrates J. Phys. Chem. A 115, 2011, 187-193.
3. Srivastava, H. K., Sastry, G. N. Viability of Clathrate Hydrates as CO2 Capturing Agents: A Theoretical Study J. Phys. Chem. A 115, 2011, 7633-7637.
4. X. Cao, Y. Su, J. Zhao. Stability and vibrations of guest molecules in the type II clathrate hydrate: a firstprinciples study of solid phase J. Phys. Chem. A, 119 2015, 7063-7069.
5. Ramya, K. R.; Venkatnathan, A. Vibrational Raman Spectra of Hydrogen Clathrate Hydrates from Density Functional Theory J. Chem. Phys. 138, 2013, 124305.

Keto-Enol Tautomerization Triggers an Electrophilic Aldehyde Deformylation Reaction by a Nonheme Manganese(III)-Peroxo Complex

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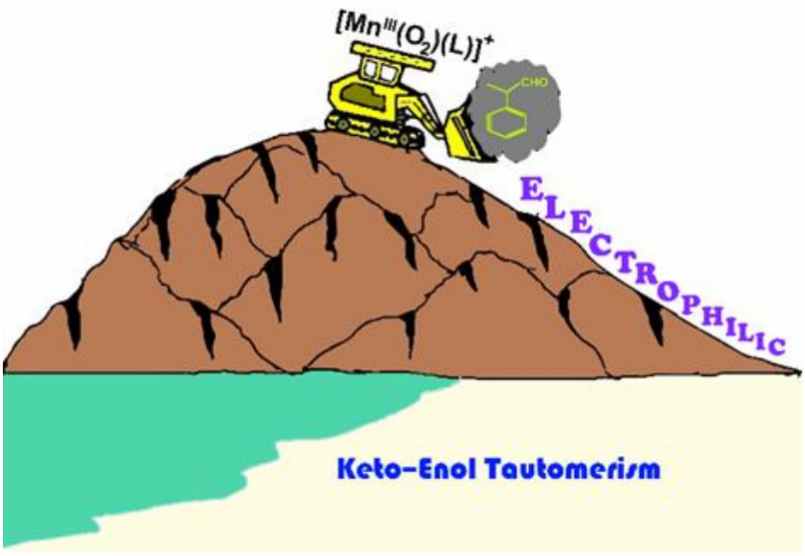
Oxygen atom transfer by high-valent enzymatic intermediates remains an enigma in chemical catalysis. In particular, manganese is an important first-row metal involved in key biochemical processes including the biosynthesis of molecular oxygen (through the photosystem II complex) and biodegradation of toxic superoxide to hydrogen peroxide by superoxide dismutase. Biomimetic models of these biological systems have been developed to gain understanding on the structure and properties of short-lived intermediates but also with the aim to create environmentally benign oxidants. In this work, we report a combined spectroscopy, mass spectrometry, kinetics study on aldehyde deformylation by two side-on manganese(III)-peroxo complexes with bispidine ligands. Both manganese(III)-peroxo complexes are characterized by UV-Vis and mass spectrometry techniques and their reactivity patterns with aldehydes was investigated. We find a

novel mechanism for the reaction that is initiated by a hydrogen atom abstraction reaction, which enables a keto- enol tautomerization in the substrate. This is an essential step in the mechanism that makes an electrophilic attack on the olefin bond possible as the attack on the aldehyde carbonyl is too high in energy. Kinetics studies determine a large kinetic



isotope effect for the replacement of the transferring hydrogen atom by deuterium, while replacing the transferring hydrogen atom by a methyl group makes the substrate inactive and hence confirm the hypothesized mechanism.

Self-Assembly Mechanism of a Peptide Based Drug Delivery Vehicle

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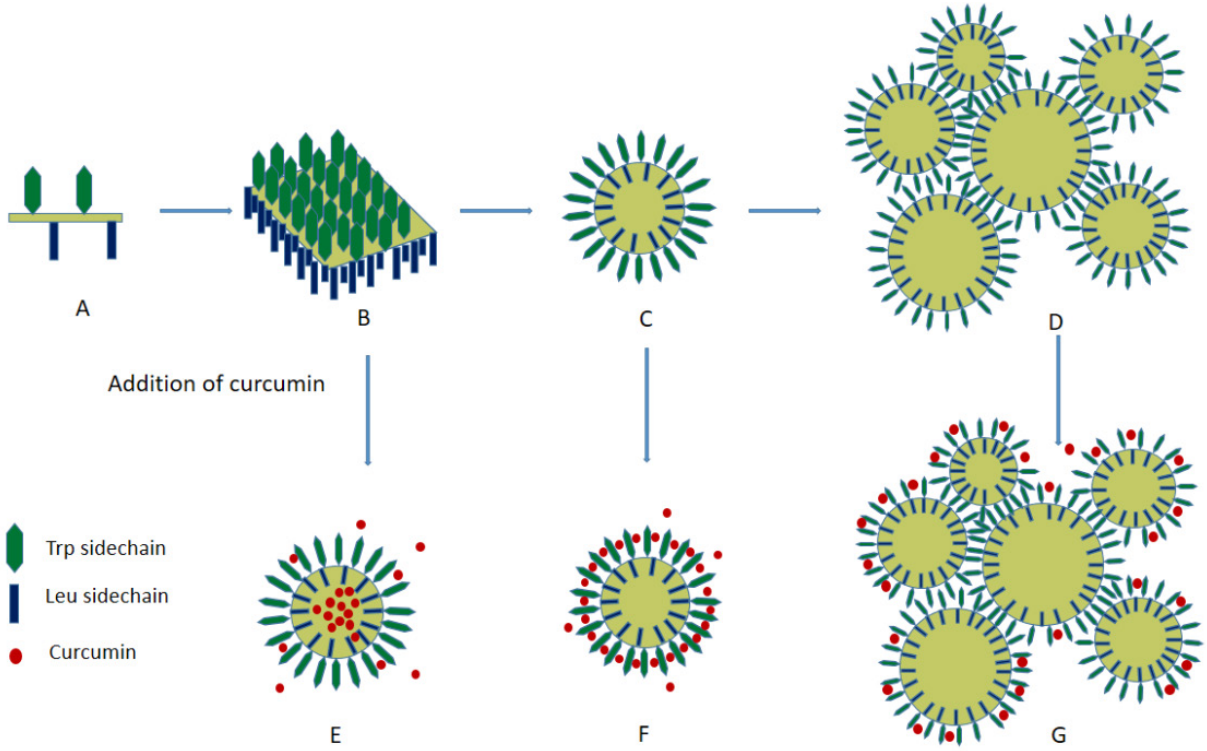
We report mechanism of concentration dependent self-assembly of a tetrapeptide. Peptide Boc-Trp-Leu-Trp-Leu-OMe self assembles to form discrete nanospheres at low a concentration. Tryptophan side chains point outwards of the nanospheres while leucine side chains point towards the core of the nanospheres. The nanospheres fuse together to become microspheres with increase in peptide concentration. At higher concentration of the peptide, the microspheres start clustering. This is stabilized by the aromatic interactions between the side chains of the tryptophan residues that cover the outer surface of the peptide microspheres. In addition to behaving like the conventional hollow sphere based drug delivery vehicles which entraps the drug and performs stimuli responsive release, this prototype can interact, stabilize and intercalate hydrophobic dye carboxyfluorescein and anti-cancer drug curcumin even on the surface through aromatic interactions. The dye/drug can be released in acidic pH and in presence of physiologically relevant ions like potassium.

Figure: Schematic representation of concentration dependent self-assembly and drug binding pattern of P. A) P monomer, B) β- sheet like conformation of P, C) P nanospheres at 0.02 mM, D) Clustered P microspheres at 10 mM, E) Entrapment of dye in nanospheres, F) Binding of Curcumin on at the surface of P nanospheres and G) Binding of Curcumin on at the surface of P microspheres at 10 mM.



References:
1. Yan, X. H.; He, Q.; Wang, K. W.; Duan, L.; Cui , Y.; Li, J. B. Transition of Cationic Dipeptide Nanotubes into Vesicles and Oligonucleotide Delivery. Angew. Chem. Int. Ed. 2007, 4, 2431 – 2434.
2. Kim, J.; Han, T. H.; Kim, Y.; Park, J. S.; Choi, J.; Churchill, D. G.; Kim, S. O.; Ihee, H. Role of Water in Directing Diphenylalanine Assembly into Nanotubes and Nanowires. Adv. Mater. 2010, 22, 583 – 587.
3. Hudson, Z. M.; Lunn, D. J.; Winnik, M. A.; Manners, I. Colour-Tunable Fluorescent Multiblock Micelles. Nat. Commun. 2014, 5, 3372-3380.
4. Kang, J.; Miyajima, D.; Mori, T.; Inoue, Y.; Itoh, Y.; Takuzo, A. A Rational Strategy for the Realization of Chain-Growth Supramolecular Polymerization. Science 2015, 347, 646–651.

Smart Polymeric Material for Inclusive Oil/Water Separation through Complementary Use of Selective-Absorption and Gravity Driven-Filtration Process

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Oil spills and solvent leakages frequently occur in water bodies and have caused catastrophic effects to the environment1. Conventional methods such as combustion or the use of common absorbents, including zeolites,2 activated carbon,3 organic fibers,4 and polymers5 become pale and weak due to their poor absorption efficiency or induced secondary pollution during the cleanup process. Therefore, it is urgent to explore a more economic, effective, and feasible strategy to solve these disastrous events. Here, we have exploited a naturally abundant fibrous substrate6 (i.e.; cotton ball) in energy-efficient and environmental-friendly cleaning of different forms of oil-contaminations including floating light-oil, sediment heavy-oil and emulsions, after the appropriate optimization of both the topography and essential chemistry in the fibrous

substrate through catalyst-free, simple and scalable 1, 4 conjugate addition reaction between amine and acrylate groups in ambient condition. The synthesized superhydrophobic cotton (SHC) that is capable of extremely repelling water both in air and under oil, has provided a common avenue for highly selective 1) absorption (with efficiency of above 2000 wt.%) of oil (both heavy and light oils) and 2) gravity driven active-filtration of oil. The synthesized material is highly efficient in separation of oil from aqueous phases that are chemically harsh, including the extremes of pH (1 & 12), artificial seawater, UV exposures etc. Further, the current approach provided a simple basis to separate oil from complex three-phase oil/water mixture that composed of heavy- oil phase (bottom layer), aqueous phase (middle layer) and light-oil phase (top layer), where the strategic use of SHC allowed successful clean-up of oil from complex oil/water mixture through complementary—absorption and filtration processes.

(1) Wang, B.; Liang, W.; Guo, Z.; Liu W.; Chem Soc Rev. 2015, 44, 336.
(2) Radetic, M. M.; Jocic D. M.; Jovanc, P. M.; Petrovic, Z. L.; Thomas, H. F. Environ. Sci. Technol. 2003, 37, 1008.
(3) Bayat, A.; Aghamiri, S. F.; Moheb, A.; Vakili-Nezhaad , G. R. Chem. Eng. Technol. 2005 , 28 , 1525 .
(4) Deschamps, G.; Caruel, H.; Borredon, M. E.; Bonnin, C.; Vignole, C. Environ. Sci. Technol. 2003, 37, 1013.
(5) Sonmez, H. B.; Wudl, F. Macromolecules. 2005, 38, 1623.
(6) Rather, A. M.; Jana, N.; Hazarika, P.; Manna U. J. Mater. Chem. A, 2017, 5,

A Sub-ppb vapor phase detection of Nerve gas agent using amine functionalized conjugated polymer

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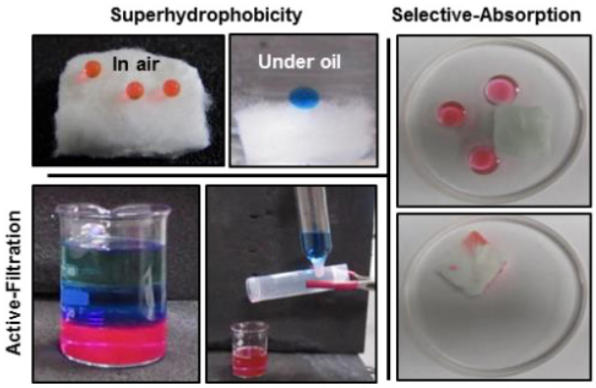

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Considering the need to counteract current climate of terrorism threat and environmental pollution we presented a highly selective and convenient method for monitoring the ultra-trace level of nerve gas agent in a real working situation. A conjugated polymer PFPDA was synthesized via Suzuki cross coupling polymerization and has been used as a sensory layer to fabricate the two terminal gas sensor device. The gas sensor shows excellent sensitivity towards Diethyl chlorophosphate, a nerve gas mimic. The DCP was quantified by monitoring change in the current density of the device upon exposure to its various concentrations. The minimum detection limit is as low as 0.05ppb which is much lower than the maximum permissible exposure limit of DCP. Such high sensitivity of the device for DCP is due to the non-covalent interaction of DCP with the PFPDA after getting absorbed on to the polymer thin film. To gain more insight of mechanistic pathway spectroscopic techniques (Mass and IR) as well as theoretical calculations were utilized. Furthermore, a control polymer PFP was also employed to authenticate the role of amine group of polymer PFPDA in sensing response of the device.

Keywords: Poly 9,9-(dioctyl-9H-fluoren-2-yl)benzene-1,2-diamine (PFPDA), Poly 9,9-(dioctyl)-2- phenyl-9H-fluorene(PFP), Diethyl chlorophosphate (DCP).

Morphological tuning of photo-booster g-C3N4 with higher surface area and better charge transfers for enhanced power conversion efficiency of quantum dot sensitized solar cells

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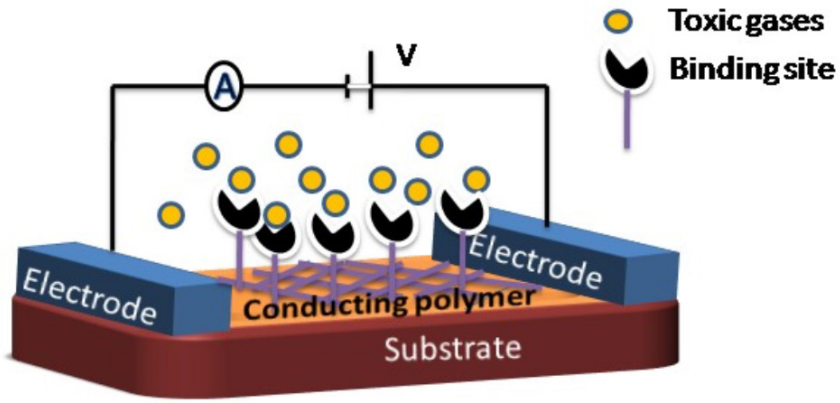

Figure 1: Device Structure of two terminal Gas Sensor.

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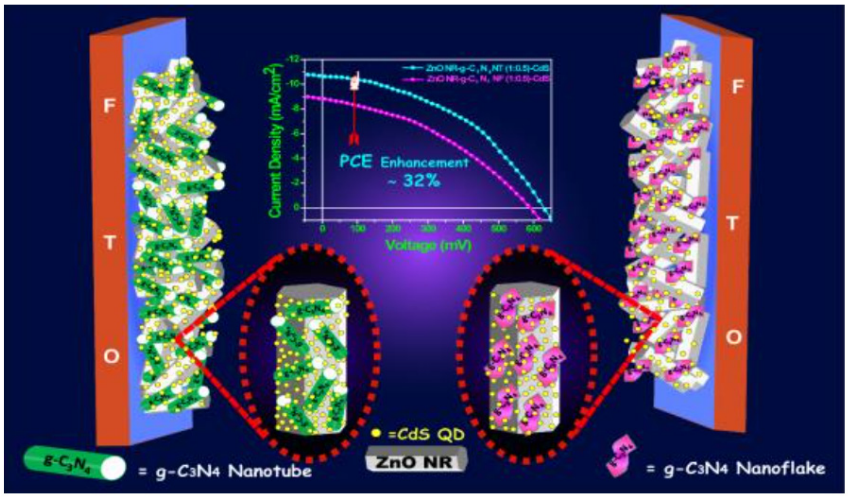
In the photovoltaic, large number of UV or visible light responsive materials has been utilized to harvest the solar energy by means of Solar cell [1]. Due to unique electronic and optical properties, graphitic carbon nitride (g-C3N4) is a promising metal free, visible light active polymeric organic semiconductor for solar energy conversion [2]. To get better performance of g-C3N4, it is important to optimize the material by modifying morphology, optical, and electronic properties via nanocasting, doping and coupling with other semiconductors [3]. So, Photo-booster effect of g-C3N4 Nanotubes (g-C3N4 NTs) on the photovoltaic properties are investigated using the composites having ZnO Nanorods (ZnO NRs) with different composition ratios, sensitized by CdS quantum dots. Enhanced performance is attributed to the cumulative effects of this composite i.e., (i) a significant decrement of fluorescence intensity in steady state PL, (ii) faster electron lifetime and good electron injection rate from dynamic PL, and (iii) sufficient loading of sensitizer at photoanodic scaffold for better harvesting of solar energy. An increase of 32% in power conversion efficiency (PCE, η) is observed in case of g-C3N4 NTs based device as compare to g-C3N4 Nanoflakes (g-C3N4 NFs) [4]. Increased PCE value is mainly due to (i) efficient separation and transportation of the photogenerated charge carriers along a one dimensional (1D) path, resulting in shorter lifetime of charge carriers and (ii) high surface area which provides more active sites for loading of sensitizer particles, results in an improvement of light harvesting ability. Further, electrochemical impedance spectroscopic (EIS) analyses showed an efficient interfacial charge transfer by reducing the recombination processes i.e., the back transferring of photoexcited electron at electrode/electrolyte interface.

References:

1. X.X. Xu, C. Randorn, P. Efstathiou, J.T.S. Irvine, Nat. Mater. 11 (2012), 595–598.
2. Y.J. Zhang, T. Mori, J.H. Ye, Sci. Adv. Mater. 4 (2012), 282–291.
3. J.S. Zhang, X.F. Chen, K. Takanabe, K. Maeda, K. Domen, J.D. Epping, et al., Angew. Chem. Int. Ed. 49 (2010), 441–444.
1. M. S. Ansari, A. Banik, M. Qureshi, Carbon 121 (2017), 90–105.



Stereo- and Regio-selective Synthesis of 4-Vinylpyrrolidine from N- tethered Alkene-Alkenol

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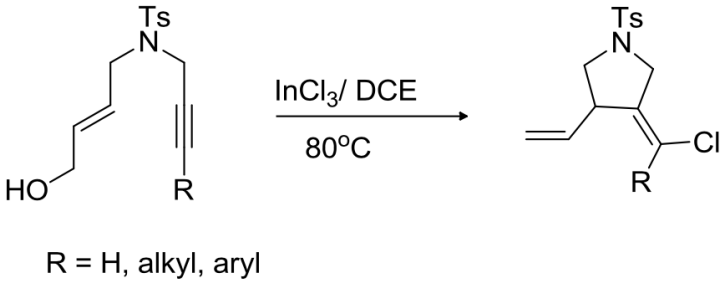
The five membered nitrogen heterocyclic compounds are gaining interest in organic synthesis due to their presence in wide range of biologically active molecules. Pyrrolidines, a five membered saturated N-heterocycle are found in a wide variety of natural products1 and pharmaceuticals.2 Apart from these, pyrrolidine based organocatalysts3 and chiral ligands4 have been employed in a range of organic transformations. Because of their enormous synthetic importance, several efforts have been made towards the synthesis of pyrrolidine. We have developed an efficient method for the synthesis of five-membered nitrogen heterocycles by treatment of N-tethered 1, 6-enynes mediated by indium trichloride in good yields. The configuration of the 1, 3-dienes of the five-membered chloro-substituted vinyl pyrrolidines is stereocontrolled. Mechanistic pathway involves a cationic reaction with Lewis acid activation of the allylic alcohol thereby allowing a nucleophilic attack by the alkyne and then subsequent trapping by chloride.

Keywords: heterocycles, pyrrolidines, Lewis acid, stereoselective, 1,3-diene REFERENCES

(1) J. P. Michael; Nat. Prod. Rep. 2008, 25, 139.
(2) S. Hanessian; M. Bayrakdarian; X. Luo; J. Am. Chem. Soc. 2002, 124, 4716.
(3) P. I. Dalko; L. Moisan; Angew. Chem., Int. Ed. 2004, 43, 5138.
(4) F. Fache; E. Schulz; M. L. Tommasino; M. Lemaire; Chem. Rev. 2000, 100, 2159.



Aggregation Induced Emission or Hydrolysis by Water? The Case of Schiff Bases in Aqueous Organic Solvents: A Text Book Chemistry Ignored for Decades

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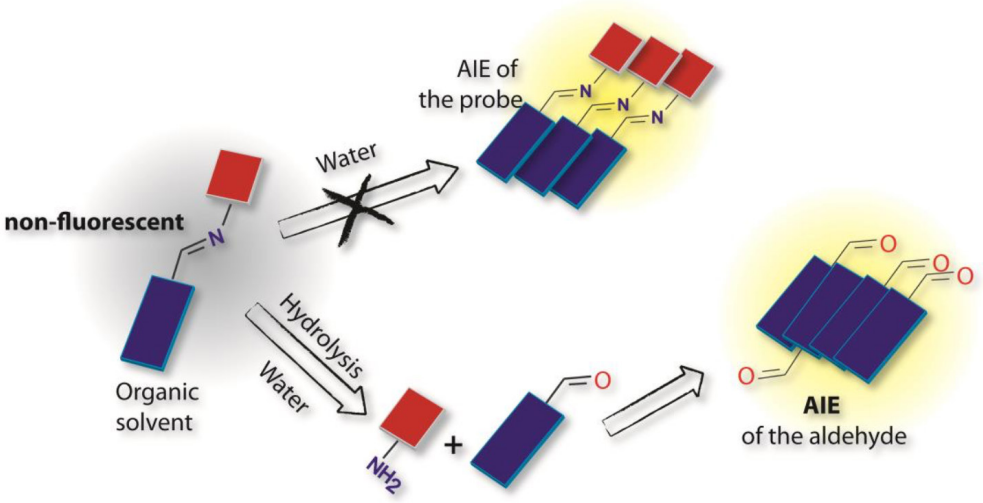
In the last two decades, several Schiff bases have been reported as AIEgens which remain non-emissive in organic solvents but show strong fluorescence in presence of water. A methodical analysis involving 21 Schiff bases, including some of the reported molecules, show that in presence of water, the Schiff bases hydrolyze to yield the corresponding starting aldehydes and amines. The observed emission in presence of water is found to be originated from the aggregation of the fluorogenic aldehydes and not of the original molecules. Thus, while the AIE effect is valid for these systems, certainly, these Schiff bases cannot be termed as AIEgens. Notably, the observation that these aldehydes can act as AIEgens through their excimer emission is an important phenomenon with respect to the current understanding of AIEgens.

References:

1. Luo, J.; Xie, Z.; Lam, J. W. Y.; Cheng, L.; Chen, H.; Qiu, C.; Kwok, H. S.; Zhan, X.; Liu, Y.; Zhu, D.; Tang, B. Z. Chem. Commun. 2001,1740.
2. Wang, Z.; Gui, C.; Zhao, E.; Wang, J.; Li, X.; Qin, A.; Zhao, Z.; Yu, Z.; Tang, B. Z.; ACS Appl. Mater. Interfaces 2016, 8, 10193.
3. Pramanik, B.; Das. D. J. Phys. Chem. C 2018 (Under Revision).



Covalent and Bulk 'Optimization' of Chemical Functionalities in Porous Organic Coating

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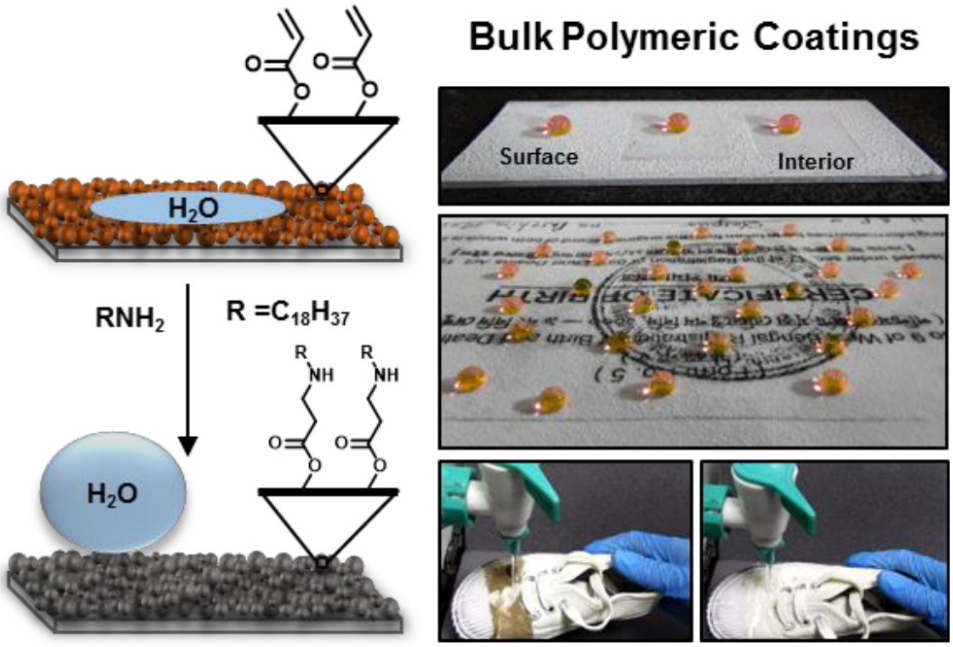
In past, there are several important and smart materials are synthesized through controlled functionalization of the thin and featureless 'reactive' polymeric interfaces1. The synthesis of 'chemically-reactive' and porous polymeric coatings having the ability to tune desired chemistry—covalently and three-dimensionally (including interior/interface), through facile and robust synthetic process, is fundamentally challenging, and would be important for designing various practically relevant durable and smart materials. Here, a catalyst free, 1,4-conjugate addition reaction and inherently scalable spray-deposition2 process are strategically exploited in both developing appropriate topography and manipulating essential chemistry—three dimensionally. The 'amine-reactive' residual acrylate-moieties in the porous polymeric thick (254±10 μm) coating4 provided a facile chemical avenue for regulating chemistry all throughout, and eventually yielded bulk polymeric coatings with chemically modulated Cassie-Baxter and Cassie-Wenzel transitional states3 through controlled optimization of the metastable trapped air level. The bio-mimicked wettability remained unperturbed even after incurring severe physical/chemical insults, including physical removal of material, prolonged (30 days) exposures of UV-irradiation etc. This simple design is capable of coating wide range of substrates, irrespective of their chemical compositions, geometries and dimensions. Even, some practically relevant flexible and complex objects—that are printing paper (A-4 size) and shoes, are decorated with durable bio-inspired property for early demonstration of protecting manual 'write-up' and printing from aqueous exposure and self-cleaning of the dust-contaminated interfaces. This bulk optimization of essential chemistry could be useful in synthesis of various other smart materials for many relevant outdoor applications4.

References

(1) Buck, M. E.; Zhang, J.; Lynn, D. M. Layer-by-Layer Assembly of Reactive Ultrathin Films Mediated by Click-Type Reactions of Poly(2-Alkenyl Azlactone)s. Adv. Mater. 2007, 19, 3951–3955.
(2) Li, Y.; Chen, S.; Wu, M.; Sun, J. All Spraying Processes for the Fabrication of Robust, Self-Healing, Superhydrophobic Coatings. Adv. Mater. 2014, 26, 3344- 3348.
(3) Zhu, H.; Guo Z.; Liu, W. Adhesion behaviors on superhydrophobic surfaces. Chem. Commun. 2014, 50, 3900-3913.
(4) Maji, K.; Manna, U. Covalent and Bulk 'Optimization' of Chemical Functionalities in Porous Organic Coating. Manuscript Submitted, 2017.



An Efficient Aluminum Catalyzed Enantioselective Ring Expansion of Aziridines to 2-Iminoselenazolidines

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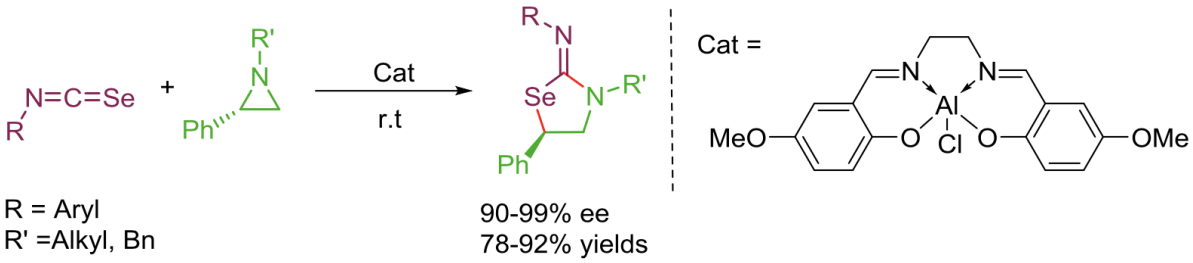
The recent advances in the domino (3+2) cycloaddition of aziridines with heterocumulenes have led to the development of effective methods for the construction of diverse five membered heterocycles.1 In contrast, cycloaddition of isoselenocyanates with aziridines are less investigated.2 Selenium heterocycles are important structural scaffolds of large biological and medicinal properties.3 Herein, we report an Al-catalysed stereospecific ring expansion of chiral unactivated aziridines4 with isoselenocyanates in excellent optical purities. The catalyst having ligand with electron donating 4-methoxy substituent exhibits superior optical purity in comparison to that bearing electron withdrawing 4-nitro group.5 The reaction provides a potential route for the generation of stereospecific 1,3-selenazolidin-2-imines at ambient conditions.

References

1. (a) Baeg, J. O.; Bensimon, C.; Alper, H. J. Am. Chem. Soc. 1995, 117, 4700. (b) Munegumi, T.; Azumaya, I.; Kato, T.; Masu, H.; Saito, S.. Org. Lett. 2006, 8, 379. (c) Sengoden, M.; Irie, R.; Punniyamurthy, T. J. Org. Chem. 2016, 81, 11508.
2. (b) Sengoden, M.; Punniyamurthy, T. Angew. Chem. Int. Ed. 2013, 52, 572.
3. (a) Sh, A.-H. Eur. J. Med. Chem. 2008, 1971. (b) Cardoso, A. L. Pinho eMelo, T. M. V. D. Eur. J. Org. Chem. 2012, 6479.



4. Stanković, S.; D'hooghe, M.; Catak, S.; Eum, H.; Waroquier, M.; Speybroeck, S. S.; Kimpe, N. D.; Ha, H. - J. Chem. Soc. Rev., 2012, 41, 643.
5. Fu, Y.; Hou, G.–H.; Xie, J.–H.; Xing, L.; Wang, L. –X.; Zhou, Q. –L. J. Org. Chem. 2004, 69, 8157. (b) Shokri, A.; Wang, X. –B, Kass, S. R.; J. Am. Chem. Soc. 2013, 135, 9525.

Development of Sensors Based on π-Conjugated System for Highly Sensitive and Selective Detection of Nitroexplosive-Picric Acid

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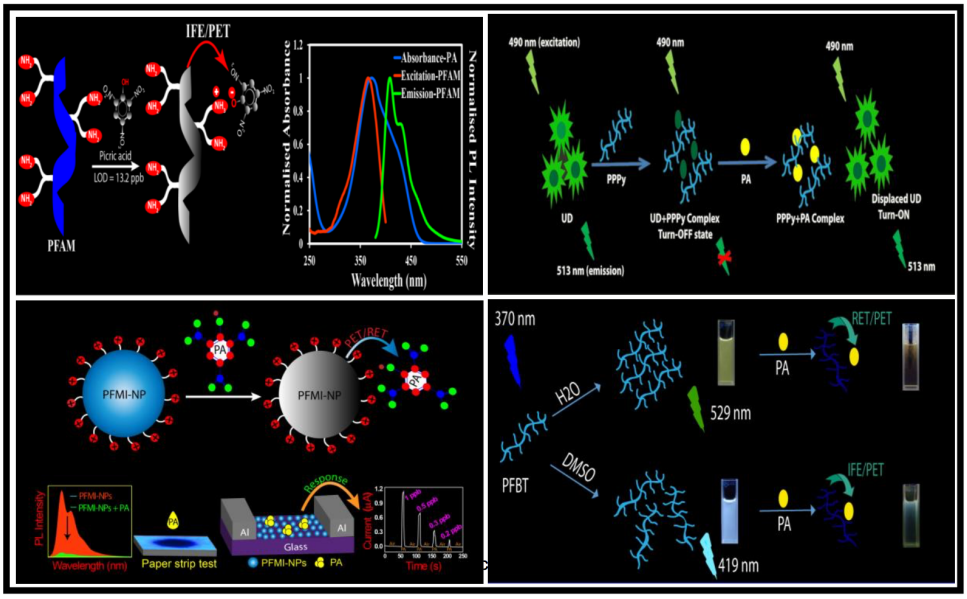
We have designed and synthesised four different types of π-conjugated polymers and utilized them in attaining simple, low cost and portable optical/electrical sensors capable of monitoring nitroexplosive-Picric acid (PA) at ultra-trace level. The conjugated polymer PFAM showed rapid and specific recognition toward PA on solid support and in solution based on IFE/PET mechanism. The non-fluorescent cationic conjugated polymer PPPy participates in indicator displacement assay resulting turn-on fluorescence selectively in presence of PA. The cationic conjugated polymer nanoparticle PFMI displayed remarkable fluorescence response towards PA in solution and vapour phase via two terminal electronic device based on RET/PET mechanism. The cationic conjugated polymer PFBT displayed substantial fluorescence quenching for PA in solution as well as solid state based on IFE and RET mechanism and utilised economical paper strips for on-site detection of nitroexplosive.



References.

1. Hussain, S.; Malik, A. H.; Afroz, M. A.; Iyer, P. K. Ultrasensitive Detection of Nitroexplosive-Picric Acid via a Conjugated Polyelectrolyte
in Aqueous Media and Solid Support. Chem. Commun. 2015, 51, 7207–7210.
2. Malik, A. H.; Hussain, S.; Kalita, A.; Iyer, P. K. Conjugated Polymer Nanoparticles for the Amplified Detection of Nitro-explosive
Picric Acid on Multiple Platforms. ACS Appl. Mater. Interfaces 2015, 7, 26968–26976.
3. Tanwar, A. S.; Hussain, S.; Malik, A. H.; Afroz, M. A.; Iyer, P. K. Inner Filter Effect Based Selective Detection of Nitroexplosive-Picric
Acid in Aqueous Solution and Solid Support Using Conjugated Polymer. ACS Sens. 2016, 1, 1070–1077
4. Tanwar, A. S.; Iyer, P. K. Fluorescence "Turn-On" Indicator Displacement Assay-Based Sensing of Nitroexplosive
2,4,6-Trinitrophenol in Aqueous Media via a Polyelectrolyte and Dye Complex. ACS Omega, 2017, 2, 4424–4430.

Enhanced Photovoltaic Performance using Biomass Derived Nano 3D ZnO Hierarchical Superstructures and a D-A type CS-Symmetric triphenylamine linked bisthiazole

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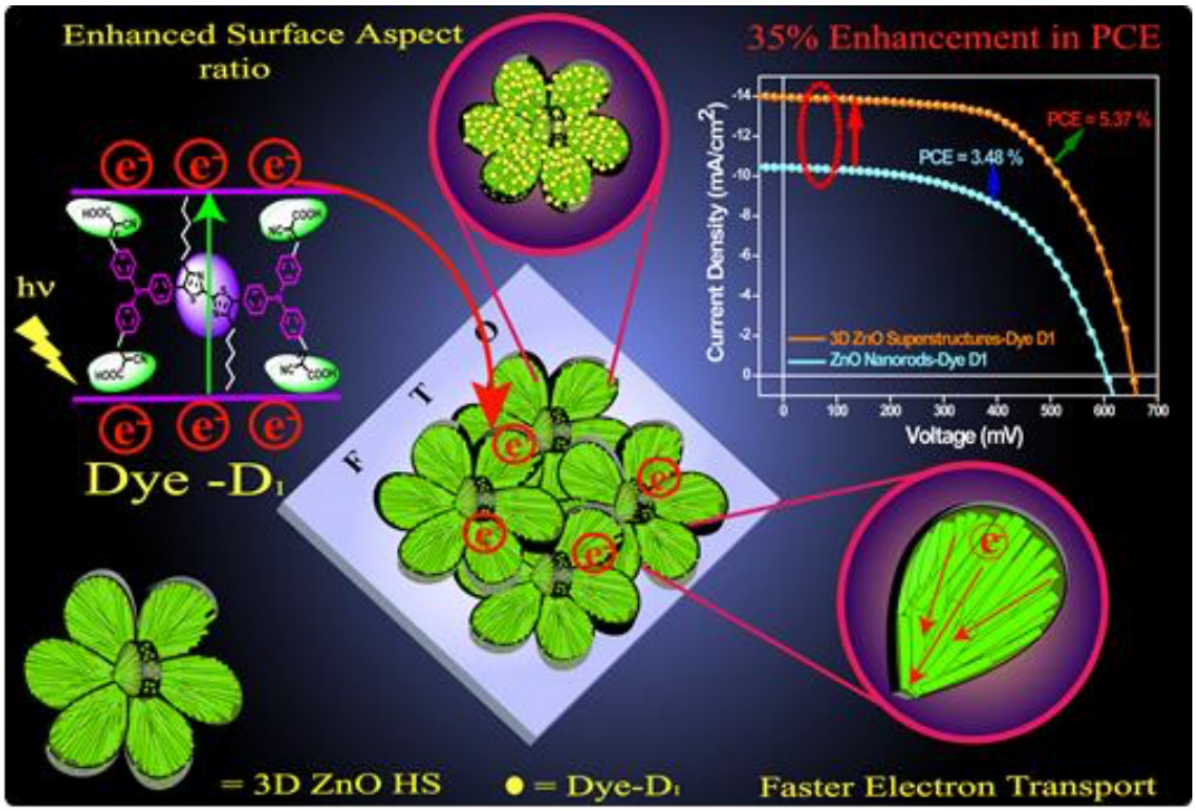
In the recent trends, combination of controlled shape defined building blocks and their engineered arrangement for the development of micro/nanostructured materials has been emerged as a suitable candidate for the advanced Nano- devices [1-2]. These functional materials showed unique structure derived physicochemical and optoelectronic properties. Herein, we are reported a facile one step hydrothermal route for the controlled, biomass assisted synthesis of three dimensional (3D) Zinc oxide (ZnO) hierarchical superstructures (HSs), assembled with compacted ZnO nanorods (NRs) [3]. Anionic polysaccharide "Polygalacturonic acid" is utilized as a crystal growth modifier for assembling the basic building blocks (ZnO NRs). Photovoltaic properties of as-synthesized 3D ZnO HSs as compared to its basic structural unit i.e., ZnO NRs are investigated by sensitizing with a bisthiazole linked metal free donor- acceptor dye; D1. A substantial enhancement (~ 35%) in efficiency (η) for 3D ZnO HSs based device (η ≈ 5.37 %) as compare to ZnO NRs (η ≈ 3.48 %) is being observed, mainly due to better charge separation and collection, owing to a superior electron transport ability of compacted building blocks, better light-scattering effect, higher BET surface area for sensitizer loading and efficient electron injection from dye D1 to the ZnO.



References:

1. J. M. Nam, C. S. Thaxton, C. A. Mirkin, Science 301 (2003), 1884-1886.
2. E. V. Shevchenko, D. V. Talapin, N. A. Kotov, S. O'Brien, C. B. Murray, Nature 439 (2006), 55-59.
3. M. S. Ansari, R. Maragani, A. Banik, R. Misra, M. Qureshi, Electrochimica Acta 259 (2018),262-275.

Cathode Engineering Using Water/Alcohol Soluble Organic Molecules for High Performance and Stable Polymer Solar Cells

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Polymer solar cells (PSCs) have already achieved the milestone value of 12% power conversion efficiency (PCE) but their instability associated with a low work function metal cathode in open atmosphere, becomes a critical issue for real applications. To overcome the air-sensitive problem, two easy-accessible solution-processed, environmentally friendly organic small- molecule cathode interlayers, with perylene diimide (PDI) as the core, named as PDI-X and PDI-Y, are explored. Due to the extended planar structure of the PDI units, the two interlayer materials show high conductivities which make them capable of functioning efficiently in a wide thickness range. It is also found that the work function tuning effect of the two PDI-based interlayers allows high work function metals (such as Au and Ag) to act as the cathode. High efficiency is achieved with the conventional device structure with PTB7-Th as a donor and PC70BM as an acceptor for both the PDI derivatives. The success of the two PDI-interlayers indicates that p-delocalized planar structures with high electron affinities could be particularly useful in developing high-performance organic interlayer materials.

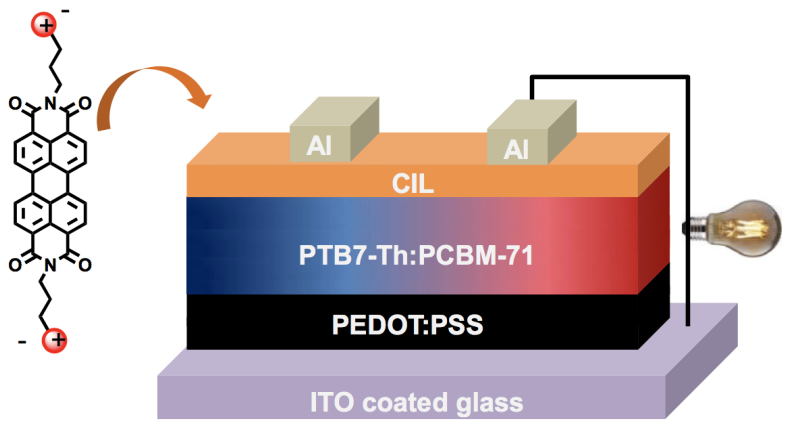

Figure 1: Structure of CIL and solar cell architecture

References:
(1) Park, S. H.; Roy, A.; Beaupre, S.; Cho, S.; Coates, N.; Moon, J. S.; Moses, D.; Leclerc, M.; Lee, K.; Heeger, A. J. Bulk Heterojunction Solar Cells with Internal Quantum Efficiency Approaching 100%. Nat. Photonics 2009, 3, 297–302\
(2) Xu, Z.; Chen, L.-M.; Yang, G.; Huang, C.-H.; Hou, J.; Wu, Y.; Li, G.; Hsu, C.-S.; Yang, Y. Vertical Phase Separation in Poly(3- hexylthiophene): Fullerene Derivative Blends and its Advantage for Inverted Structure Solar Cells. Adv. Funct. Mater. 2009, 19, 1227– 1234.

Dependence of spiral wave dynamics on excitability parameter

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Spiral waves are ubiquitously found in systems ranging from the sub-micronic neuronal tissues to the super-massive galaxies [1]. They are of special interest due to their relevance to complex biological phenomena, especially in the context of human heart [2, 3]. Spirals of electrical activity have been suggested to be responsible for cardiac arrhythmias, some of which are life threatening .The study of these vortices has attracted much attention in recent decades. In this work we have explored the effects of excitability on spiral wave properties.

We carry out numerical simulations using the Oregonator model, which consists of two reaction diffusion equations given by,

$$\frac{du}{dt} = \frac{1}{\epsilon}[u(1-u) - \frac{fv(u-q)}{u+q}] + D_u\nabla^2 u$$

$$\frac{dv}{dt} = u - v + D_v\nabla^2 v$$

Here, u and v are dimensionless forms corresponding to the concentrations of bromous acid and the oxidized form of the metal catalyst respectively, q and f are kinetic parameters, and Du, Dv are the respective diffusion coefficients of u and v. ε represents the ratio of the time scales of the dynamics of the fast and slow variables.

By changing the value of the parameters, we are able to change the excitability of the system. The various regimes of wave activity are explored by varying the excitability parameter, ε [4]. It is observed that changing ε affects the wave nature. There is a strong dependence of the nature of the phase portrait, and hence the oscillatory character of the system on ε. The trajectories of the spiral tip are also seen to change with the ε value. Our numerical findings have been confirmed by experiments employing the Belousov Zhabotinsky reaction, where the excitability is changed by varying the concentrations of the reactant species.

References

1. Dutta, S. , Das, N. P., and Mahanta, D. in Complexity and Synergetics, edited by S. C. Müller, P. J. Plath, G. Radons, A. Fuchs , Springer Publishers, Heidelberg, 2017.
2. Cherry, E. M. and Fenton, F. H. New J. Phys. 2008, 10, 125016.
3. Mahanta, D., Dutta, S., and Steinbock, O. Phys. Rev. E, 2017, 95, 032204.
4. Mahanta, D., Das, N. P., and Dutta, S., Phys. Rev. E, accepted.

Tertiary Alkyl Amine as the Source of Diene for Dehydrogenative Diels-Alder Reaction

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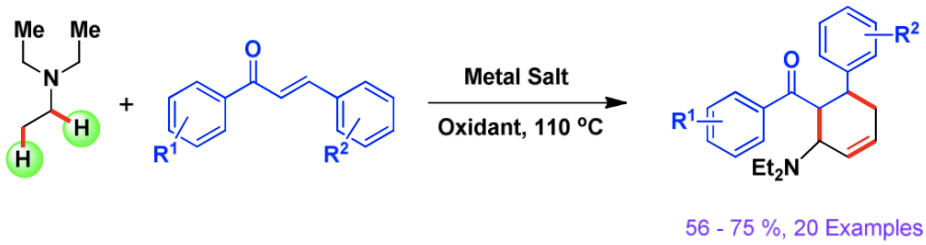
Trialkyl amine was found to be an excellent source for diene towards cycloadition reaction with various enones. Both α- and β- protons were involved in this self-coupling of two alkyl amine, to in-situ diene production of diene through a Single

Electron Transfer (SET) mechanism. This present protocol adds a new direction in Diels- Alder Reaction1.



56 - 75 %, 20 Examples

(1) Selected reports on Dehydrogenative Diels-Alder reaction: (a) Stang, E. M.; White, M. C J. Am. Chem. Soc. 2011, 14892. (b) Ozawa, T.; Kurahashi, T.; Matsubara, S. Org. Lett. 2011, 13, 5390. (c) Wu, X.; Zhu, H.-J.; Zhao, S.-B.; Chen, S.-S.; Luo, Y.-F.; Li, Y.-G.; Org. Lett. 2018, 20, 32. (d) Manna, S.; Antonchick, A. P. Chem. -Eur. J. 2017, 23, 7825.

Tertiary Alkyl Amine as the Source of Diene for Dehydrogenative Diels-Alder Reaction

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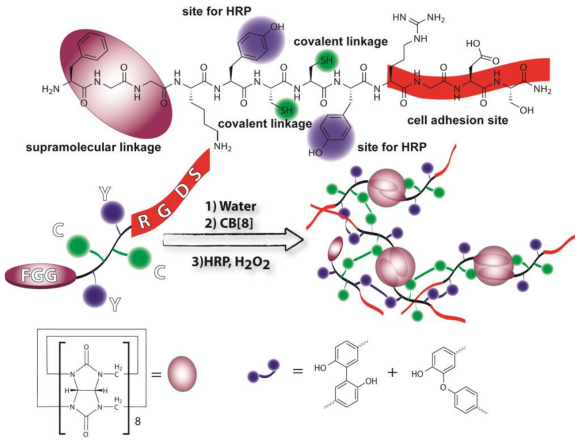

Figure 1: chemical structures of peptide monomer and CB[8] and the schematic representation of the cross-linking strategy

References
1. G. Huang, F. Li, X. Zhao, Y. Ma, Y. Li, M. Lin, G. Jin, T. J. Lu, G. M. Genin and F. Xu, Chem. Rev., 2017,117, 12764-12850.
2. I. W. Hamley, Chem. Rev., 2017, DOI: 10.1021/acs.chemrev.7b00522.
3. Z. Huang, Y. Fang, Q. Luo, S. Liu, G. An, C. Hou, C. Lang, J. Xu, Z. Dong and J. Liu, Chem. Commun., 2016,52, 2083-2086.

C-terminal dipeptides of Amyloid β crystallize in parallel β-sheet arrangement

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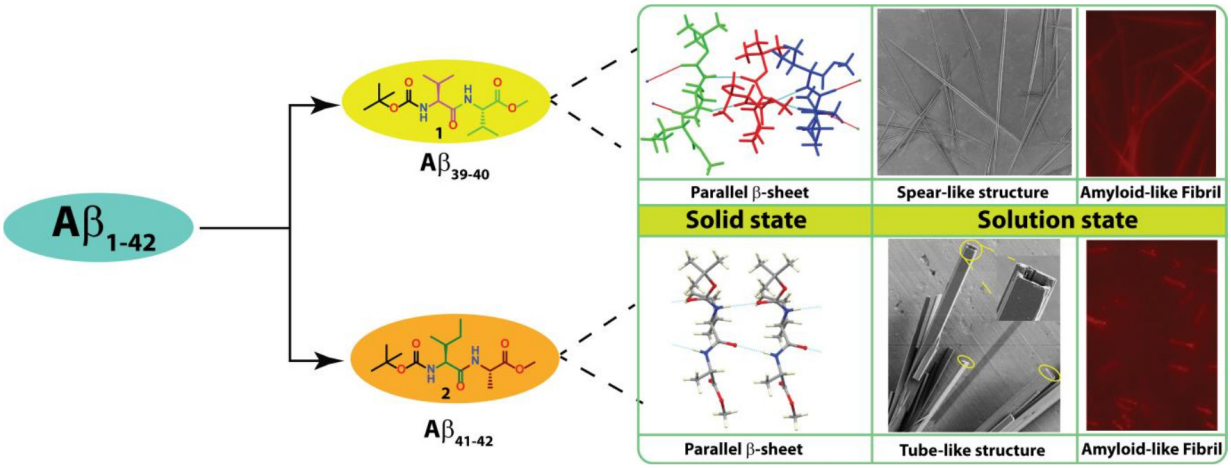
Understanding of protein folding, misfolding and aggregation mechanism is a real challenge at present for the scientists and researchers. The in vivo aggregation of protein to form cytotoxic oligomers and amyloid fibrils causes cell damage and the pathogenesis of several human degenerative diseases including Alzheimer's disease (AD), Parkinson's disease (PD), Huntington's disease (HD), type II diabetes (T2D), and Prion related disorders.1 Alzheimer's disease is one of the most devastating ailment among amyloidogenesis induced dementia. It causes progressive attrition of cognition, task performance ability, mood, speech, behavior, and memory.2 Herein, we represented two dipeptides, Boc-Val-Val-OMe (1) and Boc-Ile-Ala-OMe (2), containing sequence identity with hydrophobic C-terminus (Aβ 39-42) of Alzheimer's Aβ39-40 and Aβ41-42 peptide, respectively, exhibit intermolecular hydrogen bonded supramolecular β-sheet structure in crystalline form. The higher order aggregation of peptide 2 showed a supramolecular cross-β- sheet structure. The morphology analysis indicated that peptide 1 and 2 self-assembled to form straight unbranched two ended spear and hollow tube-like structures, respectively, in methanol-water (2:1) medium. Then, we performed various biophysical techniques, including Congo red and ThT dyes strain microscopic experiment, FESEM, PXRD and FTIR for understanding the morphology and amyloidogenic nature3 of these peptides.



References
1. D. J. Selkoe, Nature, 2003, 426, 900.
2. I. W. Hamley, Chem. Rev., 2012, 112, 5147.
3. C. Subbalakshmi, P. Basak and R. Nagaraj, Biopolymers, 2017, 108:e23033.

Ligand-Accelerated Robust Cobalt(II)-Catalyzed Site-Selective C7-Arylation of Indolines with Boronic Acids

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The Transition-metal-catalyzed directing group assisted site-selective C-H functionalizations1 has recently performed as a potential synthetic tool for the regioselective carbon-carbon bond formation. Among them, the C-H arylation is mostly restricted to Pd and other noble transition metals.2 Cost-effective and eco-benign Cobalt being a first row transition metal, guided this methodology into new dimension. As direct C7 functionalization of indoles remain elusive, the C7 decorated indoles can be accommodated through chelation assisted functionalization of indolines, followed by oxidation. Ligand accelerated cobalt(II)-catalyzed removable pyrimidyl coordinating group assisted C7 arylation of indolines with arylboronic acids has been established in the presence of Mn(OAc)2·4H2O as the oxidant at moderate temperature.3 The use of cobalt(II) catalyst, Grignard-reagent free, operational simplicity, aerobic C7 selective and ample substrate scope are the significant practical features of this synthetic protocol.

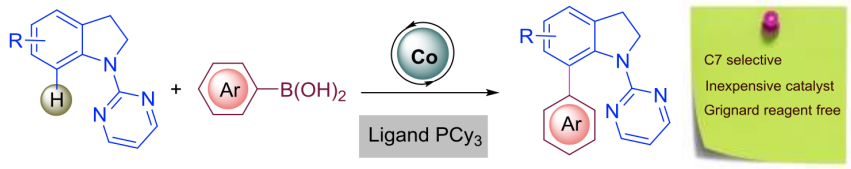

Fig.1

Reference:
1. Gandeepan, P.; Koeller, J.; Ackermann, L. ACS Catal. 2017, 7, 1030.
2. Zhang, Z.; Tanaka, K.; Yu J.-Q. Nature 2017, 543, 538.
3. De, P. B.; Pradhan, S.; Banerjee, S.; Punniyamurthy, T. manuscript submitted.

Stepwise hydrogelation of a naphthalene diimide appended peptide amphiphile and its application in cell-imaging and intracellular pH sensing

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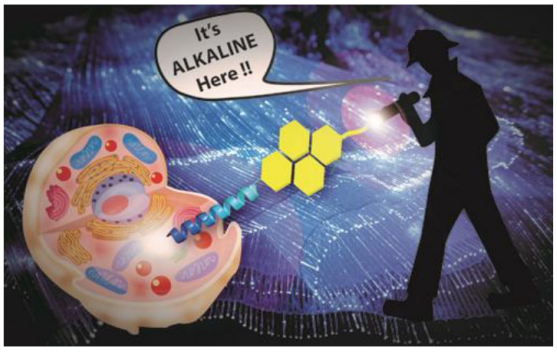
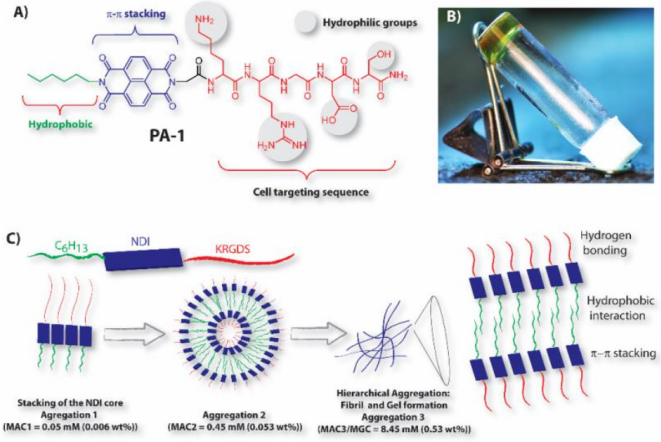
This study reports the self-assembly and application of a naphthalene diimide (NDI)-appended peptide amphiphile (PA). H- bonding among the peptide moiety in conjunction with π-stacking between NDI and hydrophobic interactions are the major driving forces behind the stepwise aggregation to form hydrogel. The PA in three self-assembly steps, produced efficient self-assemblies in water at physiological conditions, forming nanofibrous network which further formed self-supportive hydrogel. Importantly, this water soluble conjugate was found to be non-toxic, cell permeable and was used for cell imaging at very low concentration and has an extended biological application to assess intracellular pH. The relatively good biocompatibility and intracellular pH determining capability suggest it as a promising candidate for use as a supramolecular material in biomedical applications.





References
1. D Das et al, Biomacromolecules 18 (2017) 3630.
2. D Das et al, RSC Advances 3 (2013), 9117.
3. R V Ulijn et al, Angew. Chem. Int. Ed. 53 (2014) 5882.
4. D Das et al, Langmuir 29 (2013) 14274.

Utilization of Zinc Oxide Nanostructures as an effective electron transport layer for inverted bulk heterojunction solar cell

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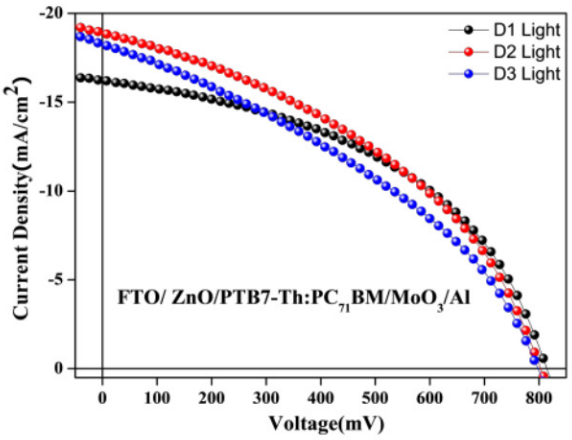
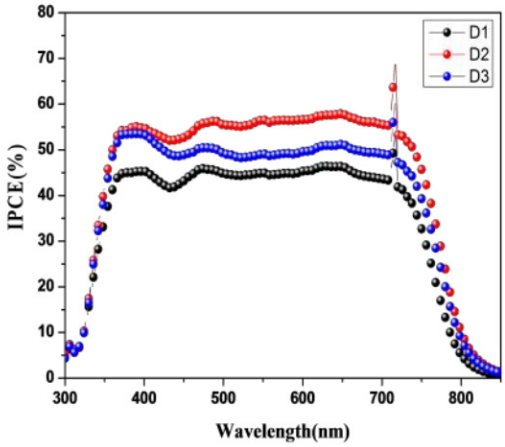
Among the family of electron-transporting materials, n –type metal oxides with deep-lying energy levels are currently predominant cathode interface layer (CIL) materials in single-junction and tandem organic solar cells (OSCs). OSCs based on metal oxide CILs exhibit high performance which can be contributed to the fact that the metal oxide CILs have salient features like ambient stability, good solution processability, high optical transparency and excellent capability to extract/transport electron carriers. To date, effective CILs for OSCs include binary oxides (such as ZnO, TiO2, Nb2O5 and SnO2), and newly emerged ternary oxides (such as Al doped ZnO, Mg-doped ZnO and Cs-doped metal oxides). Among all binary oxides, ZnO is a virtuous candidate to be utilized as CIL material due to its features such as low cost, easy synthesis, non-toxicity, high stability and unique optical/electronic properties. Generally, ZnO materials have a low conduction band (CB) energy level of ≈ 4.20 eV, which offers an efficient electrons transfers based on their energy levels with respect to ITO (work function ≈ 4.40 eV) and also good energy match with CB levels of various fullerene-based acceptors such as [6,6]-phenyl-C61-butyric acid methyl ester (PC61BM), PC71BM and indene-C 60 bis-adduct (ICBA), etc. The optical transparency, mobility and interfacial properties of ZnO CIL materials can be tuned with their variations in crystalline structures, film morphologies, surface energy compositions, film thickness and structural defects etc. which greatly depend on the processing conditions. However, the device performance of OSCs are varying with the different processing condition of CIL material i.e., ZnO. Therefore, optimized processing condition of ZnO layer is required for meeting a better photovoltaic performance of OSCs, owing to improve optoelectronic and structural properties.





References:
1: J. Huang , Z. G. Yin , Q. D. Zheng , "Applications of ZnO in organic and hybrid solar cells" Energy Environ. Sci. 2011, 4, 3861.
2: S. Trost, K. Zilberberg, A. Behrendt, T. Riedl, "Room-temperature solution processed SnO2 as an electron extraction layer for inverted organic solar cells with superior thermal stability" J. Mater. Chem. 2012, 22, 16224
3: S. Sanchez, S. Berson, S. Guillerez, C. Lévy-Clément, V. Ivanova,"Toward High-Stability Inverted Polymer Solar Cells with an Electrodeposited ZnO Electron Transporting Layer" Adv. Energy Mater. 2012, 2, 541
4: M. K. Siddiki, S. Venkatesan, Q. Qiao, "Nb2O5 as a new electron transport layer for double junction polymer solar cells" Phys. Chem. Chem. Phys.2012, 14, 4682
5: Tridip Ranjan Chetia, Mohammad Shaad Ansari, Mohammad Qureshi*, "Ethyl Cellulose and Cetrimonium Bromide Assisted Synthesis of Meso-porous, Hexagon Shaped ZnO Nanodisks with Exposed {0001} Polar Facets for Enhanced Photovoltaic Performance in Quantum Dot Sensitized Solar Cells," ACS Appl. Mater. Interfaces, 2015, 7, 13266.

Water/Alcohol Processable non-conjugated Cathode Interlayer for Stable & High Performance Polymer Solar Cells

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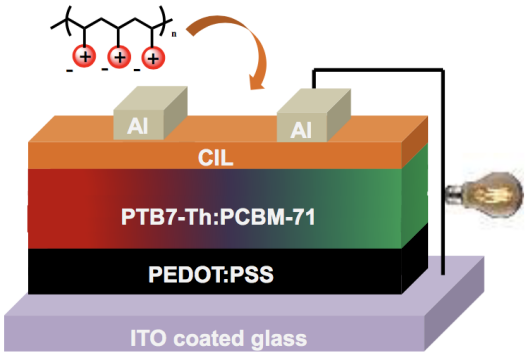
Polymer solar cells (PSCs) based on the photoactive layer of the conjugated polymer donor and the fullerene acceptor can be fabricated on light-weight flexible plastic substrates, and are promising in providing low-cost green energy. Using this technology more than12% power conversion efficiency (PCE) has been achieved recently but their instability associated with a low work function metal cathode in open atmosphere becomes a critical issue for real applications. To overcome this problem the role of non-conjugated polyelectrolyte (PVI-CH3) are being explored as cathode interlayers. Due to the ionic functionality and quantum mechanical tunnelling it improves the charge separation within the device. The ionic cathode interfacial layers increase the charge separation by modifying the work function of cathode and both the interlayer materials show high power conversion efficiency ~9 % with the conventional device architecture using PTB7-Th, PC70BM as a donor and acceptor respectively.



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The science of mental health and its awareness

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Mental health is a person's condition with regard to his/her psychological, intellectual, emotional and social well being. The term mental illness refers collectively to all diagnosable or observed mental disorders. The importance of mental health awareness is increasing day by day. People struggling with their mental health may be in your family, live next door or even teach your children. However, only half of those affected receive treatment, often because of the stigma attached to mental illness. According to W.H.O., mental disorders are the single most common cause of disability in young people. The increasing rate of suicides among youth is also a result of degrading mental health. A national survey reported that more than 50% of the college students feel so depressed due to difficulty arises in their academic curriculum. This reveals the increasing numbers of suicides cases among the students. Hence there is a serious and desperate need to understand what can be done to prevent serious emotional and mental health problems among students.
The scientists who study mental illness believe the existence of an imbalance in brain chemicals, contributing to the development of many disorders. Researchers suspect this imbalance impedes the brain's ability to move messages from neuron to neuron. As a result of this breakdown, the brain may not communicate properly with the body and a person may begin to show signs of mental illness. Mental health is the state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to his/her community. Some physical causes such as birth, trauma, brain injury or drug abuse can directly affect brain chemistry and contribute to mental illness. More commonly poor physical health can affect self esteem and people's ability to meet their goals, which leads to unhappiness or even depression. Young people are the main victims of such problems. Mental health problem is a very serious issue in today's world. People are investing themselves more in upgrading the technological world than focusing on their mental health. This is causing serious effects on individual's life as well as society. Nearly 1/3rd population of India suffers from some kind of mental disorder. And the rate is increasing day by day. This is why the awareness for mental well-being is very important. Awareness can eliminate stigma for the suffering people, it can create new improvements for the mentally ill. Awareness is a form of education. The more we know the more power we have, which can cause positive effect on our community. Keywords: Mental health, disorder, chemical contribution, awareness etc.

Photocatalytic degradradation of Simazine pesticide using Fe304/reduced graphene oxide nanoparticles under visible light irradiation

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Extensive application of herbicides and pesticides to control weed growth and to suppress the impact of plant and animal pests has become a routine practice to protect industrial and agricultural products. This has resulted in increasing public concerns. Graphene-based nanomaterials have been explored and utilised for the removal of water contaminants like these pesticides, using different degradation techniques. In this work, magnetic Fe304/rGO nanocomposite was synthesised and utilized as an efficient photocatalyst towards Simazine pesticide degradation under visible light irradiation. The maximum degradation efficiency of Fe304/rGO nanocomposite was found to be 100%. In this study, the effect of initial pesticide concentration, catalyst loading and pH of the reaction medium were investigated for the degradation of Simazine pesticide. The efficient degradation efficiency was observed at acidic pH and 0.5g/L catalyst loading amount. The degradation efficiency was decreased gradually when the pesticide concentration is increased.
Keywords: Fe304/rGO, nanocomposite, pesticide, simazine, photocatalytic degradation, graphene, efficiency.

Abstracts (Poster)

Civil

Moisture Stress Index and its relation with NDVI, SAVI and NDWI using Sentinel-2

Adnan Ahmad[1], Juna P Devi[2] . Pooja Patel[1] Apurba Das[1] and Rishikesh Bharti[1]
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In this era of limited resources and high demand, it is very essential for proper monitoring of the crop during various phases of its growth to avoid undesirable output. So, Crop Health Monitoring plays a very significant role in the agricultural sector. This monitoring can be done by the analysis of certain indices which is affected directly or indirectly by various factors like climate, soil, temperature etc. of that particular area. Moisture Stress Index(MSI) is such an index which gives specific information about the canopy stress, productivity prediction and biophysical modelling.(Pauline et al).Moisture stress gives brief idea about soil moisture as the MSI of a particular crop has an indirect relation with the soil moisture available at that particular area.

Lithological Discrimination Of Reiner Gamma Using Remote Sensing Techniques

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Moon, is the only natural satellite of the Earth is also the most studied celestial body of the Solar system. Absorbance spectroscopy is the analytical technique based on measuring the amount of light absorbed by a sample at a given wavelength. Pyroxene and olivine are two most common mafic minerals found in lunar surface and both are having characteristic absorption features.
Mineral mapping of the lunar surface provides insights into the composition and evolution of the crust and also provides important information on the primordial crust in the Earth–Moon system (Sivakumar et al, 2017). In the present study the lithology of Reiner Gamma region to map compositional characteristics

Assessment and productivity enhancement of Water storage structure in Rural Areas

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In rural area by constructing small capacity water storage structure plays an important role and now a day its prime important. By storing water through such structure recovers the ground water level and provides water to irrigation and it improves the living standards of the people. After completion of construction within short period, it reduces working capacity of structure and also due to some other reasons like lack of maintenance etc.
In this study it s observed that silt deposition is the major factor for reducing the water storage capacity and improper site location which trouble the societies in rainy season.
Now a day technology widely used for water harvesting in arid climates so methodology for the assessment of the suitability of sites for the installation of new small dams is based on selection criteria are defined both in a qualitative and quantitative way, and are based on a territorial analysis using satellite data (images, digital elevation models) and hydrological and climatologically information. Qualitative criteria imply the identification of suitable valleys, beds and rock formations, based on visual interpretation of satellite images and large-scale available cartography; other qualitative selection criteria concern the distance from settlements and infrastructures, faults localisation. Quantitative criteria are expressed in terms of indexes that synthesise the effectiveness and feasibility of the possible interventions, calculated in terms of benefit/cost ratio. So in this way productivity for water storage can be increase to its sustainability period.
Keywords- water storage structure, silting, site suitability, GIS, Cost Benefit ratio

Infrastructure asset management Of water supply scheme in rural area

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Satisfactory, continuous, drinkable and consistent water supply is the necessity of every human being. Pipe water supply scheme is vital to supply safe water which contributes to being's health and hygiene. In India presently, the main problem of water supply scheme is related to sustainability and future water demand. As we enter into the era of maintenance, an efficient use of budget in environments mostly equipped with major infrastructure definitely requires life-cycle cost analysis.
The most important aspect in operation of a water supply system is to construct an inventory and clearly understand what one's assets are, and the second most critical element is to calculate the life cycle cost, in order to assist in planning and budgeting by evaluation of alternative for the lifespan of a facility. Life cycle cost consists of initial installation cost, maintenance cost, and disposal and replacement costs which are calculated using NPV (Net Present Value) method. Through LCC analysis, water service providers can estimate the budget required in the future and based on the analysis results; obtain budgetary approval from the government.
Also, the ways to secure revenue/ financial stability in the future are suggested and thus an economic asset management direction is proposed. Keywords: Life Cycle Cost (LCC), Maintenance, Inventory, planning and budgeting, Asset Management, evaluation of alternatives, Water Supply System

A Short-term Noise Study in a Cement Plant

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Industrial noise is one of the important contributors of ambient noise pollution. We carried out a short-term ambient noise monitoring at four locations of a cement milling and grinding plant, i.e. Topcem India in Guwahati by SVANTEK 977 noise level meter. The study was carried out to investigate the impacts of industrial noise on the ambient environment generated due to various activities inside the plant including raw material storage, clinker grinding, vehicular movement inside the plant, other machinery operations and boring operation. The observed daytime A-weighted equivalent noise levels (Leq) near highways and truck parking, near workshop and staff quarter and near truck tippler were found to be 58.9 dB(A), 64.1 dB(A), 61.7 dB(A) and 61.3 dB(A), respectively and night time were 59.2 dB(A), 65.2 dB(A), 65.2 dB(A) and 60.9 dB(A), respectively. Near workshop and staff quarter, the observed mean Leq values 65.2±1.63 on that day exceed the CPCB prescribed noise limit of 55 dB(A) and 45 dB(A) at daytime and night time, respectively. Peak noise (L10) is very strongly correlated with median noise (L50), background noise (L90), traffic noise index (TNI) and noise pollution level (NPL) respectively. Median noise (L50) is highly correlated with background noise (L90), traffic noise index (TNI) and noise pollution level (NPL) respectively. Noise pollution level (NPL) is highly correlated with background noise (L90) and traffic noise index (TNI). These observations signify that overall ambient noise level may contribute to noise induced health disorders including hearing damage, cardiovascular affect, anxiety, etc. over the longer period of exposure.
The study therefore proposes a suitable noise barrier to ensure reduction of noise near various locations and also study the effect of restricted vehicular movement on the noise levels.
Keywords: ambient noise, equivalent noise level, dB(A), cement plant, noise barrier, noise level meter, peak noise(L10), background noise(L90), median noise(L50), traffic noise index (TNI), noise pollution level (NPL), correlation

Studies on assessment of suitability of commonly available surfactants for use in foam concrete production

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Foam concrete classified as lightweight cellular concrete is produced by introducing sufficient quantities of stable air pores into a neat cement paste or fresh mortar by adding suitable foaming agent (surfactant). The use of foam concrete has been increased over the past few years in countries like Netherland, Sweden, Germany, USA, Switzerland and UK owing to its key attributes like high flowability, low self weight, minimal consumption of aggregate and excellent thermal insulation properties. However in India foamed concrete production has not gained confidence due to technical and engineering unfamiliarity. Secondly most of the available imported foaming agents and foam generator are cost ineffective which highlights the need for identification of new locally available surfactants for use in foam concrete production. Basically surfactants can be natural or synthetic based depending upon the source from which they are obtained.

It is to be noted that for production of foam concrete with desired properties, stable and good quality foam is the key requirement However, the literature available on the influence of characteristics of foaming agent and foam on the properties of foam concrete are rather limited. Against these background issues, this research attempts to provide a critical review on characteristics of surfactant and foam for use in foam concrete production. Also the present work focuses on the evaluation of suitability of commonly available natural and synthetic surfactants for use in foam concrete production. The production process of natural surfactant being complicated, suitable method for preparation of natural surfactant based on optimization of different production parameters such as hydrolysis concentration, duration and temperature of hydrolysis need to be identified. The essential foam and foamed concrete characteristics evaluated are density and stability (foam), fresh density and compressive strength (foam concrete). The initial foam density was found to decrease with increase in surfactant concentration due to decrease in amount of liquid fraction and increase in amount of entrained air. Results on compressive strength of foam concrete indicated that it is mainly a function of volume of entrained air voids.

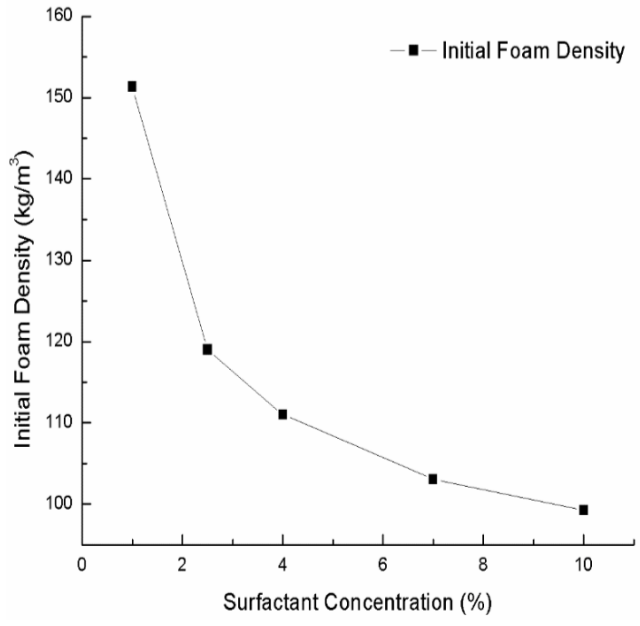

Fig 1. Variation of Initial foam density with Surfactant concentration

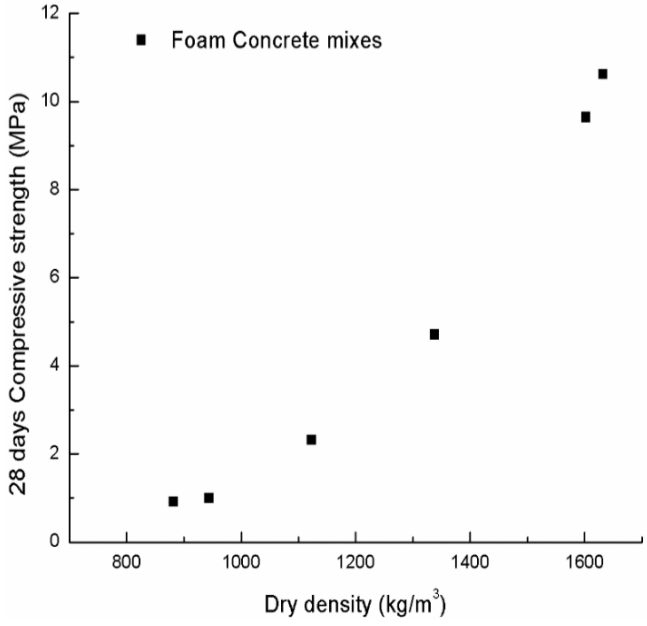

Fig 2. Strength-density relationship of foam concrete

A practical proposal for utilisation of degraded municipal solid waste: Recycling in fired bricks

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As a potential pathway to sustainable construction, this novel study demonstrates the feasibility of incorporating degraded municipal solid waste (MSW) as one of the constituents for production of fired bricks. The raw materials, degraded MSW and two different soils, i.e. laterite soil and alluvial soil, were mixed together in different proportions ranging from 5 to 20%. Specimens of these mixtures were then fired at 850 and 900 °C respectively. Various properties such as bulk density, linear shrinkage, loss on ignition, water absorption, compressive strength, and modulus of elasticity on light of the respective Indian and ASTM standard codes were studied and compared. An optimum constituent mix of 20% degraded MSW with (laterite or alluvial) soil fired at temperature of 900 oC was found to be most appropriate for brick production. The ultimate uptake of this study is 8% net saving in the energy consumption of external fuel by mixing 20% degraded MSW.
Keywords: Degraded municipal solid waste; fired brick; sustainable development; compressive strength; recycling

A critical evaluation of various models to predict the swell pressure of compacted benonite buffer in the context of deep geological disposal of nuclear waste

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Compacted bentonite/bentonite-sand mixture is preferred as a buffer material in the deep geological repository (DGR) for the safe disposal of high-level nuclear waste (HLW). Bentonite has a tendency to swell when it comes in contact with moisture. To understand the mechanism of swelling and its impact on the performance of the buffer it is important to study the swelling behavior of bentonite buffer for its application in deep geological repository. There are two mechanism behind the swelling 1) By hydration of exchangeable cations known as crystalline swelling and 2) Swelling by repulsion of Defused Double Layer (DDL) of two adjacent clay particles. The variation in swell pressure of bentonite buffer depends upon pore fluid salinity, compaction density, temperature, types of bentonite and their physico-chemical properties, etc. Many researchers have studied the mechanism of swelling of bentonite buffer in DGR conditions and proposed various models to predict the swell pressure values as a function of compaction density, pore fluid salinity and other physico-chemical properties. A critical review of various models to predict the swell pressure of compacted bentonite is presented in this study. The uniqueness of each model and the respective advantage and limitations are reported. Such a study will be quite handy in order to select a model to fix the design values of the bentonite buffer and to verify the experimental results based on the physicochemical properties and mineralogical data of the raw bentonite.
Keywords: Bentonite, Swell pressure models, Deep geological disposal, Engineered barrier system

A practical proposal for utilisation of degraded municipal solid waste: Recycling in fired bricks

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As a potential pathway to sustainable construction, this novel study demonstrates the feasibility of incorporating degraded municipal solid waste (MSW) as one of the constituents for production of fired bricks. The raw materials, degraded MSW and two different soils, i.e. laterite soil and alluvial soil, were mixed together in different proportions ranging from 5 to 20%. Specimens of these mixtures were then fired at 850 and 900 °C respectively (Fig. 1). Various properties such as bulk density, linear shrinkage, loss on ignition, water absorption, compressive strength, and modulus of elasticity on light of the respective Indian and ASTM standard codes were studied and compared. An optimum constituent mix of 20% degraded MSW with (laterite or alluvial) soil fired at temperature of 900 oC was found to be most appropriate for brick production. The ultimate uptake of this study is 8% net saving in the energy consumption of external fuel by mixing 20% degraded MSW.

Keywords: Degraded municipal solid waste; fired brick; sustainable development; compressive strength; recycling

Fig. 1. Brick manufacturing process.

Spatial Variation of Water Quality Parameters for Dipor Bil, Assam, India

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The following study aims at providing a spatial variation of the water quality parameters, especially Biochemical Oxygen Demand (BOD) and Total Dissolved Solids (TDS) for Dipor Bil (Study Area) so that proper rejuvenation techniques can be adopted for the development of the depleting water body. 19 sampling points were marked and samples were collected from the desired sampling sites. They were further analysed for BOD and TDS and the data were processed in the GIS platform to create spatial maps which would thereby indicate the areas of the water body which are the most polluted. This would thus give a fair idea of the existing scenario of the Dipor Bil with regards to the water quality, and would thereby provide a platform for the planning and development of necessary techniques for improving the water quality.

Keywords: Water Quality, GIS, BOD, TDS

Biochar as a capable bulking agent to improve nutritional properties during composting of lignocellulose aquatic weed

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Biochar are considered to be the best materials having stable carbon compound. It has also identified to be the best additive during composting of organic wastes with higher moisture content. However, the effect of biochar has not been investigated on nutritional properties during composting of lignocellulose dominant weed i.e. Eichhornia Crassipes that may hamper the composting process. The main novelty of this work was to study the effect of a small amount of biochar (2.5%) on the nutritional variation during composting process of Eichhornia Crassipes. Two treatments: (i) control (water hyacinth 60% + cow dung 30% + saw dust 10%) having total weight of 150 kg and (ii) the similar mixture treated with biochar small amount (2.5%) were composted using rotary drum composter.
The study revealed that Biochar when mixed with Eichhornia Crassipes improved nitrogen, phosphorus and potassium of end product i.e. compost. The values of nutritional properties were observed to be sufficient as per the recommended value. The addition of biochar for the composting process could improve the value of Eichhornia Crassipes composts by decreasing nitrogen losses and increasing nitrogen availability in lignocellulose dominant weed.
Keywords: Aquatic weed; lignocellulose aquatic weed; composting.

Porosity Estimation by Digital Image Analysis

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Introduction: Rapid development of unconventional oil and gas exploration in the past decade has given rise to an all-round changes in the supply-demand structure, recovery method, and technical innovation in the petroleum industry. Rock and fluid properties, along with reservoir characteristics, provide the basic idea for analysis, development, and production of petroleum and hydrocarbon reservoirs. In order to establish a general model, reservoir and drilling engineers collect and analyse associated rock properties data of interest from different sources regularly, including geological, petrophysical, geophysical, geochemical, well logging, and drilling techniques. The overall objective is to gather a detailed description and build a conceptual and comprehensive model of the reservoir, which leads to the formation of a strategy to produce the reservoir optimally and maximize recovery from the reservoir. This study is mainly based on simple and cheap technique for defining pore scale heterogeneities on macroscopic petrophysical properties because accurate prediction of this physical properties requires understanding the micro-scale physics of the constituents of porous media. Porosity and permeability are the two fundamental properties of rock responsible for storing and producing hydrocarbons. Porosity is one of the key measurement which controls the different physical properties of rock like permeability (Haines et al., 2015).

Thus, estimation of porosity of rock is important. The bulk volume of rock comprises of both pore volume and volume of solid rock matrix. Porosity relates to the microscopic void spaces in rock where oil and gas are accumulated. It can be determined through different conventional techniques like helium porosimetry, water saturation, mercury injection which are costly and time taking. For obtaining accurate information on the pore architecture of different rocks, there is a need of analysis of pore size distribution in microscopic level since porosity is associated with micro level only.

Integration of GIS and Hydraulic model for flood Inundation mapping due to dam break

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Construction of dams across a flow of river fulfils all the needs of human being but loss caused by the dam break incident creates disaster in downstream area. Dam break study is useful to summarize the pattern of flood generated and area under inundation. This gives us solutions to prepare emergency action plan so that losses will be minimum. In this study an attempt is made to develop an integrated technology for flood mapping using combination of Geographical information system(GIS) i.e. DEMs (ASTER) and hydraulic modelling software i.e. HEC-RAS. Various crass-sections along the length of river can be taken and various parameters like discharge, water level, depth needs to be considered. Study shows the integration of GIS and HEC-RAS is the effective way for generation of inundation mapping.

Developing sustainable Stormwater and Wastewater drainage system for rural areas

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India is emerging country in terms of the development of infrastructure and smart cities. The development of rural areas are though major concerns, number of economically weak communities are being isolated by distance, bad road conditions, lack of water supply. Stormwater is a prime issue for these areas because of unavailability of proper streets and drains. Stormwater management practice will help to collect excess water from streets, sidewalks, roof of houses and put to use for agricultural activities and other needs of public in rural areas. Designing a stormwater and wastewater drainage system will minimize the water scarcity and provide sustainable environment for growth of rural areas. This study emphasize on preparation of stormwater network and waste water drainage network for rural area and Life Cycle Cost Analysis for future prediction of maintenance of the system. The expected outcomes of this study will be is to provide efficient water to meet the need of population residing in rural areas, preparation of network plan that will assist the governing bodies to execute storm water projects, decision making on allocation of funds for sustainable development of rural areas and also finding the expected average yearly maintenance and repair costs of the system.

Application of Remote Sensing and GIS Techniques for Identification of Critical Sources and Quantification of Pollutants of Nonpoint Source Pollution

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Nonpoint source pollution is a term used to describe pollution resulting from diffuse sources. Nonpoint source pollution generally results from urban runoff, automotive fluids, fertilizers & pesticides from crop production, construction industry where tracing the pollution back to single source is difficult. Being major contributor of pollutants, nonpoint sources are deteriorating water quality. Assessment of nonpoint pollution in water resources plays key role for environmental protection & provide support for decision making related to pollution control . Assessing potential contributors of nutrient export like Nitrogen and Phosphorous requires remote sensing, Geographical Information System (GIS), hydrology and soil science. Due to large range of potential pollution sources & extent of pollution, mapping and assessing from ground is almost impossible. This study is aimed at using remote sensing & GIS techniques to identify nonpoint pollution sources in Indrayani river, Pune, Maharashtra. This has been carried out by using Agriculture Non-Point Source Pollution Model (AGNPS). By using image classification techniques of remote sensing the various thematic maps were generated. While ArcGIS technique were used to process the data required for AGNPS model. Aspect map, slope coverage and curvature map of the study area were also prepared with ArcGIS .The developed AGNPS model predicted runoff using GIS modelled SCS curve number technique & identified potential nonpoint sources of pollution within the watershed contributing to Indrayani river. The obtained results match considerably with the actual values. Major limitation for AGNPS model is due to handling vast amount of input data for modelling , In this case ArcGIS is proved effective tool for spatial data handling from various sources

Keywords: Nonpoint Source Pollution Modeling; Nitrogen & Phosphorous; Remote Sensing Techniques; ArcGIS; AGNPS Model; Indrayani River;

Two-dimensional finite element analysis of jointed rock slope: A Himalayan case study

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Himalayan rock slopes are highly vulnerable to landslides due to geological and tectonic activities. The study area lies along NH 109 road from Rudraprayag, the only pilgrimage route to holy kedarnath, which experiences high vehicular traffic. There are many cases of landslides reported due to the unpredictable weather and landslide prone rocks in this seasonal pilgrimage route. Stability analysis is essential and effort should be given to understand their failure mechanism which resembles the actual field instability. It is important to take mitigation measurements to minimize the losses due to slope failure and to ensure the safe transportation along this route. In this case study, stability analysis of the rock slope, located on National Highway (NH-109) is performed using Phase2 of Rocscience software by considering rock mass as continuum. Two methodologies, equivalent continuum method and combined continuum-interface numerical method, are adopted for the analysis. In order to perform stability analysis of a heavily jointed rock slope, incorporation of all the joints in numerical model, require immense computational efficiency. Under such cases, equivalent continuum model (Hoek et al. 2002) considering homogeneous, isotropic system of reduced rock mass strength parameter derived from Geological strength index, is useful to predict the stability of rock slope. Numerical modeling by considering rock mass as a homogenous medium does not resemble the actual field conditions in all cases. In case of blocky rock slope failures, the main cause of failure is the anisotropy created by the joints. It is important to incorporate to joint properties to study the actual instability. Combined continuum-interface numerical method introduces the joints are explicitly in the numerical model which accurately represents the behaviour of rock slopes in actual field condition. In this method, the joints are considered as interface elements with zero thickness. Factor of safety is calculated using Shear strength reduction (SSR) technique which is based on finite element method (FEM). Kinematic analysis based on Stereographic Projection is performed to understand the modes of failure of the rock slope. in DIPS (Rocscience 2016a).

Keywords: Equivalent continuum method, combined continuum-interface method, Shear strength reduction technique, Finite element method

References

Hoek, E., Carranza-Torres, C. and Corkum, B. (2002) Hoek-Brown criterion-2002 edition, Proceedings of the NARMS-TAC Conference, 10 July 2002, Toronto, Canada 1, 267-273. University of Toronto Press

Abstracts (Poster)

Computer Science

Automated Detection of Diabetic Retinopathy

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Diabetic Retinopathy is one of the leading causes of blindness and eye disease among the population of the developed world. It is observed that all patients with this disease suffer from decrease or loss of their vision. The diagnosis of Diabetic Retinopathy (DR) through color fundus images requires experienced clinicians to identify the presence and significance of many small features which, along with a complex grading system, makes this a difficult task. However, if caught early enough, progression to vision impairment can be slowed if not altogether stopped. This project is an attempt towards finding an automated way to detect this disease in its early phase by using Convolutional Neural Networks (CNN) to diagnose DR from digital fundus images and classifying them into five classes (no DR and different classes of DR). We train this network using a high-end graphics processor unit (GPU) on the available dataset and show impressive results for a high-level classification task.

Keywords: Diabetic Retinopathy, Convolutional Neural Networks, Deep Learning, image classification

IoT and the vulnerability to a consumer's privacy

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Internet of Things (IoT) is connecting any electronic device onto the Internet. A car or any household general purpose electronic devices such as TV, fridge, AC etc. can be connected to the Internet, which makes using them more convenient. But these devices may collect a consumer's private data which may be reused for the benefit of the consumer, which are then stored on a cloud server. The greater risk is that these data are sometimes not encrypted and also have poor access authorization, making the data insecured. Hackers and other organizations may steal the users' data from the cloud server or from the devices itself and process it for big data analyzing. The data collected from each individual users collectively becomes big data. Which after analyzing, the organizations get an idea of improving their businesses at the risk of the consumers' private data, which a typical consumer is not aware of. We propose certain ways of using these devices and recommending the consumers to be cautious while using these devices

Effective use of Virtual Reality to empower the learners of Basic Science

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The emergence of computer based virtual learning environment like virtual reality is going to be the empathy of the future generations for learning basic science. With truly immersive headsets now on the market, academics are beginning to explore how to use technology for pedagogical use. This work is related to some of these aspects. A major goal of this project is to give students the opportunity to focus on how an online experimental setup can be constituted using virtual reality. Visualizing and doing of laboratory experiments are the most effective ways to simplify and clarify the understanding of complex theoretical concepts. Using Virtual Reality laboratories, complicated experiments can be simplified. The 3D interactive virtual labs like Labster, LabInApp focuses on the heuristic approach of understanding science by promoting, learning by doing using VR giving a playful learning environment. Here the students will be able to conduct experiments remotely. The VRLab system consists of the following sub-systems : The systems server station, which consists of one PC for each experimental setup that will be supported and an additional central server; the client system, which includes a user interface based on 3-D graphics and virtual reality technologies ; and the Web portal, which provides the user with additional information and functionalities and acts as an integration platform for the entire system.

Keywords: Virtual Reality, experimental setup, VRLab

Study of the influence of microblog with embedded object

These days microblogging social media websites like twitter, Facebook, Tumblr are the essential source of news and information. People share their thought and opinions here in the form of tweet or post. And this information diffuses in the form of retweet or share. Here we are focusing on the tweets. So, prediction of retweet count is very important for both the end users and service provider. We can understand the pattern and control the diffusion of the tweet. This report will try to address the question, what attributes and features make a tweet viral? Since, user can post only 140 characters in a tweet and use of internet slang, misspelled words, short forms are obvious, so it is a challenging task to extract relevant features to predict the retweet count. However, Visual properties of embedded image of tweet can help us in predicting retweet count more accurately. In this study, our primary goal is to predict the expected retweet count of a given tweet with the help of visual cues of an embedded image in tweet in addition to structure base and content based features. To perform the experiments, real-world dataset is prepared that is extracted through the Twitters public API based on user IDs.

An Adaptive Deflection Router with Dual Injection and Ejection Units for Mesh NoCs

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Proving the correctness of Moores law in processor scaling till date, researchers continued proposing scalable architecture designs containing multiple processing cores on a single chip. Network-on-Chip (NoC) is a widely adopted interconnection framework for satisfying the communication requirements of such multi-core systems, also called as Chip Multi-processors. Input buffered routers dominated initial NoC designs due to their simple wormhole switching and high load handling capacity. However, they consume a significant portion of chip power due to the presence of buffers. Buffer-less deflection routers are then proposed as an energy efficient alternative to the traditional input buffered routers. But, they also suffer from performance degradation at high injection rate due to high deflection rate. Hence, minimally buffered deflection routers are proposed who outperform input buffered routers in low injection traffic and buffer-less defection routers in high injection traffic. Deflection is a commonly used routing technique both in buffer-less and minimally buffered routers. When two flits (packets are broken down into multiple flits) that want to have the same output port reach a router, only one gets the requested port, and the other flit is deflected through an undesired port. Nevertheless, the deflected flit eventually reach the destination by proper livelock prevention mechanisms. Minimally buffered routers accommodate some deflected flits to reduce the deflection rate. We have worked on the limitations of a state of the art minimally buffered deflection router DeBAR [1] which suffers from (a) starvation of side-buffered flits due to ineffective priority scheme, (b) Output Channel Wastage and (c) sequential positioning of independent operations. We then proposed an energy efficient Adaptive Deflection Router with Dual Injection and Ejection Units (ADIEU) that effectively reduces average latency, buffer occupancy and deflection rate of packets (flits). Our ADIEU design is a 2-stage deflection router that uses a minimal side-buffer to accommodate a fraction of deflected/misrouted flits. A block diagram of various stages of the router pipeline of ADIEU is shown in Fig. 1. A, B, and C are the pipeline registers. The units kept between A and B form the first stage of the router pipeline whereas the units between B and C form the second stage. Four internal flit channels carry input flits through various units of the router pipeline.

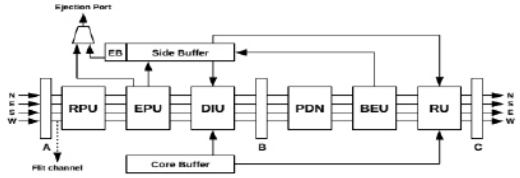

Fig. 1: Router pipeline of ADIEU. RPU-Routing and Priority unit, EPU- Ejection and Pre-emption unit, DIU-Dual Injection Unit, PDN-Permutation Deflection Network, BEU-Buffer Ejection Unit, RU-Re-injection Unit, EB-Ejection Bank.

II. Performance Evaluation

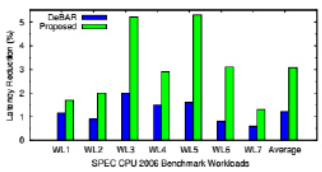

Fig. 2: Percentage reduction in latency

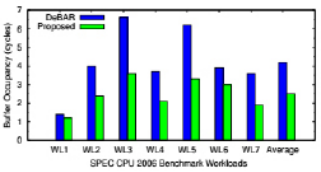

Fig. 3: Reduction in buffer occupancy

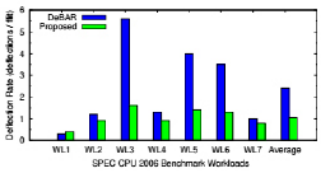

Fig. 4: Reduction in deflection rate

SPEC CPU 2006 benchmark based workloads (W1 – W7) are used for performance evaluation of our proposed ADIEU with respect to DeBAR and MinBD [2] (some cases) designs. We can see from the figures that for almost all the workloads, ADIEU shows reduction in flit latency (Fig. 2), buffer occupancy (Fig. 3) and deflection rate (Fig. 4). Significant reduction can be seen for high injection rate workloads like W3 and W5. We also find that there is a dynamic power reduction of 11.5%with respect to DeBAR due to lower buffer occupancy and lower deflection rate in our proposed ADIEU router.

REFERENCES

[1] J. Jose et al., "DeBAR: deflection based adaptive router with minimal buffering," in DATE, 2013, pp. 1583–1588.
[2] C. Fallin et al., "MinBD: minimally-buffered deflection routing for energy-efficient interconnect," in NOCS, 2012, pp. 1–10.

Abstract

Online social media is gaining popularity exponentially, especially among the teenagers. They spend lot of time browsing through social media and start living a "False life". Everything that happens there, they take it seriously and therefore it starts reflecting in their "Real Life". Bullying is a serious problem and it can lead the victim to depression and other mental problems. This results in him/her to stay isolated and sometimes it ends up with some really bad consequences such as suicides. If we can identify bullying on social media at an early stage then we can save the victim from all the pain he would have gone through. This work is about the first phase in the process of developing a system that can identify the insult and insulting words that are used popularly in Indian subcontinent region. In this phase we have thoroughly studied researches done in this domain, listed out some of the major challenges we will have to face during the process of developing of such system, And finally tried some of the baseline classification techniques of machine learning to study how these techniques perform in our context.

Abstracts (Poster)

Design

Re-modeling the 'phonebook' in a smart phone: Personalization based on intimacy and immediacy

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With rapid innovations taking place in smartphone technologies, features in the phonebook has evolved significantly to provide us more options for managing our social network. Personalization of these kinds of intimate social networks with the closest, most meaningful ties, such as between close friends, family, relatives and even close colleagues, are characterized through classification based on high frequency of interaction, but also by an inherent need to feel connected, to be in touch. In a qualitative study following ethnographic research and analysis of phone call logs revealed that, people interact with only a small fraction of the people actually present in their phonebook contact list. Our experiments examined the manner in which the users manage the phonebook and their co-relation to the frequency of interaction and intimacy and immediacy of need with the people they contact. Based on the research conducted, we propose a design approach that enhances the personalization of the mobile phonebook to provide the user with option of reordering hierarchies of their own intimate networks. In the paper, we also study the efficiency and usability of such a personalization tool.

Keywords: Contacts · phonebook · personalization · social network · interaction

User Centered Conceptual Design of Accessible Self-Transfer Assistive Device

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The improvement towards self-transfer assistive technology through design and engineering educational principle is a focus of this paper, with the aim of designing and evaluating an improved wheel chair based accessible assistive device that can assist elderly and hip / knee replaced patients during daily activities or early recovery time. Mostly the health care centers provide traditional walkers, crutches and wheel chairs for such patients without additional assistive devices, thus imposing burdens to the nurses or caregivers, these devices are not easily conform to the center of gravity of the patient and frequently causes the risk of falling high thus leading to dislocation of joints. The unique feature of our device shows that it helps not only in standing and sitting activities but also it can facilitate during bathing and toilet process. Recent reports has shown that total hip or knee replaced individuals and other age related patients are facing difficulties and they are forced to be dependent on nurses and caregivers during these period. In this paper new design improvement has been implemented by combining engineering and design educations in order to take the human-machine interactions into consideration. Creative design tools have been used such as TRIZ, theory of inventive problem solving. Based on the design criteria, dimensional synthesis and analysis of critical parts are analyzed and verified using finite element method; similarly three dimensional modelling of the whole product has been modelled and assembled together with the human model. Ergonomic evaluations such as rapid upper limb assessment (RULA) based on posture analysis were analyzed and verified in digital human modeling environment to conform to diverse patients. The designed new mechanism is driven by a motor and linked with extension spring to utilize the stored energy; the result has shown that the combined effect of actuator torque and the torque developed by the spring are shown to increase in the same fashion for selected population with different weight. The overall result is in good agreement and it shows a new research direction for industrial involvement in developing this product. Hence implementation of this product will help in reducing the burden of nurses and caregivers particularly in hospitals there by giving safe, comfort and independent life for the users.

Keywords: Digital Human Modelling, Design tools, Ergonomics, RULA, TRIZ.

A study on visual forms of wall art tradition of rural Jharkhand

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The concept of wall art was emerged among the indigenous communities of Jharkhand when they started to live in mud houses. These mud houses are constructed with certain measurement and annually painted with various visual forms. It is observed that the visual forms are mostly inspired from their local surrounding such as garland of flowers, animals, birds, agricultural activities and dancing forms. In this poster, various visual methodologies such as symmetrical operation, content analysis and compositional interpretation are used to study the structure, colour and composition of existing visual forms. This poster concludes with the findings of visual characteristics of traditional wall art of rural Jharkhand.

Keywords: Wall art, Visual form, Jharkhand

A study of effectiveness and feasibility of a panipuri vending cart design in context of a developing city

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There has been a significant increase in the number panipuri vendors in many cities all over the country. Most of these vendors enter the business by selling panipuri on a compact stall that is made of a cane stand and detachable wooden base. This portable stall has been around for long because of the novelty in its design and its affordability. However, the vendors have to carry this compact stall, along with all the food preparation material, on their shoulders and head every day from their home to the vending location in morning and back to home in the night.

A preliminary research conducted in Guwahati, a developing city in Indian state of Assam, showed that the vendors are carrying a weight on their heads, which was exceeding the recommended limit. This has been affecting their neck and spine. A second user study was conducted to understand the challenges they face during their journey from home to their vending location.

A concept of a compact trolley for panipuri vending was designed to tackle the above problems and a frugal prototype was fabricated, tested in the city to validate the effectiveness and feasibility of the concept. Based on the observations made, a final design is proposed in the paper. It could overcome the contextual challenges and provides the vendors with a better alternative for transportation of their panipuri stall.

Keywords: panipuri, vending cart, transportation

Assamese Cinema and Legal Address with reference to Juvenile Justice Act 2015: A case study on Konikar Ramdhenu

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Indian cinema has covered a hundred years long journey. It started with Raja Harishchandra in 1913, which was a silent movie. Gradually it evolved and adopted audio techniques which gave birth to first talking movie Alam Ara in 1931. After 2-3 years only, Assamese cinema made its debut with Jaymati in 1934 by Jyotiprasad Agarwala. It was the first black and white movie with full audio-visual techniques. It has passed through a stage of golden and glorious era of black and white cinema and has entered in today's colored, digitized and 3-D movies. In this long journey, Indian cinema completed hundred years. Indian cinema has pondered and represented skill fully the multiple burning issues of poverty, unemployment, corruption, dowry deaths, rape, partition, militant movements, rural urban divide, plight of the Indian farmers, political unrest and many more. Apart from the representation of love as a central theme, Indian cinema have challenged and questioned the multiple issues, which were and are obstacles in the path of development and have shook the human conscience and belief system. However, with the changing times, the trends and development themes have changed in the Indian cinema and mainly in mainstream Bollywood movies. This study analyses how cinemas continue to act as a form of media for communicating to the masses while they remain a source of entertainment. Referring to the history of representation of society through cinema, the study focuses on the Assamese society through a case study of some selected National award winning Assamese films. Referring to these movies, findings reflect on the role of cinema as an informative medium representing the various issues, especially legal issues being faced by people in a society. However the least represented issue in the Assamese film history is the child related issues. It is Jahnu Barua who is seen to be attracted to this particular issue, made some films reflecting child psychology related themes. Among all the children related issues, juvenile is a very important, sensitive and delicate legal issue of present day's society. Konikar Raamdhenu of Jahnu Barua is the only Assamese film ever made on this issue where analysis is presented on the Juvenile Justice Act, which is very important in today's situation. The film portrays possible positive consequences of this law. This study is an endeavor to categorize the characteristics of the film Kanikar Ramdhenu in relation to juvenile delinquency in Assam.

Design a product for Kangaroo Therapy

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20 million premature and low-birth weight babies are born every year. 80% of these births take place in rural areas of developing countries. Due to a lack of resources, 4 million of these babies die, and many of those that do survive grow up with life-long health problems. Many of these deaths and illnesses are caused by hypothermia, and can be prevented with an incubator. Traditional incubators, however, cost between 10,000$ –25,000$, and are available only in urban hospitals. Most rural parents do not have the resources to get their babies to major hospitals. Aim of this project to Design a product which ensure the kangaroo care therapy for a pre-term infant. Baby which deliver before 36 week is called as pre-term baby. Normally the baby live 36 to 42 weeks in their mothers' womb. For the development of such a Pre-term infants the doctor prefer to keep them in the incubator and provide kangaroo therapy. Kangaroo therapy also helpful for the physical as well as mental development of baby, because kangaroo care also minimize the pain during the all the painful procedures such as heel prick which pre-term infants have to undergo, when parents are not available in NICU. When baby feels pain, it affects the baby psychologically so kangaroo therapy is important for the complete growth of baby. At present there is no as such product which ensure the kangaroo therapy ,but in market there are some products for normal baby which help them for long sleep, by taking inspiration from such existing product, a product was designed for preterm infants which ensure kangaroo therapy .Here two products were designed: a lower end product and a higher end product.

Performance evaluation of single operator handheld battery powered tea harvesting machine in context to tea gardens of assam

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Tea is a widely consumed drink in the world as a beverage. The history of tea cultivation in India is quite old. After China, India is the second largest producer of tea. Presently tea industry is facing a shortage in the workforce, and so the industry is looking for suitable automation alternatives in various stages of tea production. Indian Institute of Technology Guwahati has designed and developed a single operator handheld battery powered tea harvesting machine. This paper reports the results and analysis of the experiments carried out with the newly developed single operator handheld battery powered tea harvesting machine from performance point of view. The experiments were performed in a tea garden of Assam, India.

Keywords: Product design, tea, machine, agriculture, ergonomics

A study of effectiveness and feasibility of a panipuri vending cart design in context of a developing city

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There has been a significant increase in the number panipuri vendors in many cities all over the country. Most of these vendors enter the business by selling panipuri on a compact stall that is made of a cane stand and detachable wooden base. This portable stall has been around for long because of the novelty in its design and its affordability. However, the vendors have to carry this compact stall, along with all the food preparation material, on their shoulders and head every day from their home to the vending location in morning and back to home in the night.

A preliminary research conducted in Guwahati, a developing city in Indian state of Assam, showed that the vendors are carrying a weight on their heads, which was exceeding the recommended limit. This has been affecting their neck and spine. A second user study was conducted to understand the challenges they face during their journey from home to their vending location.

A concept of a compact trolley for panipuri vending was designed to tackle the above problems and a frugal prototype was fabricated, tested in the city to validate the effectiveness and feasibility of the concept. Based on the observations made, a final design is proposed in the paper. It could overcome the contextual challenges and provides the vendors with a better alternative for transportation of their panipuri stall.

Keywords: panipuri, vending cart, transportation

Abstract

Almost every girl at certain point of time face issues in tracking their menstrual cycle. Especially young girls have many question and misconceptions regarding menstrual cycles. Many mobile based applications are avilable for tracking menstrual cycles but content specificaly they fail to support indian females. Motivation behind the project is to provide a proper solution which will help young gilrs to track their menstrual cycle to understand their body reactions in diffrent phases, to be prepared for emotional and physical symptoms and to avoid myths and misconceptions regarding menstrual cycles.

Abstract

Architecture design of schools, both in India and abroad, has borrowed from typical educational space planning models through the history of evolution of instructional systems and technologies. Space modelling of educational institutions has developed its pattern language as permutation and combinatorial derivatives of our very own Gurukul, Madrasa, Dharamshalas and Sangha schools in India, as well as the Western schools like Amsterdam, Boise, Chicago, Montessori, Prairie and Waldorf. Contemporary architectural transformations have moved rapidly towards parametric modelling by virtue of smart 2D and 3D CAD modelling tools, especially the very comprehensive BIM (Building Information Modelling) packages, applications of which are steadily growing in all building sectors like residential, institutional, commercial, corporate and industrial. However, the same progression has not happened in educational building sector. This work is a precursory attempt at developing a pattern language for architectural design of schools using parametric modelling.

Keywords: Architecture Design, BIM, Parametric Modelling, Pattern Language, School Planning

Abstracts (Poster)

Electronics and Electrical Engineering

A Review of Methods, Dataset and Recent Advancement of Vision-based Hand Gesture Recognition Systems for HCI

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The ability of computers to recognize hand gestures visually is essential for future human–computer interaction (HCI). The applications of gesture recognition cover various domains, ranging from sign language to medical assistance to virtual reality. However, vision-based recognition is extremely challenging not only because of its diverse contexts, multiple interpretations, and spatiotemporal variations but also because of the complex non-rigid properties of human hand. This paper surveys the main approaches in vision-based hand gesture recognition for HCI. Major topics include different classes of gestures; gesture system architectures; recent advances and applications of gesture-based human–computer interfaces. A detailed discussion is provided on features and major classifiers in current use. A special attention is given to classification schemes at various stages of gesture recognition system for a better understanding of the topic to facilitate further research in this area.

Keywords: Human-Computer Interaction, Vision-based hand gesture.

Classification of IRIS Flowers using Extreme Learning Machines

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The learning speed of feed forward neural networks is in general far slower than required and it has been a major drawback in their applications for past decades. This paper deals with a classifier based on a new learning algorithm called extreme learning machine (ELM) for single hidden layer feed forward neural networks (SLFNs). The presented model is used to classify the IRIS flower data in three classes namely, setosa, versicolour and virginica. The method randomly chooses the input weights and analytically determines the output weights of SLFNs. The experiments have been conducted on IRIS dataset taken from publically available UCI repository. The classifier achieves an average sensitivity of 96.29% and a mean positive predictivity of 86.67% for 80%training and 20% testing data. The quantitative results show the efficient and good performance of the presented method. In addition
to that, the algorithm tends to provide the best generalization performance at an extremely fast learning speed.
Keywords: Extreme learning machine, IRIS, Neural networks.

Energy Conserving φ-MAC Protocol for WSN Using Adaptive TDMA

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Wireless sensor networks (WSN) are used in different advance control and monitoring application. There is always a need of maximizing their efficiency in terms of energy consumption as the lifetime of a sensor node is important aspect of wireless sensor networks (WSN). The protocol is based on some modification of IEEE 802.11(i.e. Multi-Phase MAC (φ-MAC) protocol) with adaptive Time division multiple access (TDMA) protocol named as bit-map-assisted Round-Robin (BMA-RR). The Multi-Phase MAC (φ-MAC) protocol uses periodic listening and sleep modes to conserve energy. Sensor node in φ-MAC protocol are allocated in different phases so that listen periods are non-overlapping and effectively reduces traffic.
Using adaptive TDMA-based MAC protocol also focus on energy conservation and decrease transmission latency. It also increases throughput on node with heavy traffic. In this proposed work, the nodes which are not active can go to sleep mode for energy conserving .On the other hand, sensor nodes which have more data to send can request cluster head to allocate more time slot for data transmission. The proposed MAC protocol shows better performance than traditional TDMA-based MAC protocol.

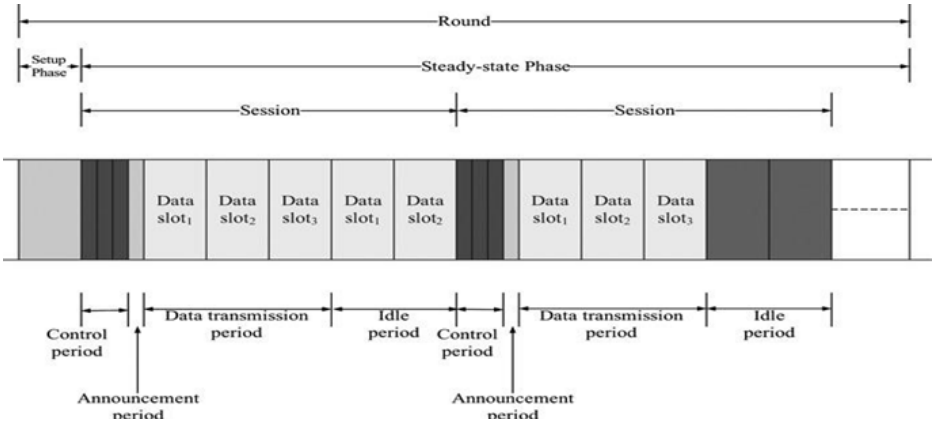

Fig 1: Illustration of a complete round including a cluster set-up phase and a steady-state phase [2]

Fig.1 shows the block diagram of the complete round where the cluster set-up phase uses cluster algorithm based on low-energy adaptive clustering hierarchy (LEACH) and steady-state phase consists of control period follows a TDMA-like schedule ,in the announcement period cluster head initiates and broadcasts a transmission schedule for the source nodes, in data transmission period ,each source node send/receive its data to/from cluster head at its allocated time –slots, if all node have no data to send the system directly proceed to idle period .The next session is begins with control period and same procedure is repeated.
The result of proposed protocol shows the better energy conserving algorithm which maximise the sensor's data rate and results in better utilization of the spectrum with lower –transmit power requirements.

References:
[1] Abdul-Elah Sanad AL-Sanad,"φ-MAC:An energy-aware multi-phase MAC protocol for wireless sensor networks",2005 King Fahd University of Petroleum and Minerals(KFUPM),2002
[2] T.-H. Hsu, P.-Y. Yen, "Adaptive time division multiple access-based medium access control protocol for energy conserving and data transmission in wireless sensor networks" ,IET Commun.,2011,Vol.5,Iss. 18, pp. 2662-2672
[3] Akyldiz, I.F., Sankarasubramanium, Y., Su, W., Cayirci, E.: 'Wireless sensor networks: a survey', Comput. Netw., 2002, 38, (4), pp. 393-422

Intelligent Ad-hoc Network based on Smart Route Discovery

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With the widespread use of mesh networks, a strong need to enhance quality of service is appeared. Fast and reliable route is the primary focus in the mesh network communication. The sharing of the network band within the routers or devices is controlled by MAC layer via CAMA-CA, which provides a contention based distribution channel access mechanism that allows wireless medium sharing. In mesh network, significant thing is the finding the route, to reach targeted router. Mesh network basically share the wireless medium loaded with number of routers. In this paper, we design a significant route or path finding method which helps to reach targeted router from the coordinator router in wireless medium. Carrier Sense Multiple Access with Collision Avoidance (CSMA-CA) shows a significant role in this protocol for giving access to the channel in the network. In this method if channel is found idle then only a router broadcast a command over the air. If channel is busy then the router will abort the transmission for some delay and runs a contention window time. On the other hand, coordinator router broadcast a command to search targeted router. This command is received by different routers which retransmits the same command to subsequent hop routers and a hopping of same command takes place till targeted modem reached. Now when the command reaches the targeted router, the decision of the best route takes place by considering the best link quality and number of hops. After selecting the best route, it will reply to the address of the neighbor and response will relay and reach to the coordinator router.

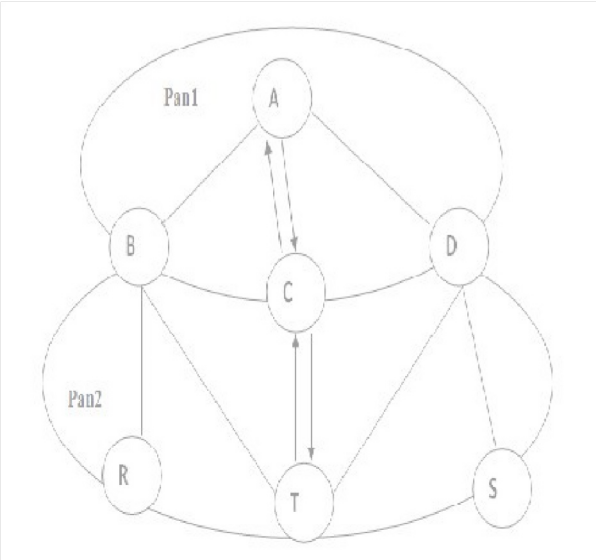

Figure 1. We have shown 2 different personal area networks, named Pan1 and Pan2. Here coordinator node is 'A' and targeted node is 'T'. As per the above method we found the best route is "A-C-T".

References:
[1] IEEE Standard for wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, 1999.
[2] Wireless Communications: Principles and Practice 2nd Edition by Theodore S. Rappaport.

Performance Analysis of Opportunistic Space Division Multiple Access with Beam selection MIMO System for Moving Users

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4G has been implemented in many countries. Demand of high data rate is increasing continuos. Cognitive Radio (CR),Vigible Light Communication (VLC), Device to Device communication (D2D), Hetrogenious Network (Hetnet), Multiple Input Multiple Output (MIMO), Massive MIMO are some technology which are used increase data rate. MIMO is the technology in which we use space diversity. Opportunistic space division multiple access with beam selection (OSDMAS) is a MIMO technique which uses orthonormal beamforming sequence to modulate training sequence to know channel state information (CSI). In this paper we calculate ergodic throughput, for OSDMAS in various channel for stationary as well as for moving users.

Keywords: CR,VLC,D2D,Hetnet,MIMO,massive MIMO,OSDMAS,CSI,OP,SER,BER .

Broadband Leaf Shaped Microstrip Patch Antenna

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With the advent of broadband systems in wireless communication, the demand for the antennas operating over wide range of frequencies have been increased day by day. The types of antennas which offer wide bandwidth are referred to as broadband antennas. Microstrip patch antenna has been playing a significant role in developing compact, low volume, planar antennas for microwave and higher frequencies. They are compact, low cost and relatively inexpensive to design and manufacture. They have become very popular because of their thin planar structures and easy fabrication using printed circuit techniques and there is also the possibility of adding active devices such as pin diode (microwave integrated circuits) to make itself as an active antenna. But the patch antennas offers narrow bandwidth. Over the last few decades the antenna engineers are working in this domain and different approaches are available for designing broadband patch antennas [1]. The commonly available shapes of such microstrip antennas are rectangular, circular, dipole, triangular, square and elliptical. In this project one leaf shaped microstrip antenna (MSA) is designed using semi-circular and triangular metal sheet which is operating over x, ku and k bands. The coaxial feed is used for the antenna. The simulations and parametric optimization have been carried out by using High Frequency Structural Simulator (HFSS) [2].
The proposed antenna is operating over the frequencies 7 – 22 GHz. It provides 98% impedance bandwidth (S11< -10 dB) and high peak gain. Further, by introducing holes in the leaf structure the operating band of the antenna can be changed. So, by introducing switches along with the holes the antenna will be converted to reconfigurable antenna. The whole structure can be used for different applications such as radar, satellite communication, and tele communication and for short range k-band applications.

References:
[1] Kumar, Girish, and K. P. Ray. Broadband microstrip antennas. Artech House, 2003.
[2] Ansys High Frequency Structural Simulator (HFSS) Ver.16.2.

A review of topologies of multiport DC-DC converters

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Power electronic DC-DC converters are extensively used in satellite systems, uninterrupted power supply systems, hybrid energy systems, electric vehicles, portable handheld devices like mobile, cameras, etc. and aerospace applications. The conventional method of using an individual converter for each renewable sources increases cost, the number of components, control complexity and reduces the efficiency. Hence, DC - DC converters have successfully evolved from a single input single output (SISO) to multiple input m ultiple output (MIMO) converters. These converters can be interfaced with energy sources and loads of various forms. Use of a single converter with multiple ports makes the system compact and reduces control complexity. Continuous efforts are being made to reduce the number of switches and cost, with attempts to improve efficiency, reliability, and flexibility of the multiport systems. With the increase in sharing of components, the cost of the system decreases leading to the decrease in losses, hence increasing the overall efficiency. Multiport converters are classified as Multiple input multiple output systems (MIMO), multiple input single output system (MISO) and single input multiple output (SIMO) systems. Each converter has different topologies based on the applications. MISO systems are used to interface different renewable energy sources with a single load. SIMO systems are used to supply different levels of voltages from a single input source. The converters are further classified as isolated and non-isolated converters. The conversion ratios of isolated converters are higher than non-isolated converters. The main concern of this paper is a detailed understanding of multiport converters with comparisons among different topologies. The review can guide the users to select an appropriate topology based on the application.

Massive MIMO based UWA Communication using ZFBF Precoding Technique

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Underwater Acoustic Communications consists of various devices & networks of interconnected devices like electro-acoustic transducers, piezo-electric transducers, unmanned submarines, etc. These devices utilize the Underwater Acoustic Channels for applications that are multimedia extensive which includes seabed explorations, defence & tactical surveillance, oceanic data acquisition & rescue operations. These applications are highly delay-sensitive, demand high data traffic and contains loss-sensitive traffic data. However, Underwater Channels differ uniquely than RF channels and suffers with low bandwidth, high delay in propagation, variable multipaths, require high power & offers high attenuation quotient. To cater to these issues and offer greater reliability with higher bandwidth & efficiency, Massive MIMO technique has been considered here. With ZeroForcing Beamforming (ZFBF) precoding technique, interferences from other users are forced to zero at each receiver by cancelling all inter-user interferences. The multiuser interferences are totally eliminated by projecting each stream onto the orthogonal complement of the inter-user interference. It takes into account the inter-user interference but neglects the effects of noise.

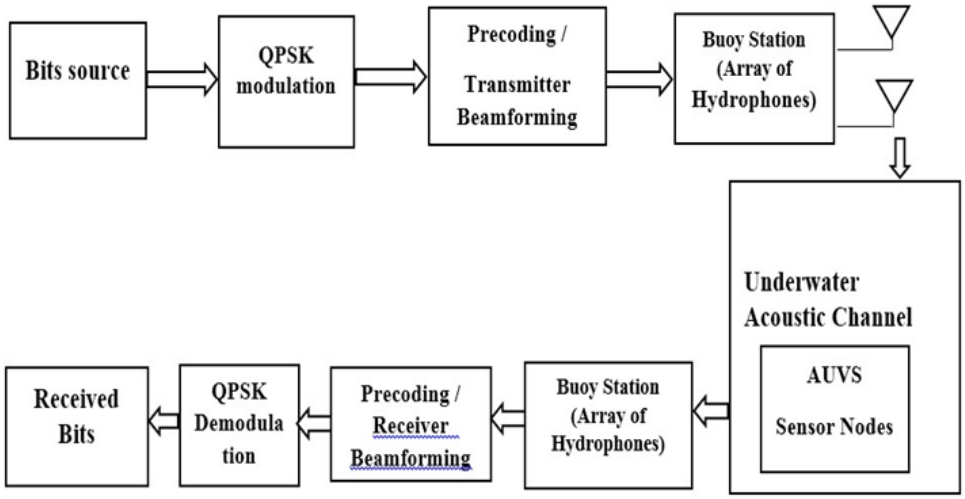

Fig 1 : System Model

The solution is closely connected to the linear ZF scheme. Numerical results demonstrate that the proposed suboptimal scheme accomplishes a performance which can be approximated to the optimal however with lower complexity.

References

[1] E M Sozer, M Stojanovic, J G Proakis, "Underwater acoustic networks", IEEE Journal of Oceanic Engineering, vol. 25, no. 1, pp. 72-83, 2000
[2] Larsson, E., Edfors, O., Tufvesson, F. & Marzetta, T. 2014. Massive MIMO for next generation wireless system. IEEE Communication Magazine, 59(2): 186-195.
[3] Bello Lawal, Syed Saad Azhar Ali, Azlan Bin Awang," Massive MIMO Systems for Underwater Acoustic Communications", 2016 IEEE 6th International Conference on Underwater System Technology: Theory & Applications.

Framework of an Optical Based Sensor System for Estimation of Chlorophyll Content in Leaves

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Plant nutrition is the basic need for plant growth and productivity. Nutrient monitoring of plants is the key factor for farmers and agriculturalists. Chlorophyll content of a plant is one of the most important natural indicators of plants nutritional stress, photosynthetic capacity and the overall health status of plants. The proposed sensor system therefore aims to develop an optical sensor syst em based on imaging and spectroscopic techniques governing leaf properties such as transmittance, absorption/reflectance for early and nondestructive detection/monitoring of plant health status. The proposed sensor is based on measuring the diffused reflectance/transmittance of tulsi leaves, using very simple visible and infrared LEDs and photo-detectors. And based on these transmittance/reflection measurements obtained from the tulsi leaves at their various growth stages, the spectral characteristics are obtained. These spectral signatures are then statistically analysed to correlate them with the plant health status. The proposed methodology is expected to provide non-destructive, convenient, reliable and cost-effective solution for the agri-tech industry.

Keywords: Chlorophyll,Simple Ratio Vegetation Index(SRVI),Reflectance,Transmittance,Plants Nutrients,Spectroscopy.

The main objective of this work is to determine certain unique optical properties of the plant which can be correlated to plant nutrients such as Nitrogen and thereafter design a system for estimation of chlorophyll in leaves.
For this the steps involved are:
o Illuminate the sample with an appropriate light source such that it corresponds to the chlorophyll content of leaf.
o Measure the transmittance/reflectance/absorption.
o Obtain spectral transmittance/reflectance/absorption curves.
o Analysis of the obtained spectral signatures.
o Development of algorithm based on the unique spectral signatures obtained

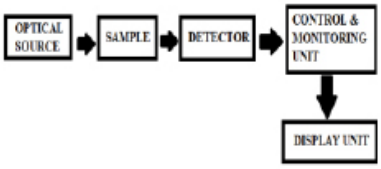

Figure 1: Block diagram of the proposed sensor system

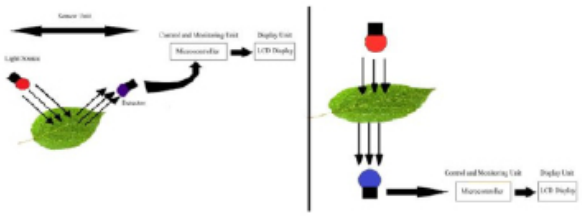

Figure 2: Schematic diagram of the proposed sensor system

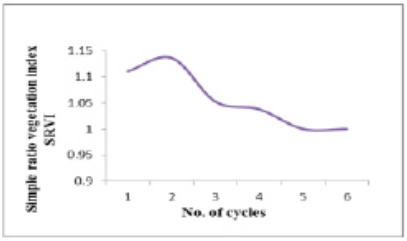

Figure 3:SRVI for different growth stages of Tulsi plants

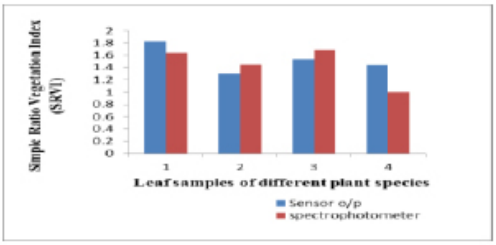

Figure 4:SRVI for proposed sensor system and spectrophotometer

Conclusion:

The potential of the sensor of simple Vis-NIR sensor to measure the chlorophyll content was studied. Two simple frameworks, one based on reflectance measurements from Tulsi canopy and the second one based on transmittance measurements from single leaf have been designed. It was observed that mainly the red and infrared sensor output can be correlated to the chlorophyll content of leaves. The proposed system showed satisfactory results in comparison to the standard spectrophotometer method. Thus in future, further experiments will be carried out to obtain a standard threshold for the SRVI, such that the stress in plants can be detected at a very early stage. The proposed framework is expected to have a great potential in detecting nutrient stress despite some shortcomings. The potential of the sensor system could be extended to other nutrients elements and if this proves successful it could greatly help by providing a cost-effective and reliable source in nutrient management.

Electromagnetic response of dielectric nanostructures in liquid crystals

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Sub-wavelength periodic metallic nanostructures give rise to very interesting optical phenomena [1] like effective refractive index, perfect absorption, cloaking, etc. However, such metallic structures result in high dissipative losses and hence dielectric nanostructures are being considered increasingly to be an efficient alternative to plasmonic materials [2]. High refractive index (RI) dielectric nanostructures exhibit magnetic and electric resonances simultaneously giving rise to interesting properties like perfect magnetic mirrors, etc. In the present work, we study light-matter interaction of cubic dielectric structures made of very high refractive index material Te in air. We observe a distinct band-like structure in both transmission and reflection spectra resulting from the interaction between magnetic and electric dipolar modes. FDTD simulations using CST software are performed to analyse the different modes excited at the band frequencies. The medium when replaced with liquid crystal gives rise to asymmetry in the band structure emphasizing one of the dominant magnetic modes at resonance frequencies. This will help in achieving a greater control on the excitation of the predominant magnetic dipolar modes at resonance frequencies with applications as perfect magnetic mirrors.

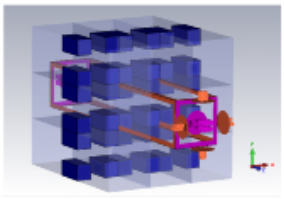

Figure 1:Layer of periodic dielectric cubes of Te after applying periodic boundary conditions.

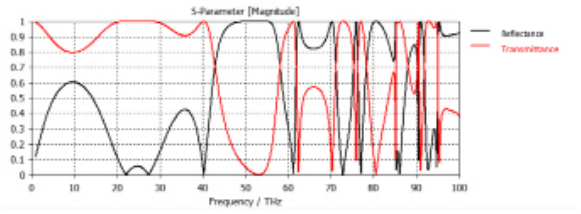

Figure 2: S-parameter plot for transmitted and reflected waves for cubes placed in the liquid crystal medium.

REFERENCES:

[1] Jia, D., Yang, C., Li, X., Peng, Z., Liu, Y., Cao, Z., Mu, Q., Hu, L., Li, D., Yao, L., Lu, X., Xiang, X., Zhang, H. and Xuan, L., \Optical hyperbolic metamaterials based on nanoparticles doped liquid crystals",Liq. Cryst., Vol. 41, No. 207, 2013

[2] Saman Jahani and Zubin Jacob, 'All–dielectric metamaterials', Nature nanotechnology, Vol 11, 2016.

Face Recognition Based Smart Attendance System

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Face Recognition is a biometric method of identifying an individual by comparing live capture or digital image data with the stored record for that person. It is considered as an optimal solution for enrolment of attendance among all biometrics applications such as fingerprint and has a high potential to replace the current manual attendance system. In this paper, we have proposed an idea where Viola Jones Algorithm is used for face detection and then pose estimation/alignment [3] is done by Face Landmark detection followed by Deep Convolution Neural network as feature extractor and SVM as classifier for face recognition. Raspberry pi 3 model B with Broadcom BCM2837 processor is used for controlling and data storage purpose. Raspberry pi 3 model B contains 1 GB RAM to achieve high speed of operation and accuracy [1]. Figure: 1 shows the outline of the proposed method. An infrared sensor detects the presence of a student near the entrance and triggers a camera to click photo. This photograph is then processed using our proposed method and compared with the database to register the particular student's attendance. Face Recognition basically involves two most important procedures:
A) Detection of a face (determining whether the recorded or clicked picture is that of a face or some other body part)
B) Face verification (confirmation of the face from the faces stored in the database).
After the student attendance is recorded, the particular student receives a message via app notification for conveying that his/her attendance has been recorded. In case a student is absent, the parents are notified via app notification.

References:
[1] Gaddam, S.C. and Ramesh, N.V.K., 2016. Attendance Management and User Security System's based on Eigen Faces Algorithm using Raspberry pi 2 and Ethernet. Indian Journal of Science and Technology, 9(17).
[2] Baltrušaitis, T., Robinson, P. and Morency, L.P., 2016, March. Openface: an open source facial behavior analysis toolkit. In Applications of Computer Vision (WACV), 2016 IEEE Winter Conference on (pp. 1-10). IEEE.
[3] Kazemi, V. and Sullivan, J., 2014. One millisecond face alignment with an ensemble of regression trees. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 1867-1874)

Figure 1: Outline of Proposed Method

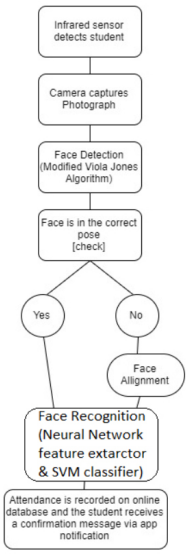

Figure 2: Raspberry Pi 3

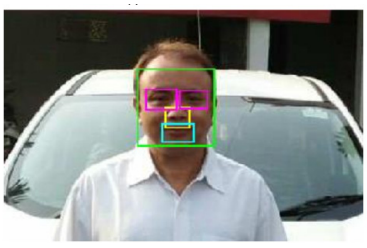

Figure 3: Output of modified viola jones face detection algorithm

A Power Quality Improvement Technique Using Statcom For 3-Φ Self-Excited Induction Generator Feeding 1-Φ Load

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The energy crisis is one of the factors with maximum impact on the development of society. Studies have shown that Electricity plays a very important role in making changes in HDI (Human Development Index). Both are related directly with each other. Thus if we aim at developing the power sector of any society, state or country; development is likely to follow. Further with the wider distribution of population over the planet, isolated communities started to develop leading to the idea of distributed generation. Most of the rural, sub-urban and urban parts of country use single phase load. A low cost three phase generating system need to be developed which can operate in these areas is necessary.

It is noted that most of the locally available resources are isolated and decentralised in nature. So an off-grid technique or development of a stand-alone system for generation of power and supplying to utilities is much necessary. Use of Asynchronous machine (induction machine) as a generator is becoming more popular for effective and low-cost system to harness the renewable energy over synchronous generators because of its lower unit cost, inherent ruggedness, brushless(in squirrel cage construction), absence of separate dc source, simple and robust construction, ease of maintenance, self-protection during faults, good dynamic response etc. Various power quality issues are reported when we use a three phase Induction Generator and let it feed a single phase load using the connection techniques (Fukami, Steinmitz, Smith, C2C) that have been reported the literature. Due to nonlinear behaviour of loads, loads continuously inject harmonics into the asynchronous machine. These harmonics in voltage and current increase the power losses create unwanted heating and torque pulsating in the shaft of the generator and the machine. A power quality improvement technique using STATCOM is realised in this project work. A controller is developed that takes care of voltage and frequency without derating of the machine, removes the unbalances occurring in voltage and waveforms as well as reduces harmonics in to complete system while a three-Φ Induction Generator (IG) feeds single-Φ loads liner/nonlinear balanced/unbalanced. Hysteresis current PWM controller is used to generate pulse for STATCOM. Fukami connection is preferred over other techniques of converting three phase to single phase load as it compensated the need of reactive power support for Self Excited Induction generator apart from solving the purpose of conversion stated. Single phase rectifier load is considered to be fed in by the system. The modelling of the overall system is carried out in MATLAB Simulink PSB and performance of the overall system is studied. The value of PI controller gain constants have been obtained on a trial and error. Results so obtained are compared with results of PQ improvement technique available in literature.

Asymmetric Metamaterial Based Thin Film Sensing

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Metamaterials are nowadays, an area of avid research owing to their several unusual properties. However, ohmic and radiative losses play a major spoilsport in development of plasmonic metamaterial based devices. Recently it is found that asymmetric MMs can be effective in overcoming radiative losses, hence improving MM responses [1]. Dark eigen modes have weak interactions with the ambience, hence results in high quality factors, which can be excited in suitably designed asymmetric metamaterials. However, they are known to exist in symmetric SRRs also but cannot be excited directly because of the symmetry in structure. These modes, dominated by magnetic dipoles or higher order multipoles, are accessible by symmetry-broken SRRs [2,3]. Asymmetric MMs can demonstrate sharp resonance peaks with high Q factor. Such high Q asymmetric SRRs can form the platform in designing highly efficient thin film sensors for THz frequency domains.

Out of the many sensing schemes that have been reported, we have used the frequency shift sensing technique. In order to examine the sensing abilities of designed metamaterial, the refractive index of polyimide layer, which is applied on the top of the metamaterial structure, is varied for each particular thicknesses of polyimide to obtain sensitivity and hence Figure of Merit (FoM) values. We have designed the metamaterials and carried out numerical studies and simulations using the commercially available numerical software, CST microwave studios.

DESIGN AND FIGURE OF MERIT OF THE METAMATERIAL

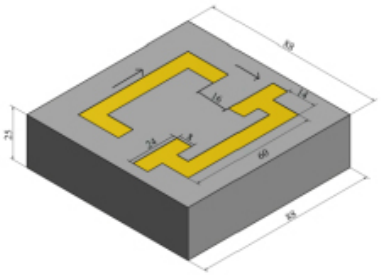

Fig1. Schematic of the proposed single unit cell consisting asymmetric resonator (units in μm). The E field direction is parallel and perpendicular to the split gap.

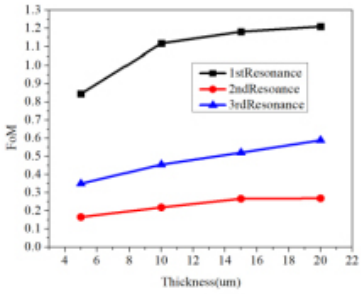

Fig.2 FoM plot for all the three resonances.

References:
[1] V. A. Fedotov, M. Rose, S. L. Prosvirnin, N. Papasimakis, and N. I. Zheludev, "Sharp trapped-mode resonances in planar metamaterials with a brocken structural symmetry," Phys. Rev. Lett. 99, 147401 (2007).
[2] Dibakar Roy Chowdhury, Xiaofang Su, Yong Zeng, Xiaoshuang Chen, Antoinette J. Taylor, and Abul Azad," Excitation of dark plasmonic modes insymmetry broken terahertzmetamaterials", Optics Express 19401(2017)
[3] SJM Rao, D Kumar, G Kumar, DR Chowdhury, "Modulating the near field coupling through resonator displacement in planar terahertz metamaterials", Journal of Infrared, Millimeter, and Terahertz Waves (2017)

Gesture Controlled Robo-Hand

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In real life, almost all of daily-encountered tasks require human hand perform. In some cases, certain task may require high power while others may require high dexterity. In other cases, some tasks may pose hazard for human to execute while others may be impossible for human to operate In today's world there is an increasing need to create artificial arms for different inhuman situations where human interaction is difficult or impossible. They may involve taking readings from an active volcano to diffusing a bomb, to control switch and machine in operation, in high temperature areas or in dusty atmosphere. Here we propose to build a robotic arm controlled by natural human arm movements so that the work can be done easily and without any harmful hazards. Thus robo-hand is best for us. In our paper the basic components are the hand itself, the servos, the Arduino, the glove, and the flex sensors. The glove is mounted with flex sensors that changes their resistance value when bend. The value of the resistance increase when it bends more and its value are minimum in normal condition. They're attached to one side of a voltage divider with resistors of a constant value. So we get voltage signal according to the change in the resistor. This voltage signal is transmitted and received through XBEE. XBEE is used for wireless communication. In our paper we have used XBEE S1 module which is already configured so there is no need to program in it. It transmits and receives data serially. We have used Arduino UNO which having six PWM output pins. Which is programmed to reads the voltage change in output signal according to the hand movement. Now we use five SG90 servomotors. The servos pull strings that will act as tendons, allowing the fingers for movement. So we gets robo hand movement according to changing the movement of our hand.

Keywords- Arduino UNO, Flex Sensor, XBEE, Servo Motors.

Performance Improvement of Monopole Loaded Hybrid Dielectric Resonator Antenna by using Sleeve-like Structure

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At microwave and millimetre wave frequencies, the printed metallic antennas suffer from high frequency ohomic losses which causes degradation in radiation efficiency. The dielectric resonator antennas (DRAs) have no such losses which make it a popular candidate for high frequency antennas. But again from the fabrication point of view, the printed antenna can be easily fabricated in low cost. So keeping the benefits of both metallic as well as DRAs the hybrid antennas are playing the popular roles for designing broadband antennas. Different configurations of hybrid DRAs are available in open literature. Among them monopole-loaded DRAs provide ultra-wide bandwidth. It can provide about 160% impedance bandwidth [1]. The main trend indicates using of different shaped DRAs with vertical monopole or shaped monopole. The monopole plays dual roles, (i) Selfradiator and (ii) feed for DR. The multiple resonances of both the resonating and radiating structures provide ultra-wideband width. A conventional monopole antenna with ground plane modification (shorted annular ring around the monopole) is the simplest form of sleeve antenna [2]. By introducing sleeve structure with conventional monopole helps to increase the bandwidth of monopole antenna, as sleeve structure provides additional resonance. In present work, first the performance of some existing hybrid antennas [3] has been studied by introducing sleeve-like structure and it offers better performance in terms of bandwidth. Then one novel hybrid DRA has been designed by incorporating the sleeve like structure. It provides 120% impedance bandwidth (s11< -10 dB). The designing has been done by using Ansys High Frequency Structural Simulator (HFSS) [4].

References:

[1]Erfani, Elham, et al. "A hybrid dielectric resonator antenna for spectrum sensing and ultra-wideband applications." Microwave and Optical Technology Letters 58.11 (2016): 2609-2611.

[2] Khan, Salman Naeem, and Muhammad Ashfaq Ahmed. "Printed sleeve monopole antenna." Ultra Wideband Communications: Novel Trends-Antennas and Propagation. InTech, 2011.

[3] Guha, Debatosh, Bidisha Gupta, and Yahia MM Antar. "Hybrid monopole-DRAs using hemispherical/conical-shaped dielectric ring resonators: Improved ultrawideband designs." IEEE Transactions on Antennas and Propagation 60.1 (2012).

[4] Ansoft's high frequency structure simulator (HFSS) version 16.2

Downlink analysis of a hybrid RF/VLC system

Visible Light Communications (VLC) has been recently recognized as an efficient mechanism for increased data rate applications, particularly for wireless devices enabled with internet which are increasing at an exponential rate. VLC makes providing high data rates and coverage to such large number of devices possible, which has become equally challenging with conventional radio frequency (RF) based communication. However, the performance of VLC degrades severely in the absence of line of sight (LOS) components. Also, assuming the VLC source always ON is impractical, since it primarily depends on the lightening requirements. As a solution, integrating RF and VLC systems to compensate each of their loopholes has been proposed. The VLC system can compensate in increasing the data rate, while the RF system in uninterrupted communication when LOS components are absent. These systems have been termed as hybrid RF/VLC systems. In hybrid radio frequency (RF)/VLC, the receiving mobile terminal (MT) is either connected to the RF or the VLC access point (AP) depending on the availability of LOS components. In this paper, we study the downlink analysis of a hybrid RF/VLC system. The MTs are assumed to have energy harvesting capability. In particular, the downlink achievable data rates, signal-to-interference plus-noise ratio, and outage probability of these systems is studied in reference to the amount of energy harvested. We find that different lighting requirements vary the energy harvesting in hybrid RF/VLC. Thus, a comparative analysis of energy harvesting in different cell deployments has been carried out.

ABSTRACT

Visible Light Communications (VLC) has been recently recognized as an efficient mechanism for increased data rate applications, particularly for wireless devices enabled with internet which are increasing at an exponential rate. VLC makes providing high data rates and coverage to such large number of devices possible, which has become equally challenging with conventional radio frequency (RF) based communication. However, the performance of VLC degrades severely in the absence of line of sight (LOS) components. Also, assuming the VLC source always ON is impractical, since it primarily depends on the lightening requirements. As a solution, integrating RF and VLC systems to compensate each of their loopholes has been proposed. The VLC system can compensate in increasing the data rate, while the RF system in uninterrupted communication when LOS components are absent. These systems have been termed as hybrid RF/VLC systems. In hybrid radio frequency (RF)/VLC, the receiving mobile terminal (MT) is either connected to the RF or the VLC access point (AP) depending on the availability of LOS components. In this paper, we study the downlink analysis of a hybrid RF/VLC system. The MTs are assumed to have energy harvesting capability. In particular, the downlink achievable data rates, signal-to-interference plus-noise ratio, and outage probability of these systems is studied in reference to the amount of energy harvested. We find that different lighting requirements vary the energy harvesting in hybrid RF/VLC. Thus, a comparative analysis of energy harvesting in different cell deployments has been carried out.

ABSTRACT

Now a days as demand of high data rate is increasing, so as data rate is going high and high, problem of secure as well as reliable communication is increasing. Reliability is measured in terms of decoding error probability and security is measured in terms of mutual information in between transmitter and illegitimate receiver. Error Control codes have been used to increase the information rate upto channel capacity. For reliable communication decoding error probability should be zero. Secrecy capacity is known as maximum information rate from transmitter to legitimate receiver such that eavesdropper is fully ignorant. People have got secrecy capacity for LDPC code as well as for polar code in some special channel condition. Error correcting code is applied at physical layer to ensure correct reception by addressee and cryptography is applied at higher layers to enforce secrecy with respect to eavesdropper . Cryptosystem is said to be computationally secure if the best algorithm for breaking it requires at least N operation where N is some specified very large number.

ABSTRACT

In this paper, we focus on the problem of content-based retrieval for audio, which aims to retrieve all semantically similar audio recordings for a given audio clip query. We propose a novel approach which encodes the audio into a vector representation using Siamese Neural Networks. The goal is to obtain an encoding similar for files belonging to the same audio class, thus allowing retrieval of semantically similar audio. Using simple similarity measures such as those based on simple euclidean distance and cosine similarity we show that these representations can be very effectively used for retrieving recordings similar in audio content.

ABSTRACT

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Online social media is gaining popularity exponentially, especially among the teenagers. They spend lot of time browsing through social media and start living a “False life”. Everything that happens there, they take it seriously and therefore it starts reflecting in their “Real Life”. Bullying is a serious problem and it can lead the victim to depression and other mental problems. This results in him/her to stay isolated and sometimes it ends up with some really bad consequences such as suicides. If we can identify bullying on social media at an early stage then we can save the victim from all the pain he would have gone through. This work is about the first phase in the process of developing a system that can identify the insult and insulting words that are used popularly in Indian subcontinent region. In this phase we have thoroughly studied researches done in this domain, listed out some of the major challenges we will have to face during the process of developing of such system, And finally tried some of the baseline classification techniques of machine learning to study how these techniques perform in our context.

Abstracts (Poster)

Energy

Large area uniform MAPbI3 thin films for perovskite solar cells using two step technique.

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Perovskite solar cell (PSC) is an emerging technology in photovoltaic, which uses perovskite structured hybrid compound as a light absorbing material (such as methylammonium lead halide). Perovskite solar cells with recorded certified efficiency of 22.1 % are the fastest advancing photovoltaic technology till date. The main advantage of such solar cells is that it has simple and cost effective fabrication method using solution process technique, such as spin coating. However, the PSCs made by solution process have limitation of small device area due to porosity and non-uniformity in absorber layer. Pinhole-free layers can significantly improve the performance and stability of MAPbI3 based perovskite solar cells. In order to improve the quality of the absorber layer of PSCs, we have used two step method. First is the thermal evaporation (TE) of lead iodide (PbI2) and dip coating (DC) in methylammonium iodide (MAI) solution to make methylammonium lead iodide (MAPbI3). The complete formation of MAPbI3 after dipping PbI2 film into MAI solution was confirmed from XRD patterns shown in figure 1 below. Optical, structural and electrical properties of the MAPbI3 films were also studied. This method of making perovskite layer can help in better performance of a PSC, as the films have uniform coverage over large area.

Keywords: MAPbI3 perovskite, thin film, thermal evaporation.

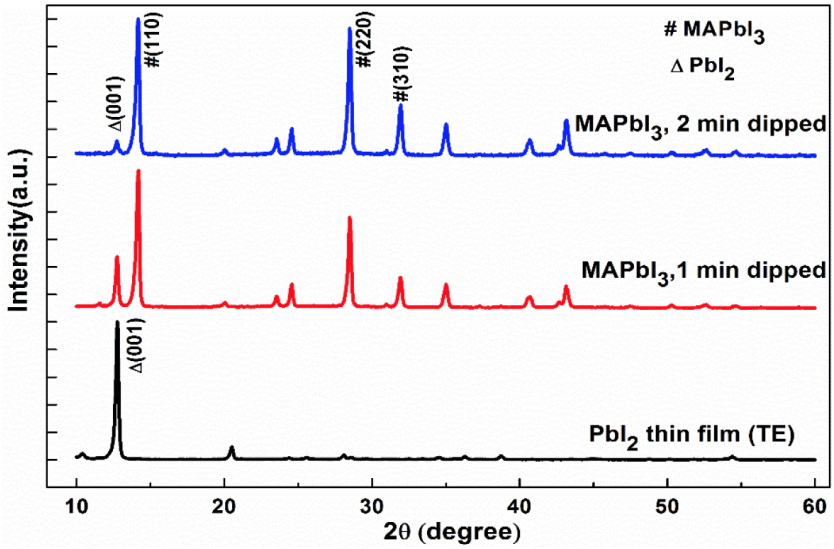

Figure 1: XRD patterns of PbI_2 and $MAPbI_3$ thin films with variation in dipping time.

Modelling and Simulation of Concrete based Thermal Energy Storage System

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Sensible heat storage technology is considered to be one of the cost effective and energy efficient technology for the heat storage applications such as: concentrated solar power, domestic hot water, industrial process heating, building heating and cooling, etc. This manuscript presents the simplified mathematical modelling approach for predicting the performances of the sensible heat storage system (SHS). One dimensional unsteady state model equation for cylindrical sensible heat storage module is solved using Modelica programming language. Overall heat transfer coefficient of the storage model is estimated by minimizing error between the unsteady state model output and experimental measurements using optimization techniques. Schematic of the experimental set up employed for testing the performances of the thermal storage system is given in Fig.1. The heat storage module is made of concrete with embedded copper tubes for circulating heat transfer fluid. Therminol 55 is used as the heat transfer fluid. The experiments were performed by varying heat transfer fluids velocity and charging temperature. The estimated heat storage capacity of the SHS system used was 10 MJ with the temperature range from 333 K to 453 K. The estimated volume average temperature was validated with the data available in the literature and also with the current experimental data. The validated model can be used for design optimization of sensible heat storage system and real time optimization of charging/discharging processes. The proposed lumped parameter model can be used as an alternate tool for the performance assessment of thermal energy storage systems.

Keywords: Sensible heat storage, Numerical modelling, Thermal Energy Storage, TES, Charging and discharging.

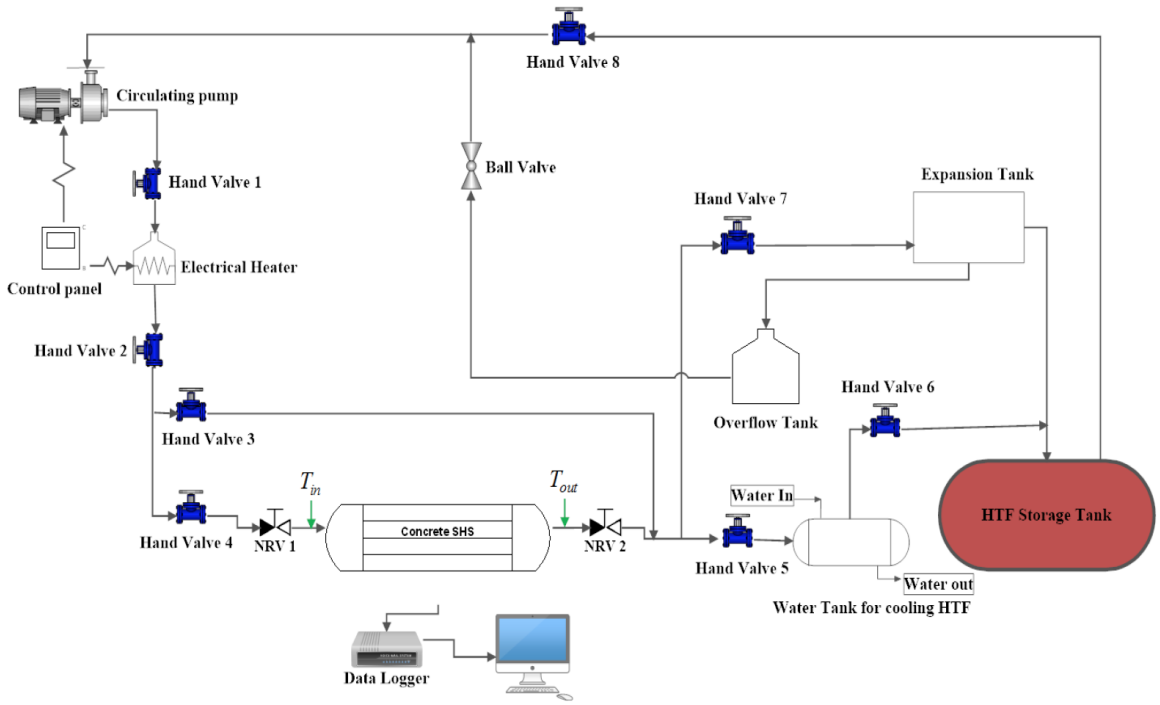

Fig. 1. Schematic of the experimental set up with SHS module

Experimental investigation of tapered surface junction probe in a shock tube approach in Constant-Force Experiment

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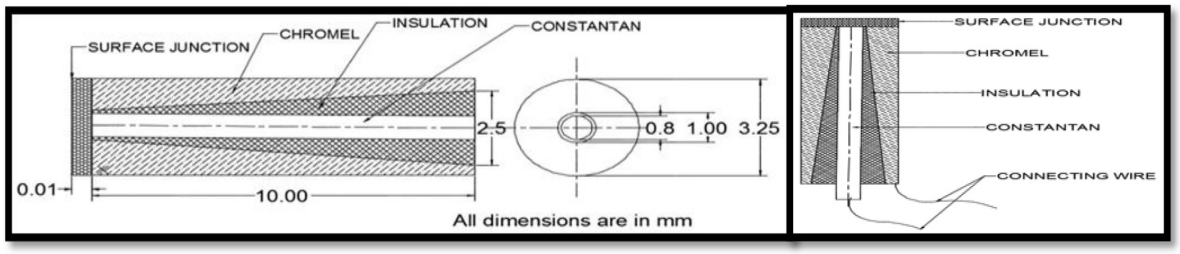
Thermocouples are measuring probes, used to measure temperatures in various experiments with accuracy. Using Co-axial surface junction thermocouple (CSJT), many researchers have calculated heat flux values from the temperature history [1, 2] and very few have calculated continuous temperature values. The application of CSJT has been mostly concentrated in high speed flows which require a time scale in milliseconds and micro seconds, e.g. shock tube and shock tunnels [3].

Fabrication, calibration and application of CSJT in shock tube

The CSJTs used by researchers are designed and fabricated by swaging one wire over another maintaining a constant thickness of insulation in between them throughout the length. In the present study, a tapered E-type, CSJT has been designed and fabricated In-house (Fig.1). The dimension of outer and inner wire is 3.25mm and 0.8 mm with a varying insulation thickness. The CSJT got calibrated in an oil bath set up to obtain a temperature voltage relationship which holds a constant slope for a temperature range of 100°C. Shock tube facility at IIT Guwahati has been used for the study which is in-house fabricated and able to withstand moderate pressure.

Keywords: Tapered Co-axial surface junction thermocouple, temperature, heat flux, shock tube



(a) Fig1. Design of tapered CSJT (b)

2. Reference

[1] Sahoo N and Kumar R. (2016) Performance assessment of thermal sensors during short duration convective surface heating measurements, Heat Mass transfer, 52,2005-2013.

[2] Agarwal S Sahoo N and Singh RK (2016) Experimental techniques for thermal product determination of coaxial surface junction thermocouples during short duration transient measurements, International Journal of heat and mass Transfer, 103, 327-335. [3] Mohammed, H., A., Salleh, H., and Yusoff, M., Z., 2011, "Dynamic Calibration and Performance of Reliable and Fast-Response Coaxial Temperature Probes in a Shock Tube Facility," Experimental Heat Transfer, 24(2), pp.109-132.

Drying of Elephant apple (Dillenia indica) in a solar tunnel dryer

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Dillenia indica, commonly known as elephant apple or chulta, is a species of Dillenia native to southeastern Asia, from India, Bangladesh and Sri Lanka and other south western countries. The fruit pulp is sour and used in Indian cuisine in curries, jam (ouu khatta), and jellies. It is extensively used in dal and fish curry in Assam. The fruits are generally high in fibre and have medicinal values. The fruits and the juice of the plant are traditionally used for the treatment of various diseases and one of the major diseases is Diabetes Mellitus. There has been growing interest in the beneficial health effects of consuming fruits of Dillenia. Sun drying is the widely used drying practised. In general, drying is commercially practised through mechanical drying. But such mechanical dryers are polluting the environment and the cost of drying is also high. Ever increasing global warming, rise in sea levels and climate change due to increasing atmosphere pollution caused by the Green House gases emission from economic activities based on fossil fuels has lead to construction of solar dryers. Compared to conventional sun drying, solar dryer can generate higher air temperature and consequential lower relative humidity. The present dryer is a tunnel like semi-cylindrical in shape, poly house made up of UV-stabilized polyethylene sheet. The temperature inside the dryer was always higher than the ambient and the variation varied from 15-20 °C. Initial moisture content of the fruit was reduced from 87.83% (w.b.) to about 10.39% (w.b.) which is considered to be a safe level. The drying rate inside the dryer was always found to be higher than the open sun drying. The relative humidity and temperature was maintained at the optimum level with the use of exhaust fan and infrared bulbs fitted inside the solar tunnel dryer. The wind flow rate at the outlet was measured at different interval with the help of Anamometer. The final dried fruit was found to be good in terms of quality, with good shelf life and was highly acceptable.

Opto-electrical and structural studies on rf sputtered deposited ZnO: Al thin film

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Aluminium doped zinc oxide (ZnO: Al) is one of the most promising material as a transparent conducting oxide material for solar cell applications. Thin films of ZnO: Al on corning 1737 glass substrate were deposited by RF sputtering technique. The ZnO: Al films are prepared by varying substrate temperature (series I) from 100°C to 200°C, keeping rf power at 80W, process pressure was 6 x 10^{-2} mbar, argon flow rate was 7 SCCM and deposition time of 15 minutes were constant. In addition, another series of films were prepared by varying RF power (series II) from 50W to 90W, keeping substrate temperature 100°C, process pressure 6 x 10^{-2} mbar, argon flow rate was 7 SCCM and deposition time of 15 minutes constant. The structural, optical and electrical properties of the prepared samples were studied by XRD, Raman spectroscopy, UV-Vis-NIR transmittance spectroscopy and Four-probe technique for electrical resistivity measurement. All the films show very high transmittance (~100%). The optical band gap calculated is 3.46 eV and electrical resistivity of the prepared sample is very low, of the order of 10^{-4} Ω-cm.

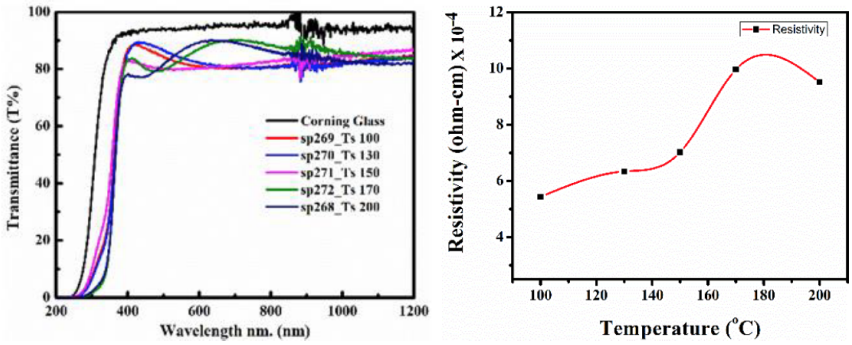

Figure 1 (a) Transmission spectra of AZO films, Variation in substrate temperature measured w.r.t. air, the transmittance spectra of corning substrate is also shown for reference. (b) Resistivity calculated by four-probe measurement.

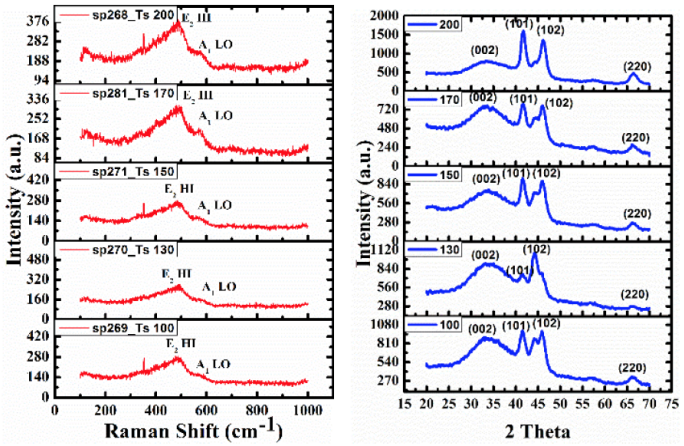

Figure 2 (a) Raman spectra of AZO thin films deposited by varying substrate temperature. (b) XRD spectra for AZO thin films.

Kosakonia pseudosacchari as Biosensor for Mercury

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Bacteria has great application potential as a catalyst in developing biosensor considering the fact that it is very robust in nature; with this idea, water samples were collected from fresh water pond located in IIT Guwahati campus. These samples were subjected to enrichment in a specific cultivating media, the enriched culture were plated on agar plate. Colonies were isolated from plate and odentified as Kosakonia pseudosacchari by 16srRNA sequencing.They were then analysed for gram staining, growth characteristics in different pH and carbon sources, photopigment, motility and salt tolerance. Further experiments were conducted to test its behaviour in presence of mercury. The results proved the samples to be gram negative having bacteriocholorophyll a and carotenoid pigments. The best carbon source for both samples proved to be glutamate at pH7.2. The pond isolate was non motile .The growth characteristics studied in presence of mercury and herbicides proved the bacterial samples to be highly tolerant. It was very well deduced that mercury affects the photopigments of the bacterias and this may be further used for sensing purpose.

Extraction & Characterisation of lignin and Biofuel production from composite invasive biomass

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Invasive weeds are the second most threat to biodiversity next to habitat destruction. The weeds screened as the feedstock were roughly ranges from 5-20 t/ha depending upon their species, growing conditions and the prevailing season (Lantana camara 10-12 t/ha, Eichhornia crassipes 6-8 t/ha, Mikania micrantha 8-10 t/ha) (Rajkhowa et al., 2005). Detailed information of their distribution in various national park, wild life sanctuary and tea gardens of Assam and boardering area is cited in (Lahkar et al., 2011) and India Country Report 101005 on National Forest invasive species activites. 2005. To achieve large scale production and year round availability feedstock blending can be an another promising solution to overcome current challenges on biomass supply.

Efficient management of this waste is a major challenge of today's world. These weeds for bio-alcohol production can be a plausible solution to address today's built environment, reduce pressure on agriculture land and focused on tomorrow's energy security and also solve not only the problem of managing waste but can also meet the ever increasing demand of energy. The lignin was extracted from the biomass in a soxhlet extractor by a mixture of organic solvent and acids. The lignin was precipitated from the concentrated lignin solution by adding warm water and small amount of ammonium chloride. Sugars were released in the water when the concentrate was washed with warm water. The precipitated lignin was dried and washed with diethyl ether to remove
impurites. Isolated lignin was characterized by Fourier transform infrared spectroscopy (FTIR), Thermogravimetric analysis (TGA) analysis. Biomass after lignin removal was subjected to dilute acid hydrolysis and enzyme hydrolysis by using mixture of enzymes which led to release of hexose and pentose sugars which was detected and quantifed by HPLC. These sugars are then fermented by Clostridium acetobutylicum to
poroduce Acetone, Butanol and ethanol. The biomass after hydrolysis is now reduced in volume and now can be compressed and transformed into Briquettes for burning purposes.

Keywords: Invasive weeds, Lignin, biobutanol, ethanol, FTIR, TGA and GPC.

Influence of Substrate Temperature on Structural and Optical Properties of TiO2 Thin Films Deposited by RF Sputtering

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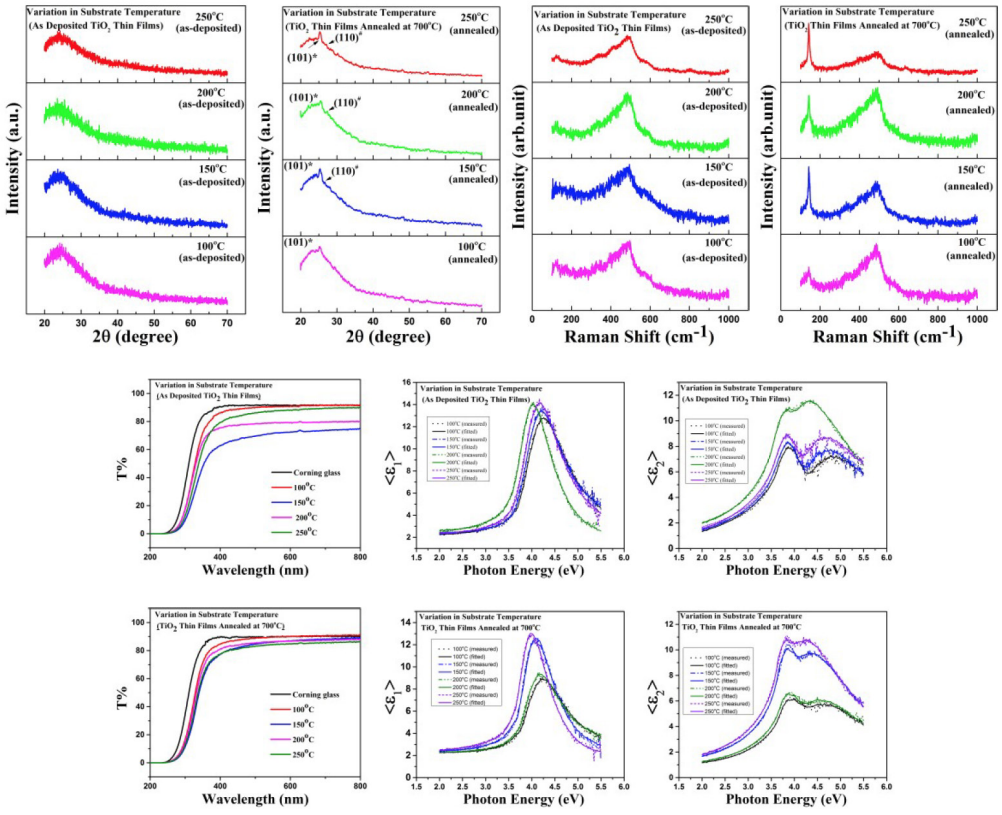
The Structural and optical properties of Titanium Oxide (TiO2) thin films deposited by RF magnetron sputtering with variation in substrate temperature (100-250°C) have been studied using X-ray diffraction (XRD), Raman spectroscopy, UV-Vis-NIR spectroscopy and Spectroscopic Ellipsometery. The as deposited films were found to be amorphous in nature, however, after annealing at 700°C for 2 hours, the peaks corresponding to the crystalline phase is observed in both XRD and Raman Spectra. The peak intensity in crystalline phase depends upon the substrate temperature during deposition and is more for higher substrate temperature. The band gap of the as deposited films at substrate temperature of 250oC is around 3.53eV and for annealed film is

3.50eV indicating not much significant effect of annealing on band gap. The measured dielectric-function spectra for thin film deposited at substrate temperature of 250oC reveal distinct structures at energy of 4.21 and 3.78eV for as-deposited thin film and 4.3 and 3.80eV for annealed thin film due to interband transitions.

The dielectric related optical constants, such as refractive index, extinction coefficient; absorption coefficient and normal incidence of reflectivity were also analyzed. These results will be presented at the conclave.



Design and development of a Solar Powered VCRS based Cold Storage System

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Wastage of crops due to lack of availability of proper storing facilities is posing a huge problem for our country at present . According to a survey done by NCCD, only 10-11 percent of the fruits and vegetables produced in India use cold storage. About 30 percent of the fruits and vegetables grown in India are wasted annually due to lack of proper infrastructure, which is a cause for concern. The motivation for the project comes from the lack of availability of proper storage facilities in Northeastern states of India, Assam being the focal point of investigation. This paper presents the design methodology and development and of a VCRS based cold storage prototype of 200 Kg storage capacity running on Solar Power. The cold storage prototype is having a 500-Watt of power requirement on an hourly basis and is met by using 2 kWp Solar PV modules placed in IIT Guwahati campus. Running it solely on Solar Power gives us an autonomy for approximately 12-hour autonomy on a daily basis. At present, the focus of the project is on designing and modeling of a thermal storage device to be integrated with the prototype to provide the backup power during the nighttime and also an efficient control mechanism for balancing the power during the day time and night time The project aims at optimizing the power requirement of the whole system, maintaining optimum efficiency while bringing down the cost to make it feasible to be used in rural areas.

A novel nano-biocomposite matrix stimulates cyanobacterial photosystems to generate steady current in a PMFC

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Improving power generation under low light conditions and efficiently capturing electrons from the photosynthetic bacteria on the electrode are critical issues for developing a viable photosynthetic microbial fuel cell (PMFC) envisioned for many applications (Sarma et al. 2016). To address these issues, a novel nano-biocomposite matrix has been developed by strategically incorporating cadmium telluride (CdTe) quantum dots (QD) and graphene nanoplatelets (GNP) in the silk fibroin (SF) film, which has been previously established as biofilm inducing biomaterial (Kaushik et al. 2016). This nanocomposite matrix was employed over the graphite electrode to develop the anode for a dual-chambered PMFC with an abiotic cathode (Fig. 1). The matrix supported biofilm growth of the photo-catalyst Synechococcus sp., surged the bacterial photosystems (PS I and PS II) with appropriate light ($\lambda_{650–750\ nm}$) at a broad excitation spectrum ($\lambda_{350–644\ nm}$) through fluorescence resonance energy transfer and facilitated the metabolic electron relay through direct electron transfer (DET) to the anode (Kaushik et al. 2017). The maximum current density of the PMFC hence obtained (1.89 Am-2) was ~5.7 fold higher than that of the corresponding blank graphite anode. The positive effect of QD was further confirmed from the fading reversal of polarity during the circadian cycle, leading to sustained current generation in the PMFC. We demonstrated that the nano-biocomposite matrix with suitable optoelectronic property improved light to current conversion efficiency (4.01 %) in cyanobacteria based PMFC set up.

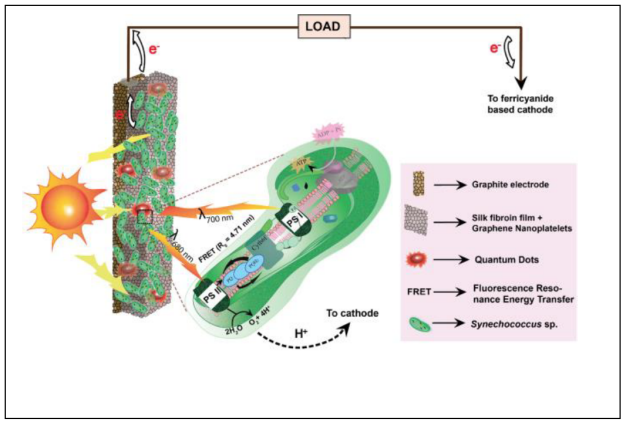

Fig 1. Schematic of the rationally designed nano-biocomposite matrix comprising of CdTe quantum dots, graphene nanoplatelets and silk fibroin on graphite electrode developed for a dual chambered PMFC with *Synechococcus* sp. as the anodic photo-catalyst.

2. Acknowledgement: Financial assistance from MNRE (No. 102/78/2010-NT) and DBT (No. BT/264/NE/TBP/2011), India, are acknowledged for funding the work.

3. References:

Kaushik, S., Sarma, M.K. & Goswami, P., 2016. Thin films of silk fibroin and its blend with chitosan strongly promote biofilm growth of Synechococcus sp. BDU 140432. Journal of Colloid and Interface Science, 479, pp.251–259.

Kaushik, S., Sarma, M.K. & Goswami, P., 2017. FRET-guided surging of cyanobacterial photosystems improves and stabilizes current in photosynthetic microbial fuel cell. J. Mater. Chem. A, 5, pp.7885–7895.

Sarma, M.K., Kaushik, S. & Goswami, P., 2016. Cyanobacteria: A metabolic power house for harvesting solar energy to produce bio-electricity and biofuels. Biomass and Bioenergy, 90, pp.187–201.

Flexible Low-Cost Sensor for Industrial and Food Packaging Applications

Brijesh Meena1, Tushar Konch[3], Vithya Saahar[4], Dr. Kalyan Raidongia[3] and Dr. Harsh Chaturvedi[2*]

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A Flexible Ammonia Gas Sensor (Image 1) was developed using Screen Printing Technique. It was fabricated by two-layer printing, first the interdigitated electrodes by using conductive ink and then an active layer by using Silicon Dioxide Ink. Silicon Dioxide Ink was prepared by mixing silicon dioxide with polymer. Four different polymers based inks were prepared and tested. Inks were developed at four different Polymer: SiO_2 ratios and all were tested for printability and sensing response. Raman spectroscopy and IV measurement in presence and in absence of ammonia fumes were performed. Conductivity was observed in the presence of Ammonia fumes and was increasing with the concentration of fumes. Sensor with different area was printed and tested. It was found that maximum sensing capacity increased with increase in area. Sensor was also integrated with printable heater at the back for continuous sensing of Ammonia. It becomes unbearable and is dangerous for humans if ammonia levels are more than or equal to 150-160 PPM. This sensor was able to sense ammonia amount as low as 36 PPM (Table 1 and Graph 1) which is lower than the amount bearable by humans. This makes it an ideal and very useful component for IoT and in Food Packaging industries.

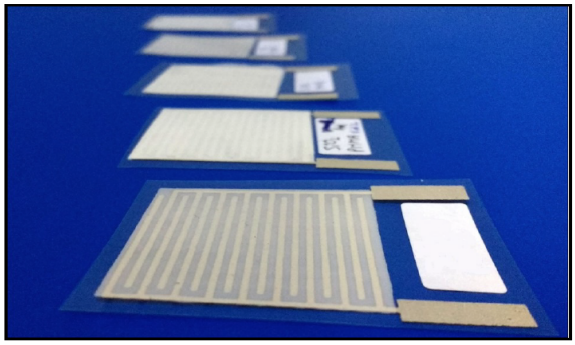

Image 1: Ammonia gas sensors 3.5×3.5 cm^2

Peak	Ammonia (PPM)
1	36
2	72
3	109
4	145
5	181

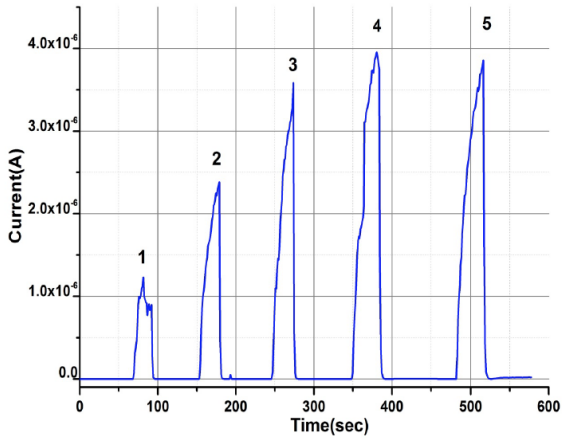

Table 1 and Graph 1: Peaks in Current vs Time graph associated with ammonia fumes concentration

Flexible fiber Supercapacitor for wearable energy storage

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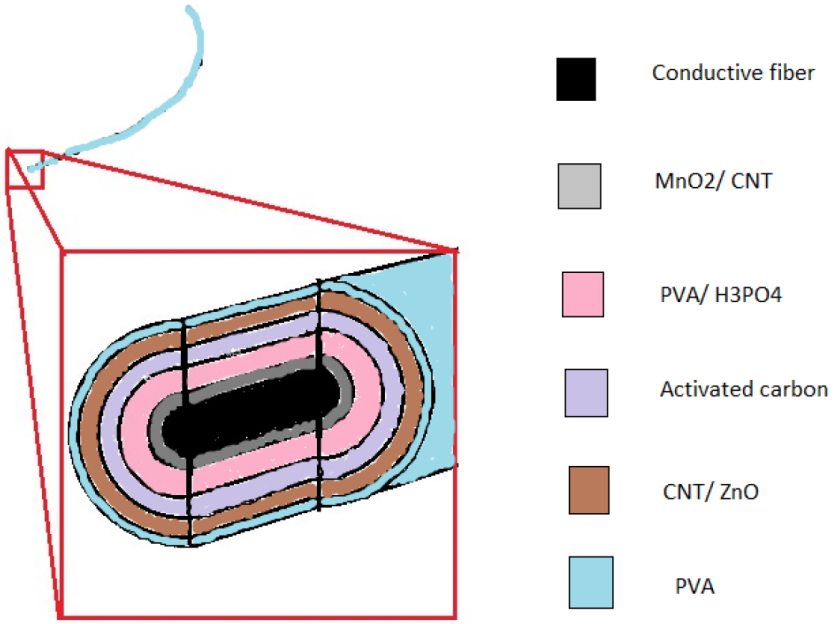
Recently the demand for wearable electronics have increased considerably and expected to grow further in the future. Lithium based batteries are predominantly used in modern day electronics but it has some limitations. Lithium is an expensive metal which increases the overall cost of the battery. Li-based battery have risk of explosion, electrolyte leakage and they are inflexible which makes it unfit for wearable devices. Also, it is not environment friendly. Due to this, a need for safe, environment friendly and low cost flexible energy storage device has arisen which would store/supply energy to wearable devices. Supercapacitors(SCs) bridge the gap between rechargeable batteries and electrolytic dielectric capacitors. SCs have higher capacity than the conventional capacitors along with high cyclability and rapid charge/discharge ability. We are developing a fiber supercapacitor which is carbon based and environment friendly. These SCs are thin fiber having coaxial structure and can be woven into fabrics. Despite having various advantages over Lithium based battery, they have low energy density. Improving the energy density of fiber SC is one of our prime objectives.These fiber SCs can be incorporated into wearable electronics in the domain of Biomedical, textile, Computing and processing. They can also be utilized for Environmental testing and monitoring applications, Electric vehicles, Power grid, Hybrid energy storage (battery and SCs).



Descriptive diagram of Coaxial fiber Supercapacitor

Quantum size effects and tunable visible photoluminescence in a-Si:H/nc-Si:H superlattices

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In this paper, we report a tunable visible photoluminescence in an unusual bulk system comprising of alternate layer of a-Si:H and nc-Si:H thin films. rf-plasma enhanced chemical vapor deposition technique was used for the growth of a-Si:H/nc-Si:H multilayer/superlattice structures. Number of such structures were prepared with the variation in nc-Si layer thickness while keeping the a-Si layer thickness constant. As the nc-Si layer thickness (d) was increased from 5-20 nm, the PL emission peak red shifted with the emission wavelength varying as d2, the characteristic signature of quantum size effects. The size of the nanocrystals could be tuned by varying the thickness of the nc-Si:H layers. We also observe long wavelength photoluminescence from interfacial states that leads to persistent photconductivity. Nanocrystalline-amorphous superlattices offer a unique pathway for synthesizing embedded nanocrystals with controlled sizes and photonic signatures.

Abstracts (Poster)

Environment

Climate Change and hydropower management within Brahmaputra river basin

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The river Brahmaputra which covers a stretch of 58000 square kilometres, originates in Tibet and then gradually flows into North-East India (Arunachal Pradesh and Assam), is fed by rivers from Bhutan and finally flows south into Bangladesh. The river has a great potential for hydropower generation in the upstream nations of India, China and also Bhutan and therefore, it is one of the major sources of economic development within the region. With shifts in rainfall pattern, glacier melt down, rise in temperature etc. climate change has become a serious matter of concern. The river Brahmaputra is a monsoon fed river unlike Ganga or Yamuna which are glacier fed. Hence, altered seasonal rainfall causes unplanned unit operations and maintaining e-flow by the hydropower dam becomes difficult. Increase in temperature leads to enhanced evaporation rate from the catchment area of the dam. The inclusion of these uncertainties has seldom been a part of decision making process involved in hydropower construction. Hydropower although considered to be a renewable source of energy has been criticized for not being sustainable. Restriction of normal flow of the river, production of methane from the submerged biomass in the catchment area, relocation of human habitat, effect to local biodiversity are the few problems associated with hydropower construction. Ignorance to the climatic factors has negative effects on social, ecological and economic aspects thereby adding on to the prevailing problems. The prevention of Dam Outburst Flood (DOF), maintaining the health of the river, optimum production of electricity can be the few outcomes of a sustainable hydropower design. Hence, if the uncertainties are taken into consideration while hydropower decision making process takes place, we can have a construction resilient to climate change. Keeping in mind the current scenario it is imperative that countries like India and China take the lead in promoting the construction of sustainable hydropower. This in the long run can also help in enhanced transboundary cooperation and fostering sustainable development within the Brahmaputra river basin.
Keywords: Brahmaputra river, Climate Change, Hydropower, Sustainability, Decision making

References:

Jiang, H., Qiang, M., Lin, P., Wen, Q., Xia, B. and An, N., 2017. Framing the Brahmaputra river hydropower development: different concerns in riparian and international media reporting. Water Policy, p.wp2017056.

Palmer, M.A., Reidy Liermann, C.A., Nilsson, C., Flörke, M., Alcamo, J., Lake, P.S. and Bond, N., 2008. Climate change and the world's river basins: anticipating management options. Frontiers in Ecology and the Environment, 6(2), pp.81-89.

Comparative evaluation of two different sulfidogenic bioreactor systems for continuous removal of heavy metals from mixture component system

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This study investigated continuous removal of heavy metals, viz Cu(II), Zn(II), Fe(III), Ni(II), Cd(II) and Pb(II) from multi-component

system by immobilized sulfate reducing bacteria employing two different sulfidogenic bioreactors: anaerobic rotating biological contactor reactor and downflow column reactor. The mixture experiments were designed as per the statistically valid factorial design of experiments. At a low inlet concentration combination of the metals, both the sulfidogenic bioreactors exhibited a maximum removal of Cu(II) (> 98 %), followed by Zn (II) (96 %) and other metals (> 86 %) and Ni(II) (> 66 %). However, at a high inlet concentration combination of the metals, the removal values were reduced, which correlated well with a low sulfate and chemical oxygen demand (COD) removal efficiencies. Statistical analysis of the results revealed that main effects, two and three way interaction effects due to different heavy metals tested in the study were significant on their removal using both of the reactor systems. Analysis of metal precipitates formed in the sulfidogenic bioreactors following field emission scanning electron microscopy (FESEM) equipped with energy dispersive X-ray (EDX)

spectroscopy confirmed that metals were precipitated as metal sulfides by SRB. Overall, low concentration and high volume of wastewater containing heavy metals and sulfate can be successfully treated using the An-RBC reactor.

Thermal pretreatment of rice straw for enhanced biogas production and its physicochemical characterization

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This study emphasizes the use of different thermal methods (i.e., hot air oven, hot water bath, autoclave and microwave) on pretreatment of rice straw prior to anaerobic degradation. These pretreatment methods resulted in reasonably high solubilisation of recalcitrant biomass. Maximum solublisation was attained by microwave (66.6 %) followed by autoclave, hot air oven and hot water bath methods. Cumulative methane yield of microwave (1900C; exposure time-4 minute) pretreated sample was 305.73 mL/g-VSadded, 43.5% higher than the control. Combining this high temperature conditions with lesser exposure time also improved the energy balance of the process. The physicochemical characteristics of pretreated rice straw were investigated by Fourier transform infrared (FTIR), Fourier emission and electron microscopy (FESEM) and X- ray diffraction (XRD). These analyses showed changes in chemical composition and physical characteristics, which made rice straw more degradable and available for enhanced methane yield.

Investigation of combined effect of various process parameters on biomass and lipid productivity of Chlorella pyrenoidosa NCIM 2738 using response surface methodology

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Owing to the scarcity of reserves and greenhouse gas emissions of fossil fuels, quest for inexpensive renewable biofuels has been a major endeavor till date. In this context, exploitation of microalgal strains for increased biomass and cellular lipid productivity is necessary for sustainable biofuel production. The present work was accorded towards optimization of the culture conditions (carbon and nitrogen sources, phosphorous, iron and various salts such as NaCl, KCl, MgCl2 and CaCl2) and physical operational parameters employing Plackett-Burman and response surface methodology design of experiments for enhancement of lipid production in Chlorella pyrenoidosa NCIM 2738. The optimal lipid productivity obtained from the experiment was according to the predicted model and confirmed the accuracy and validity of the model. The interaction plots results paved a path for medium engineering for enhanced biomass and lipid production. The strain can therefore serve as an ideal candidate for an environmentally sustainable process as it will reduce costs and production constraints associated with nutrient limitation and stress induction thereby solving a major bottleneck in commercialization of algal biofuel.

Keywords: Biofuel; Chlorella pyrenoidosa; Lipid productivity; Response surface methodology

Optimization of micro-nutrients and process parameters for treatment of refinery wastewater by oleaginous Rhodococcus opacus for potential bio-oil production

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Due to the expected depletion of fossil fuel sources in the near future, increasing attention is paid to the development of alternative sources of energy. One of the possible alternative is to convert biomass waste into lipids (TAGs) by using oleaginous/hydrocarbonoclastic bacteria like Rhodococcus opacus for production of TAGs. The principle function of TAG in bacteria is apparently to act as storage compounds. Besides the capability of TAG production, Rhodococcus opacus is known to have a wide substrate utilization range which enables them to grow on variety of alkanes and other complex organic compounds (hydrocarbonoclastic) thus making it a potential biological treatment tool for wastewater generated by petroleum refineries. Thus it can simultaneously treat wastewater and produce TAGs. The objective of this study was based on complex hydrocarbon degrading capability of Rhodococcus opacus along with TAG production. Biomass growth is highly dependent on different parameters viz. optimum inoculum size, temperature, dilution ratio etc. For preliminary optimization of different parameters the refinery wastewater was diluted with different ratios of minimal salt media (MSM) in conical flasks varying from 1:1, 2:1, 3:1, 4:1 and 5:1, Keeping 1%, 5% and 10 % (w/v) inoculum size at 30 ° C and 120 rpm. It was analyzed that 4:1 ratio (WW: MSM) gave the highest biomass growth as well as 70% COD removal in 96 h. The biomass was there after subjected to lipid extraction using a mixture of chloroform and methanol in a ratio of 2:1 (Folch method), followed by gravimetric analysis of the extracted lipid. The lipid was further characterized by using Nuclear Magnetic Resonance Spectroscopy (NMR) and Liquid Chromatography- Mass Spectrometry (LC-MS).The residual bacterial biomass was then subjected to hydrothermal treatment (HTT) for production of bio-oil.

Keywords: hydrocarbonoclastic; oleaginous; refinery wastewater; Rhodococcus opacus; TAG (Triacylglycerol), bio-oil.

Development of a Bi-functional System for Generation of Bio-energy from Natural Waste along with Carbon Dioxide Capture and Utilization

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Carbon emission from fossil fuel combustion and change in land use are forcing a rapid increase in atmospheric CO2 levels leading to climate change. The initial implementation of plans to rescue the levels of CO2 is based on a combination-of increased use of renewable energy and implementation of carbon capture and storage from industrial sources and power plants on a wide scale. Such actions are not sufficient for preventing the present world from the maximum limit CO2 emission in atmosphere (550ppm) which is foreseen in 2060. India is amongst the largest banana (Musca acuminate) producing countries and thus banana pseudo stem is commonly available in agricultural waste to be used as lignocellulosic substrate. Lignocellulose refers to plant dry matter (biomass), so called lignocellulosic biomass. It is the most abundantly available raw material on the Earth for the production of bio fuel mainly bio-ethanol. Two fungal Strain Aspergillus ellipticus and Aspergillus fumigatus are used under co-culture fermentation on banana pseudo stem to degrade holocellulose and facilitate maximum release reducing sugar. The resultant product ethanol can be used as a fuel. However this process has the demerit of production of excess CO2 which is obtained from burning of decayed banana pseudo-stem and combustion of the same. Here we have proposed a bi-functional system by virtue of which we can generate bio-energy and also capture the excess CO2 released during the production of the bio-energy. The by-product CO2 should be managed effectively in order to receive clean fuel. The most affordable way of doing the same is carbon separation by direct method,

for that we used carbon sink or adsorbent Sephrazorb or drum which will adsorb the atmospheric CO2 and directly place it to a plate containing 1M NaOH that will react with CO2 and produce two useful by- product CaCO3 and CO2 which can be utilised in various industrial applications. The objective of our study is to produce bio energy from waste and to remove the CO2 from the process so that we get a eco-friendly environment.

Keywords- Sepheazorb, Aspergillus fumigates, Aspergillus ellipticus, Lignocellulose

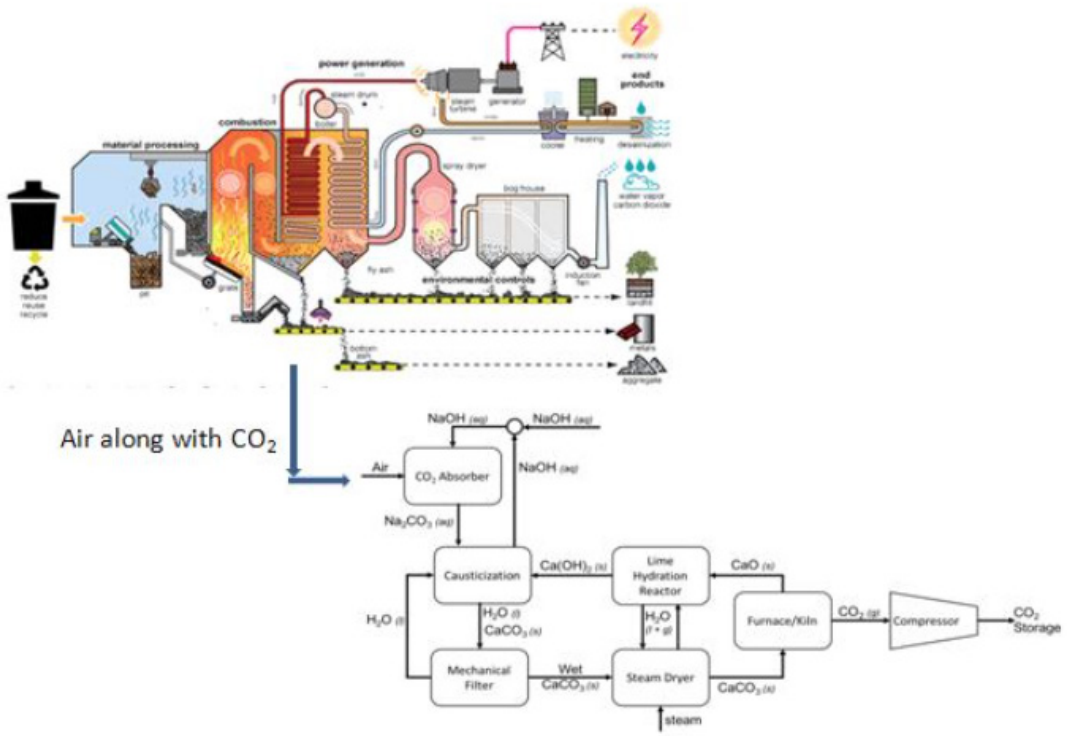

Fig- Bi-functional system for CO_2 Production of bio-energy and CO_2 capture and storage

Development and Optimization of Micro-mixer Contour by Bio-micro-machining on Copper Surface

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In this modern era, sizes of various components are continually shrinking through modern manufacturing processes. These micro/nano components are useful in micro-electronics industry, food industry, medical equipment, aerospace and in several other fields. Through non-traditional manufacturing process such as electric discharge machining (EDM), laser beam machining, chemical machining, etc., are able to fabricate fine components upto micro and nano scale, especially in the field of micro-electro mechanical systems (MEMS). However, these micromachining processes have several detrimental effects such as formation of recast layer, heat affected zone as well as cracks on the workpiece surface. By-products of these processes also effect the environment in long term.

In order to overcome these problems, some innovative and sustainable metal machining process is developed named as bio-micro-machining using Acidithiobacillus ferroxidans. These micro-organism living in natural environments usually

attack metals leaving unacceptable corrosion and causing critical deterioration. This negative phenomenon of these micro-organisms can be used in positive sense by controlling machining parameters. Therefore, an environment friendly, low cost and energy efficient manufacturing process can be a viable alternative to unconventional micro-machining processes. Fig. 1 illustrates the flow chart of bio-micro-machining. In this study, micro-mixers are fabricated on the surface of the copper. Preliminary experiments parameters like pH, temperature, shaking speed and machining time were optimized for fabrication of micro-mixer. Afterwards, design of experiments and response surface methodology are used to reduce number of experiments. Effect of process parameters like inoculum age, inoculum volume and machining time on material removal rate (MRR) are investigated. Furthermore, hardness after machining are also been carried out using Vickers hardness test. Results show that, with optimized parameters, a maximum of 0.571 grams material is removed. Fig. 2 shows the variation of MRR with respect to inoculum age. After machining, negligible change in workpiece surface hardness is observed. Moreover, pH of 2.5, shaking speed of 180 rpm, 35 oC temperate, 32.71 hours of machining, 7 days and 16 hours of inoculum age as well as 7.5 vol/vol inoculum volume are optimal parameters for achieving high amount of copper material removal.

Keywords: Bio-micro-machining; Acidithiobacillus ferroxidans; Inoculum age; Inoculum volume; Material removal rate

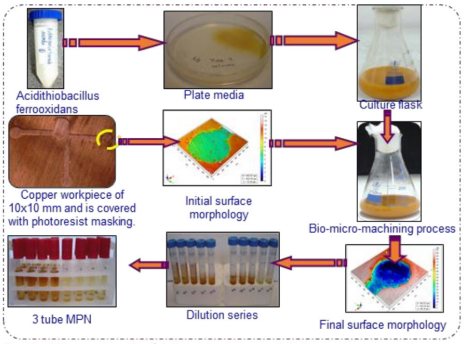

Fig. 1: Flow chart of bio-micro-machining process.

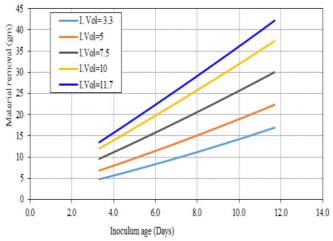

Fig.2: Effect of inoculum age on MRR

Nano-biocomposite scaffolds of chitosan, carboxymethyl cellulose and silver nanoparticle modified cellulose nanowhiskers for bone tissue engineering applications

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We synthesized highly efficient nano-composite polymeric scaffolds with controllable pore size and mechanical strength and also prepared nanocomposite (CCNWs-AgNPs) of silver nanoparticles (AgNPs) decorated on carboxylated CNWs (CCNWs) which serves dual functions of providing mechanical strength and antimicrobial activity. Scaffolds containing chitosan (CS) and carboxymethyl cellulose (CMC) with varying percent of nanocomposite were fabricated using freeze drying method. XRD and FESEM analysis of nanocomposite revealed highly crystalline structure with AgNPs (5.2 nm dia) decorated on ~200 nm long CCNWs surface. FTIR analysis was performed to confirm the interaction between CCNWs and AgNPs. Incorporation of nanocomposite during scaffolds preparation helped in achieving the desirable 80-90% porosity with pore diameter ranging between 150-500 µm and mechanical strength was also significantly improved matching with the mechanical strength of cancellous bone. The swelling capacity of scaffolds decreased after the incorporation of nanocomposite. In turn, scaffold degradation rate was tuned to support angiogenesis and vascularization. Scaffolds apart from exhibiting excellent antimicrobial activity, also supported MG63 cells adhesion and proliferation. Incorporation of CCNWs also resulted in improved biomineralization for bone growth. Overall, these studies confirmed excellent properties of fabricated scaffolds, making them self-sustained and potential antimicrobial scaffolds (without any loaded drug) to overcome bone related infections like osteomyelitis.

City Recreational Parks and Urban Wildlife- A study on Butterfly

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Butterflies not only add rich colour to nature but also react to disturbance and change in habitat and act as an ecological indicator. As many species are strictly seasonal and prefer an only particular set of habitats, they get severely affected by the environmental variations. Thus minor changes in their habitat may lead to either migration or local extinction. Because of their close dependence on the plants; butterfly diversity may reflect overall plant diversity in the given area. Thus, change in land use pattern may lead to landscape changes that can reflect a change in butterfly diversity and distribution.

North East India is a huge treasure of biodiversity and supports a rich variety of butterfly fauna. According to the International Union for Conservation of Nature and Natural Resources (IUCN), North East India is one of the 'swallowtail-rich zones' under the Swallowtail Conservation Action Plan (1984). But due to rapid urbanization and development, change in butterfly composition has been taking place. This study is hence to check the existing urban wildlife in Guwahati City with reference to Butterfly diversity.

A nine days study on butterfly diversity was done in three popular recreational parks namely, Sankardev Udyan, Nehru Park and Sati Radhika Udyan located in the heart of Guwahati City. The parks lie on the south bank of river Brahmaputra and are surrounded by human habitations and commercial hubs. Point Transect and opportunistic survey methods were followed in each park for three days during the morning and evening hours. A total of 337 individuals, belonging to 38 species of 5 families were obtained (Table 1). The dominant family was Nymphalidae having 19 species while least was Hesperidae having 2sp, others include, Pieridae 8sp. Papilionidae 6sp. and Lycaenidae 3sp. (Table 2)

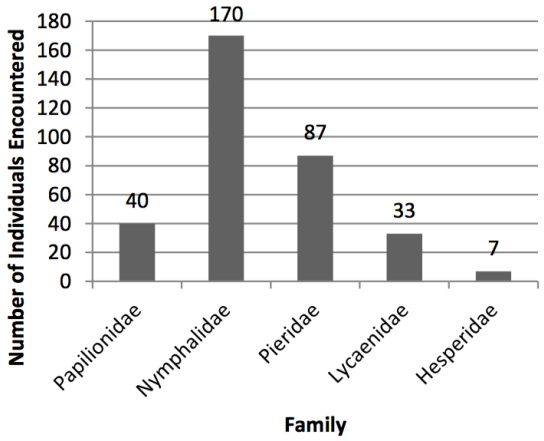

Table 1- Showing number of individuals encountered per family.

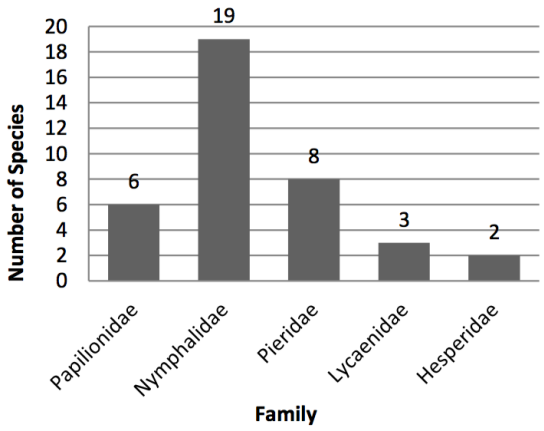

Table 2- Showing number of species encountered per family.

References-

1. Bora, A. and Meitei, L.R., Diversity of butterflies (Order: Lepidoptera) in assam university campus and its vicinity, cachar district, assam, India.
2. Singh, A.P., 2011. *Butterflies of India.* Om Books International.

Anaerobic co-digestion of rice straw and hydrilla verticillata- Modeling and process parameter optimization study

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This study exhibits the necessity for co-digestion to improve physicochemical and biochemical progression compared to mono-digestion. The individual effect of carbon/nitrogen ratio (C/N) ratio, food/microorganisms (F/M) ratio and pH, in addition to their interaction effects on methane yield (mL CH4/g-VSadded) were explored in this study. A central composite design (CCD) – response surface methodology (RSM) was used for defining the experimental design for anaerobic co-digestion of rice straw and hydrilla verticillata. Results of this study showed significant interaction of C/N ratio and F/M ratio, and individual response parameters on methane yields. The optimum condition for anaerobic co-digestion (C/N ratio 29.7, F/M ratio 2.15 and pH 7.34) showed methane yield of 287.6 mL CH4/g-VSadded, 1.81 fold (156.32 mL CH4/g-VSadded) higher than mono-digestion. Model validation proved the high adequacy of the model and methane yield is good output response variable for co-digestion study and it is necessary to optimize the transient variation in C/N ratio, F/M ratio and pH.

Keywords: Rice straw, C/N ratios, co-digestion, hydrilla verticillata, RSM

Capture of CO2 From Flue Gas Using Metal Organic Framework

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The amount of CO_2 in the atmosphere is increasing day by day. One reason of this is the continuous emission of CO_2 from anthropogenic sources. Flue gas from power plant is composed of CO_2-(~15-16%), water vapour-(~5- 7%), N2-(~70-75%) at 1 bar [1]. 63.5% of the green house gases is the CO_2. Therefore it is very necessary to separate CO_2 from the flue gas before it reaches the atmosphere. Several conventional methods are being applied for capturing CO_2 from flue gas. One of them is the monoethanol amine(MEA) based solvent aqueous solution [2]. But this method has drawbacks like requirement of high energy foe regeneration of the adsorbent and environmental issues due to volatility of MEA. Another method which is based on silica, zeolite etc. solid adsorbent. But this method has also some drawbacks like limited surface area, limitation in structural design and surface modification[3]. But these drawbacks can be overcome by using **METAL ORGANIC FRAMEWORK (MOF)** based CO_2 capturing method. MOFs is a crystalline hybrid materials consisting of inorganic metal ions or ion clusters and organic bridging ligands. Here we have used **mmen-Mg_2-(dpbpdc)** MOF based adsorbent for selective adsorption of CO_2 from flue gas [4].

Keywords:CO_2 capture, metal organic framework

References:

[1-2] Hye Ryeon Kim,Tae-Ung Yoon,Seung-Ik Kim,Jihyun An,Youn-Sang Bae and Chang Yeon Lee, RSC *Adv., 2017*, 7, 1266.
[3] Bjørnar Arstad,Helmer Fjellvåg,Kjell Ove Kongshaug,Ole Swang,Richard Blom, *Adsorption*,2008,14, 755–
[4] Dónal Ring,Junior Sophister,Trinity Student Review,2,162

Pest Management For Organic Vegetable Production

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As per the definition of the United States Department of Agriculture (USDA) "Organic farming is a system which avoids or largely excludes the use of synthetic inputs (such as fertilizers, pesticides, hormones, feed additives etc) and to the maximum extent feasible rely upon crop rotations, crop residues, animal manures, off-farm organic waste, mineral grade rock additives and biological system of nutrient mobilization and plant protection". In organic systems, insect pests are managed preventively rather than curatively. The idea is to alter the system so that pests do not find the plants, are controlled by natural enemies, or their damage is kept to a minimum. Pest management is also dependent upon having a healthy organic system. This includes a proper balance of nutrients in the soil and in the plant. Plants that are vigorous have a much better ability to withstand damage caused by insects and diseases. Organic farming system is an alternative and appropriate management system would help to improve soil health environment, thus increase the productive levels and improve quality of vegetable crops. India has tremendous potential to grow crops & vegetables organically and emerge as a major supplier of organic products in the world's organic market.
Key words: Organic vegetable production, Integrated Pest Control, Farmscaping, Natural enemies, Disease resistant varieties, Vegetable grafting

Birds in IIT Guwahati ecosystem

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Indian Institute of Technology Guwahati, one of the premiere institutes in our country is enriched with several lakes, hillocks and small portions of forest. The institute is built on a wetland; therefore it still contains patches of the same making the campus rich in biodiversity. The campus accommodates various kinds of pochards and ducks during winter in its pristine lakes, tiny passerine birds on its hills and several other big and small migratory birds in every possible corner of the institute. The campus also holds the record of sighting scavengers like rare species of vultures, Adjutant Storks etc. Out of all the raptors present, Perergrine Falcon is something which has been recently spotted. There has been atleast 100 species reported so far inside campus and the number continues to increase. The documentation done by the students of IITG has observed a shift in the pattern of migration and decrease in bird count over time. This decrease is certainly due to the ongoing non-sustainable construction activities happening inside campus accompanied by deforestation. Littering of plastic, garbage etc. into the lakes of IITG is one of the major reason for its pollution. Deforestation and pollution affects the habitat of these innocent birds in turn disturbing the ecosystem. From Jacobian Cuckoos to Taiga Flycatcher, from Cotton Pygmy Goose to Siberian Rubythroat, we have it all, but if we continue to disturb the natural habitat, we will end up losing them. The institute with its beautiful scenic view is one of a kind, and has the potential to hold numerous exotic flora and fauna, if maintained well. Therefore, it is mandatory to be kind towards nature and have a development which is sustainable, so as to protect the ecosystem of IIT Guwahati.
Keywords: Birds, IIT Guwahati, Ecosystem, Sustainable development

Aerobic Granulation: Cultivation, Characterization and Use in Oily Wastewater Treatment inside Aerobic Granular Reactors (AGR)

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Oily wastewater is produced in approximately 0.4–1.6 times of the volume of the processed crude oil which can increase water toxicity and can cause human health problems. Aerobic granular sludge is considered to be more efficient in industrial wastewater treatment than the conventional activated sludge systems, due to its compact structure, high metabolic activity, wide diverse microbial species and excellent settling capacity. Aerobic granules were developed in 3 (R1, R2, R3) acetate-fed sequencing batch reactors (SBR) which were operated with 3 different types of seed-sludge collected from sewage treatment plant (R1), petroleum refinery wastewater treatment plant (R2) and brewery wastewater treatment plant (R3). In phase 1, full granulation was achieved in 56 days in all three reactors operated in 3 cycles with 8 hours cycle time. In phase 2 of 35 days study, diesel (10 mg/L to 100 mg/L) was used as carbon source and diesel degradation was observed. All the granule characteristics (settling velocity, SVI, VSS/TSS, granule density, EPS content, PN:PS, hydrophobicity) were observed and estimated during phase 1 and phase 2. Granule microscopic images were taken by using Field Emission Scanning Electron Microscope (FESEM). The average Sludge volume Index (SVI) was 28.84 ml/g and Ratio of volatile suspended solids and total suspended solids (VSS:TSS) was 0.9 in the SBRs in phase 1. The granule protein to polysaccharide ratio (PN:PS) ranged between 2 to 8.7. In phase 2, due to rapture of granules SVI increased and VSS:TSS and PN:PS value decreased. At the end of phase 2, on day 90, it was observed that at hydraulic retention time (HRT) of 16 hours, 50% volume exchange ratio (VER), superficial gas velocity of 2 L/min maximum 99.9% Chemical Oxygen Demand (COD), 94% Ammonia-nitrogen and 68% motor oil and diesel (influent: 1200 mg/L COD, 50 mg/L Ammonia- nitrogen, 100 mg/L motor oil) removals were achieved by the aerobic granular reactors (AGR).

Keywords: Aerobic granulation, Biodegradation, Oily wastewater, SBR.

Nano conjugated aptamer based biosensor for detection of arsenic

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Arsenic poses serious problem in groundwater accounting for lives of up to 100 million people worldwide. Long term consumption leads to arsenicosis, skin lesions and cancers. Arsenic exists in many different chemical forms in nature predominantly as arsenite [As (III) as H3AsO3] and arsenate [As (V) as H3AsO4] in water. Furthermore, As (III) is sixty times more toxic than As (V) or other organic arsenic compounds.

In recent past, various spectroscopic, electrochemical as well as chemical based detection systems has been reported for detection of arsenic but these technologies have common drawbacks of heavy and expensive instrumentation, field applicability and requirement of highly and skilled technical persons, chemical processing of samples etc. There is a clear need for cheap, simple, non-toxic field test kits for routine monitoring of arsenic levels in drinking water. Biosensors can overcome all these drawbacks with the advantages of sensitivity, specificity, simplicity, low manufacturing cost with better limit of detection, fast response time, ease of use, portability, and ability to furnish continuous real-time signals. Whole cells comprising luciferase, green fluorescence protein or lac z activity as well as cell free biosensors (DNA, aptamer, protein) have been reported for monitoring of arsenic levels. These devices exploits competitive and non-competitive inhibitory properties of enzymes (cytochrome c-oxidase, acetylcholinesterase, acid phosphatase) immobilized on electrodes. These sensors also have disadvantages of poor detection limit, nanoparticle susceptibility, non-specificity, and instability and electrode generation. Aptamers are the in vitro selected artificial single-strand RNA or DNA oligo-nucleotides with unique conformations that can distinctly bind to a broad range of targets. Various nanoparticles conjugated to aptamers have been widely exploited by researchers in detection strategies for various toxic environmental pollutants. Up to now, reports involving aptamer- based biosensors for arsenic detection have been rare. Therefore, it is the need of the hour to develop rapid, ultrasensitive and reproducible detection system to record arsenic levels.

Keywords: Arsenic; Aptamer; Biosensor

Assessment of Phytodiversity of Trees Outside Forest in Central and Northern plains of Assam: a case study of Nagaon and Sonitpur district.

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Trees Outside Forest (TOF) refers to all tree crops outside the recorded forest area. According to FAO (2001), trees outside forest refers to trees on land not defined as forest and other wooded land. This includes patches, sacred groves, homegardens, avenue plantation, social forestry, tea gardens etc. TOF contributes substantially in preservation of indigenous biodiversity, sequestration of atmospheric CO2 and immensely contribute to the livelihood of people. The present study attempted to assess the phyto-diversity of TOFs in Nagaon and Sonitpur districts, two of the sample districts of the central and northern plains of Assam. Field sampling was done following standard ecological protocol and taking sample plot of varying dimensions (0.1 ha for block pattern, 0.3 ha for scattered and 10 m ×125 m for linear pattern). Different households were considered for assessing the dependency of the local people on TOFs. A total of 16 plots from various land uses were studied. The important trees in terms of Importance Value Index in patch vegetation are *Areca catechu, Albizia lucidior* and *Tectona grandis*. The important trees in terms of IVI in plantation are *Tectona grandis, Lagerstroemia speciosa and Neolomarckia cadamba*. The important trees in terms of IVI in avenue plantations are *Eucalyptus globulus, Albizia saman and Bombax ceiba*. The common trees found in temple plantation are *Ficus ramphii, Cocos nucifera and Pterocarpus santalinus*. The common trees found in village vegetation (scattered type) are *Mangifera indica, B. ceiba and Ficus religiosa*. The high diversity of the two districts may be due to the prevailing favorable microclimatic conditions of Assam which provide suitable growing conditions for different plant species. The information pertaining to TOF in Assam is mostly on macro level. A micro level in-depth and detailed assessment of TOF is essential for bridging the knowledge gap regarding TOF resources and formulating sound and holistic strategies to combat biodiversity and climate change related issues.

Key words: trees outside forest, biodiversity, dominant species, climate change

Abstracts (Poster)

Humanities and Social Sciences

Doubling Farmer's Income: A Myth or Reality

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India, where the population is mushrooming at a rate of 1.11 percent with about 1.3 billion people, it is very important to enhance the production and productivity of foodgrains to keep pace with the incrementing population. About half of the workforce of India are engaged in primery activities (agricultural activities), but most of them are practising the subsistence nature of farming due to their poor socio-economic conditions; we can realize it, if we take a look at the statement made by Ministry of Agriculture and Farmer's Welfare, that the average income per agricultural household from various sources is estimated at Rs.6,426 per month during the reference period of the agricultural year July 2012 to July 2013. But the average income of the Punjabi farmers in that period was about Rs.18,059 and the farmers of Bihar were recorded as the lowest earners with about Rs.3558 per month. From these informations, it is very clear that there is vast income inequality among the famers of different states, so considering all these constraints, the govt. of India is emphasizing more on increasing farmers income and already set a goal to double the farmers income by 2022 considering 2015-16 as the base year and named it as " Mission 22". But to have an opinion about the future, it is crucial to get acquainted with the present scenario, such that one can realize the utility of the various strategies. To gear this mission up, the govt. has undertaken various strategies like use of quality seeds, soil health card distribution, micro-irrigation, creation of e-NAM, new crop insurance scheme like "Pradhan Mantri Fasal Bima Yojana"(PMFBY) etc. In a state like Assam also, where the economy is largely based on agriculture with about 69 percent of the population engaged in it, the state govt. is taking various measures to raise the income as well as the welfare of the people. According to a report given by Ministry of Agriculture & Farmers Welfare, as on 15th August, 2016 about 212.96 lacs samples of soil were collected from Assam, out of which 127.95 lacs samples were tested and about 344.70 soil health cards (SHC) were distributed to the farmers during the cycle 2015-16 to 2016-17. It is expected that farmer's income would be enhanced with proper use of plant nutrients. During 2016-17 (rabi), PMFBY has covered about 4140 ha. of land, 8104 nos. of farmers in Assam and the amount of premium was Rs.1,68,21,262. During 2017-18, an amount of Rs.382.50 lacs has been allotted for the scheme. The target of doubling farmers income by 2022 is a dream project of the central government, however, for achieving that proper implementation of all the schemes on the part of the concerned authority, whole hearted participation and motivation on the part of the farmers are key to it's success. Otherwise we are not very sure whether the slogan of doubling farmers' income is a myth or reality.

Keywords: Doubling farmer's income, PMFBY, SHC, myth, reality, Assam.

Importance and Use of Plastic money: A Novel Method of Trading

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With the advent of globalization, liberalization and privatization, Indian economy has shown a blooming trend. As trading increased (both national and international), the medium of exchange, i.e. money has been changing into various forms. The prevalent mode of settlement across India in the 20th century has been coins, cash and cheques but with advent of economy this mode encountered transfiguration into electronic one. This leads to the development of plastic money which refers to various plastic cards with magnetic strips viz. credit cards, debits cards, ATM cards, Agricultural cards, Prepaid cards and Rupay cards. Plastic money yields many more benefits like it has far-reaching impact on the economy as a whole through low transaction costs, increased operational competence, improved financial framework and an opportunity for the expeditiously evolving Indian economy to further globalization. The Indian government aims to reduce the dependency of the economy on cash making it more deviated towards cashless mediums of transactions with the benefits of reduction in cost the printing notes, prevent shady transactions, reduce taxes, counter fake currencies etc. According to RBI In May 2017, Total of 30.86 Million credit card and 880 Million debit cards were in operation in the country. A study was conducted among 50 respondents in Assam Agricultural University, Jorhat with the objectives of exploring the awareness and use of plastic money, reasons of preferences of plastic money and problems face by the customers while dealing in plastic money. It was observed from the study that majority of the respondents (56%) had idea about plastic money as debit card. High income group categories (>Rs. 50,000 / moth) prefer credit cards for transactions. 74% respondents reported plastic money to be a safe medium and fear of theft was the major reason (36% respondents) for preference of plastic money over paper money. Non print of the transaction statements was one of the main problems faced by the respondents (52%). Negative correlation was observed between the use of plastic money and age and marital status of the respondents (Correlation coefficient of -0.081 and -0.145 respectively). Use of plastic money is changing the behaviour of trade globally. Financial institutions should take necessary steps to make awareness among the people and make the procedure of use of plastic money hassle free.

Key words: Plastic money, debit card, credit card, survey, correlation.

Bhut Jolokia: Options for enhanced farmer's income

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Known for the unique hotness Bhut Jolokia, globally introduced after it won the "Guinness book of world record" as the world's hottest chilli in 2006 (measuring 1,001,304 SHU). Currently it occupies the fifth position amongst the hottest chilli in the world. This chilli, native to the northeastern region of India known by vernacular names such as Bhut Jolokia, Bihjolokia or King chilli in Assam, Naga jolokia, Naga Morish, Raja Mirchi in Nagaland and U-Morok or Gomorok in Manipur. It is grown mainly in the state of Nagaland, Assam and Manipur and to some extent in Mizoram, Arunachal Pradesh and Meghalaya. King chilli normally yields about 1500kg/2 bigha. Characterized by more capsaicin content (3-5%) as compared to any other Indian chilli creates more demand for the chilli both in the domestic as well as international market as capsicin has many uses in the medicine. Realizing its high value, the Assam government during 2009-2010 took mission of cultivating Bhut Jolokia in 500ha of land, providing incentives of Rs 13,000/ha to each cultivator. Based on season, Bhut Jolokia fetches around Rs300-500/kg in the local market. Local initiative has been taken to export this chilli to European and US market. Ms. Leena Saikia, the owner of Frontal Agritech Private Lmt. supply over 25 tonnes of dried Bhut Jolokia around the world, her biggest market being the US. In the international market, dried Bhut Jolokia fetch as about Rs. 2100/- per kg and 1 kg of quality seed fetch Rs.30,000/- per kg, providing high demand. One requires 7.5 kg raw chillies to make 1 kg of dry chilli. As farmers can expect quick return from Bhut Jolokia, it can be adopted as a profitable business by the state farmers. Viewing its scope in the domestic as well as international market, farmers can think of getting self employed through Bhut Jolokia cultivation.

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Key words: Bhut jolokia, high value crop, profit, farmers' income, Assam

Study of socio-economic and psychological characteristics and its relationship with extent of participation of rural youth towards farming practices in Jorhat district of Assam

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The study entitled "Study of socio-economic and psychological characteristics and its relationship with extent of participation of rural youth towards farming practices in Jorhat district of Assam" following ex-post facto research design. A total of 120 respondents were selected using multi stage purposive cum random sampling technique. The data was collected by means of personal interview schedule. The findings revealed that age,size of the operational land holding , annual income of the family, training exposureand mass media exposure of the respondents is positively significant and highly correlated with extent of participation in farming activities. However,occupation of parents had significant association with extent of participation in farming activities. The regression coefficient of age, sources of farm machineries and farm implements and attitude towards farming were found to be significant.

Home Gardens: An alternative to household food security

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Home gardens play an important role in household food security of India and have thus become an integral part of rural households. Home gardening is the use of an area around the residence where various herbs, fruits, and vegetables can be grown year round for household consumption together with some livestock. Homestead garden is a cost effective technology for the optimal nutrient intake to achieve the nutritional security among resource poor people. It provides household basic needs such as food, fuel, timber and others including employment of female and aged household members. Even though most of the households have homestead area, but utilized only for growing small amount of vegetables for their own consumption, not for higher production and income generation. A survey conducted to explore the contribution of homestead products to household income showed that a nominal contribution (6 % on an average) was made by homestead products to the household income (Deka, 2013). Moreover, the productivity of the homestead garden is again low due to insufficient scientific knowledge of crop production and unavailability of good quality seeds and saplings when needed. These improperly managed homesteads would be effective to bring under year round production for improving the family nutrition and income generation of smallholders. Scientific production and utilization of the homestead can reduce purchase of expensive vegetables from outside source, earn small cash income by selling vegetables and fruits and ensure more intakes. A systematic management of homestead gardens with incorporation of different types of minor fruits and vegetables would ensure food security at the household level. Further, value addition to the surplus fruits and vegetables would open up scope for extra income to the housewives that would indirectly assure food security. Exposure visit of the women involved in homestead management is expected to enhance their knowledge and skills.

Key words: Homestead, food security, value addition, women, employment

Organic farming: A boon or a bane?

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Organic agriculture is the production system which mainly excludes the use of synthetically compounded fertilizers, pesticides, growth regulators, and livestock feed additives. It is environmentally friendly and conserves the ecological basis of farming and does not pollute the atmosphere, soil and water bodies and ensures resource conservation. Successful investment in organic agriculture creates jobs and business opportunities at the local level and increases the economic possibilities available in a locality. Globally, there is 50.9 million hectare of organic agricultural land including 'inconversion areas'. India is bestowed with lot of potential to produce all varieties of organic products due to its diverse agro-climatic regions and the inherited tradition of organic farming for long years. India's total area under organic certification is 5.71 million hectare in which it produced around 1.35MT of certified organic products which includes all varieties of foods namely sugarcane ,oil seeds, cereals and millets ,cotton ,pulses,medicinal plants,tea,fruits,spices,vegetables,coffee and also non-edible products like cotton fibre. India's North-East region gains a special mention because it has immense scope for converting its farming system to fully organic .As compared to the other regions, farmers in this region swear by their traditional ways of farming with no or minimum use of chemicals in their farmlands which keep their soil virgin and rich in organic content .Sikkim is already declared as the India's first fully organic state with over 60 ha land under organic certification. Trailing behind it are the states of Mizoram and Megahlaya to turn into fully organic.With huge amount of virgin soil, Assam too flames with great opportunities for organic farming. With increasing numbers of progressive farmers in the state, Assam has over 2000ha land under organic cultivation at present .Assam is recently covered under the centrally powered scheme ,Mission Organic Value Chain Development for North-eastern region (MOVCD-NER) which is selecting 9 districts(Golaghat,Nalbari,Kokrajhar,Kamrup Metro, Sonitpur, Majuli,Dhemaji, Cachar and Chirang) of the state for promotion of organic farming. This scheme plans to cover 5000 ha of land with 5000 farmers. Lack of training on organic practices ,Inconvenience of organic techniques ,Non-availability of organic inputs ,Lacking of price advantage, High cost of organic inputs ,Higher certification cost and complex procedural formalities for certification,Lack of financial, technological and infrastructural support , Small holding size , Remoteness of the region , Lack of Awareness ,Absence of an appropriate agriculture policy are the prime bottlenecks that are holding back the region from flourishing .If with proper and persistent effort, these prevailing bottlenecks can be battled out ,the sheer benefits of organic farming will be rightly enjoyed by the entire living entity and will surely drop as a boon to the present generation and to the generation next.

Key words: Organic farming, marketing, advantage, constraints, Assam

Hydroponics and the future of farming

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With the India's population nearing 1.3 billion – and global prosperity and the desire for more resource-intensive foods rising steeply too – it's clear that farming needs to become more productive. One way of meeting future food needs could be hydroponics – growing plants without soil, instead using a nutrient-rich solution to deliver water and minerals to their roots. It's already being used to increase farming outputs and grow plants in habitat that wouldn't normally sustain them. Despite sounding like something out of science fiction, it's nothing new. The Aztecs built floating farms around the island city of Tenochtitlan, and the explorer Marco Polo wrote about seeing floating gardens during his travels through 13thcentury China. Even we Indians have been growing vegetables in floating gardens in Dal lake since time immemorial. By the 1930s, Pan American Airways had established a hydroponic farm on a remote Pacific island to allow its flights to top up with food on way to Asia. Today farmers are slowly increasing their use of hydroponics, and researchers are looking more closely at how it could solve future food problems. In the future, some of its applications could be out of this world.

Cosmopolitanism in the Making in Early India: Searching from the Numismatic and Ceramic Corpuses

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Well ahead of the Macedonian anabasis into the subcontinent, two crucial developments were on their way to lay the keystone for cosmopolitanism that culminated more than half a millennium later. The synchronic formation of stamped and commodity money, trade relations, protestant philosophies and knowledge system and a resultant shift in demography centring in the fertile middle Ganga plain around the 6th century BC(E) anticipate the cosmopolitan culmination in premodern South Asia that may be taken to become most conspicuous in connection with the trans-Eurasian maritime and Silk Route trade. In absence of writing system in the pre-Mauryan phase, the symbols in the earliest uninscribed punch-marked coins happen to represent the zeitgeist of the epoch it conditions. Coexistence of various symbols denotes not only disparate belief systems but astronomical observations too. While the sun may stand for food-producing society or, as is discerned by Prof. Kosambi, the metal itself; the emblem sadacakra (six-spoked wheel) may as well be associated with time aside from its usual association with cakravartīn. Because, according to Rg Veda, the twelve-spoked wheel represents the annual course of the sun – an enumeration found furthered by Varāha Mihira in his Sūrya Siddhānta. Heliacal observations are found in Chinese and Egyptian agricultural traditions too. Collating symbolical readings of Prof. Kosambi with the symbolical and calendrical observations of Sir Alexander Cunningham vis-a-vis PMC furnishes critical details hitherto unexamined of the time and geography. These details when studied in combination with another hallmark object of this period, viz. Northern Black Polished Ware open up new dimensions to understand the transitions on different planes in the middle Ganga valley between the 6th to the late 2nd centuries BC(E). This paper conducts a social-semiotic study of the early Punch Marked Coins in combination with the hallmark pottery of the period and space, namely NBPW to delve into three key aspects – transition from lineage based society to the supreme statehood of Magadha, South Asian pattern of urbanism and the grounds of premodern cosmopolitanism.

Street Vendoring : Aviable option for selfemployment

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Street vending is an important activity related to informal sector in urban areas.Majority of street vendors are illiterate or educated at primary level. They have low skill and poor economic condition. Street vending provides job opportunity and means of livelihood to the urban poor. The National Classification of Occupation 1968 defines street vendors as hawker, peddler, streetvendor, pheriwala sell articles of daily utility and general merchandise such as vegetables, sweets, cloth, utensils and toys, on footpaths or by going from door to door. The vendors, normally purchases goods from wholesale market according to his needs and capital(money) available. They load them in basket or on push cart, wheel barrow or tricycle and moves in selected areas to effect sales. Many atimes they announce loudly goods or articles on sale and their prices to attract customers. Some of them may also display goods or articles of sale on footpath and effect sales. For higher profit few purchase goods in lot, in auction or other sales. May prepare and sell his/her own products and may operate means of conveyance. In Assam, street vending is very prominent in the capital city, Guwahati and other district's headquarters as well. This paper attempts to survey few street vendors of Assam to explore the types of commodities sold, employment opportunity though street vending and problems faced by the vendors. It was observed that the street vendors dealwith differenttypes ofcommodities ranging from fruits, vegetables, garments, chappals etc. The vendors opined that the business is again ful employment for their family members and the yearn a substantial income to support their families. However, the vendors face certain problems such as weather extremes, too much bargaining by the customers, lack of sanitation facility etc. Customers revealed that due to less time consumption, location of the stalls, they prefer to buy products from the street vendors. It was suggested that provision of proper vending space, issue of identity cards to vendors and improving the infrastructure could facilitate street vending in Assam which may be beneficial both for the buyers and sellers.

Keywords: Street vending, commodities, employment, income, infrastructure, Assam

Indigenous Technical Knowledge (ITK) used by Tai Khamyang community of Assam in farm management

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ITK is a local knowledge that is unique to a given culture or society which are evolved after thousands of years of observation and experience. The study has attempted to discussed about the different ITK used in farming in Assam with special with reference to Tai Khamyang community of Assam. Different ITKs like clipping off the tip of rice seedlings before transplanting, using chopped pieces of colocasia and chopped peels of Citrus grandis, growing of giant Milkweed on bunds of paddy fields, rope dipped in kerosene oil etc are used in Assam to prevent or control the insect pests attack in the crop field. The present study was done based on both primary and secondary published sources. Primary data were collected from Titabar block of Jorhat district. 30 respondents from Tai Khamyang community were selected by using stratified random sampling and personally interviewed by a questionnaire. Different ITKs are identified which are used to prevent insect infestation, field practices as well as in food processing. Using of Lata Mahudi (Croton caudatus) branches, dried tree branches, Bihlongoni leaves, fresh elephant apple leaves, fixing of dead crabs, frogs or pieces of jackfruit, use of pulp of pumelo, Banana leafs etc are some example of ITK to prevent insect attack whereas Tupula rice, Tong Tap cake are examples of food processing of Tai Khamyang community in Assam.

Key words: ITK, documentation, farming, Tai Khamyang, Assam

ICT based intervention system of agricultural advisory service as a business model: A scoping study of rice growing farmers in the state of Odisha, India

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In Odisha, agricultural sector holds domineering influence on the life and livelihood of 61 per cent of the populace and thus holds the key to socio-economic development of the state. Rice being the principal crop of the state, its low productivity due to various counts, which even lies below national average, has been troubling the sector intensely for a while. One of the major reasons always widely cited for low yield and income isthe imbalanced nutrient management in terms of quantity, split as well as time. One of the significant ways to address this problem is through the provision of customized agricultural advisory services on nutrient management. Government of Odisha under this objective has been trying to popularize Rice Crop Manager (RCM), a web based software developed by IRRI. With Information and Communication Technology (ICT) emerging asthe buzzwordin agribusiness sector, this tool also opens up potential avenues to improve scalability and accessibility of agricultural advisory services through private extension agents. The present study was a pilot exploratory attempt made to appreciate the possibilities of having input dealers, a significant category of private extension agents, as a major dissemination channel for RCM intervention along with studying farmers' willingness to pay for private extension services. Input dealers are rated as the most significant information source for farmers in India. Puri district was specifically chosen for the study with the district in addition to being agriculturally rich, also serving as the hub of IRRI and RCM activities. A total of 50 farmers,25 monitored and 25 nonmonitored, were randomly chosen from the farmer population provided with RCM recommendations duringRabi 2016-17 (Monitoredreferred to those farmers who were followed up throughout the season, either by the IRRI staff/VAWs/ NGOs,to ensure that they follow the RCM recommendations provided). The main factors explored were differences in cost of cultivation and yield between RCM practices and farmers' own practices, farmer's satisfaction with the RCM recommendations, their willingness to receive RCM recommendations in coming seasons, to pay for the service from fertilizer input dealers(private source, a proposed channel) and heterogeneity in terms of willingness to pay (WTP). A total of 34 dealers were also randomly chosen and surveyed to identify the heterogeneity in their socio-economic characteristics and business operations and more importantly to appreciate their responses towards the proposal of espousing RCM intervention as a potential business model. With the study revealing highly skewed fertilizer consumption pattern with farmers own way of average DAP and MOP usage lying above and urea usage lying below average RCM recommendations, the prospective role of balanced fertilizer application in bringing in considerable change need not be over-emphasized. Reported average yield gain of 2 Q/acre in RCM plots in comparison to plots with farmers own practice (with RCM plots and farmers' practice plots similar in all aspects of management except nutrient application) in these small holder plots with capability to bring in additional returns of more than Rs. 2000/acre also roots for potential agricultural progress through balanced nutrient management.With 96 per cent of the sample hence perceiving production and productivity gains and 92 per cent meditating potential cultivation cost reduction, all with the adoption of RCM technology, this particular stand of farmers is accentuated. This study should be seen as a pilot attempt made to see the possibility of setting up proposed ICT interventionbusiness model. The readiness shown by farmers' as well as dealers' towards this potential business proposal has definitely given hope about opening up new avenues for better and wider dissemination of RCM technology. The efforts required to train input dealers/their staffs regarding operation of the RCM app would also be minimal, given that they are already acquainted with ICT devices and knowledge about agricultural practices.Although the results are positive, the proposal does warrant a further detailed and elaboratebusiness diagnostic study in the near future to represent the entire state and test the model on pilot bases.

MASS MEDIA EXPOSURE OF RURAL YOUTH INVOLVED IN FARMING IN JORHAT DISTRICT OF ASSAM

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Communication can help in motivating youth to take agriculture as a vocation by giving them right and customized information timely and location specific. The present study on mass media exposure of rural youth involved in farming of Jorhat district of Assam was conducted following Ex-Post-Facto research design. A sample of 200 respondents were selected by using multistage purposive cum random sampling technique. The data were collected by means of personal interview schedule during 25th Feb, 2016 - 3rd April, 2016. It was found that only 24.50 per cent of the respondents regularly view farm T.V. programme followed by listening farm radio (7.50%). And only few no. of respondent regularly read or hear newspaper and read farm literature with a percentage of 3 and 1 respectively. The findings also revealed that majority of the respondents (67.00%) had low level of mass media exposure and 30.50 per cent had medium level of mass media exposure and a sizeable portion of the respondents (2.50%) had high mass media exposure. It may be because of the fact that they do not give any importance or show interest in reading, listening and viewing news related to agriculture. The present study recommended that mass media should be encouraged and utilized by rural youth in the rural areas to facilitate customized information delivery in a right time.

Keywords : Mass Media, Rural Youth, Farming

TOURISM INDUSTRY: AN INDICATION FROM MANIPUR

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Tourism is an activity essential to the life of nations because of its direct effects on social, cultural, educational, and economic sectors of national societies on their international relations (World Tourism Organisation). As one of the world's largest economic sectors, Travel & Tourism creates jobs, drives exports, and generates prosperity across the world. India has the tourism product in abundance because of its vast cultural diversity and beautiful heritage. To aid to this point stated, India ranks 7th status in the Asia pacific region for tourism according to World Economic Forum's Travel and Tourism Competitiveness Report,2016; and according to United Nations World Tourism Organization (UNWTO), India ranked 40th in the International Tourist arrivals, 2016. Manipur, also named as Jewel of India by our late Prime Minister of India, Jawaharlal Nehru, has gain lots of attractions from the tourists in terms of being richly endowed with unique culture, nature, heritage, and traditional hospitality. The major thrust areas for Manipur includes the Loktak Lake, the largest freshwater lake in the North East Region of India; where the Keibul Lamjao National Park, the only floating National Park of the world is also located; the Shirui Lily Flower known for its unique feature to be found only in the Ukhrul District of Manipur; the Sangai, the brow-antlered deer, an endangered animal known for its unique habitation only in Manipur and the Ima-Keithel, the only market being run by women. The Tourism Industry of the state has given lots of opportunities to the youths and the individuals in terms of travel agencies relating jobs and development facilities for the state. Information regarding the foreign tourists' arrivals (FTAs) in India for 2015-16 was 8 million as compared to the year, 2014-15 which was 7.6 million and 7 million during 2013-14. A considerable growth and potentialities could be observed. Manipur also have gradually developed a good picture with FTAs of 3102 during 2015-16 as compared to FTAs during 2014-15 which was 2900 even though the state lies in the corner of the country. The state has also gained immense attraction from other states of the country after the state got the awards for "Today's Traveller Award for Best State for preserving Tribal Culture", 2015 and the "Best State for Promoting Niche Tourism – Polo Tourism", 2016. During April, 2014, Manipur Tourism hosted first ever Eco-tourism Conclave in the entire North Eastern which give the emphasis of the importance of natural eco-tourism in attracting more tourists to the state. Government of Manipur is fully keen to explore the tourism sector for marketing it in the hope of economic growth of the state as a whole. But the exploration work is hampered by state's socio-economic and political problems. However, if properly conceived and executed development will prove not only financially viable but also prove to be of immense benefit to the state.

Key word: Tourism industry, benefits, potentiality, constraints and eco-tourists spots.

"There were rows and rows of bodies: the pale, the dark, and the in-between": Disposable Bodies and Wasted Lives in Hanif Kureishi's "The Body"

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In "Ageing, Experience, Biopolitics" (2012) Neilson Brett states that in the current culture of replacement and regenerative medicine, the normative, temporal homogenous model of the human body involving birth, growth, ageing, and death is problematized. Biotechnological intervention enabled by the developments in the domains of molecular biology have epistemologically and ontologically redefined our experientiality of ageing that we notionally conceive as a biological and universal phenomenon. Biogerontologists classify ageing as a disease that can be cured and slowed down by re-ngineereing the fundamental biomechanism of the human body. In Liminal Lives (2004) Susan Merrill Squire discusses how in the era of biomedicine ageing as a phenomenon is negotiable in biological term. Since the beginning of the twentieth century, biomedical practitioners have attempted to cure ageing by replacing failing organs and tissues whether through organs and tissue transplantation or through mechanical or biotic organs. Technocratic biomedicine attempts to circumvent the process of organic degeneration of the human body by intervening and reconfiguring human bodies' biomechanism. Hanif Kureishi's novella "The Body" (2002) fictionally engages with the bioethical issues elated to ageing, biocitizenship, and organ transplantation by extending the discussion from a human to a posthuman society where wealthy ageing citizens are able to replenish their degenerating organic body by incorporating biomatter from non-citizens. In the novella, human bodies that are used for transplantation surgery are conceived to be equivalent to clothes that are purchased on the basis of the race, gender, size, and age preferences enlisted by the purchasers of the body. Body shopping is made available for a few wealthy ageing people who can afford to buy new and attractive young bodies thereby disposing of the old and the withered one. This paper proposes to examine Kureishi's novella "The Body" in order to throw light on how the literary piece is complexly reflective of the biomedical practices that classify human bodies as disposable biocommodities to be consumed as therapeutic products by the ageing population. The paper analyzes the concepts of biocitizenship and wasted lives by examining the crisis of identity and agency among people inhabiting the margins of the society who are exploited for organ transplantation and bioscientific experimentation. The paper draws on Nikolas Rose and Carlos Novas' concept of biocitizenship and Zygmunt Bauman's notion of wasted lives for discussing the socio-cultural and political status of the non-citizens who are classified as biomedical fodders that are consumed by the capitalist clientele for slowing down the organic devolution of their ageing body.

Keywords: organ transplantation, ageing, biocitizenship, wasted lives

Abstracts (Poster)

Mathematics

ε-uniform numerical method for a singular perturbation problem

Gautam Singh Srinivasan Natesan

January 25, 2018

Here, we study the numerical solution of singularly perturbed two- point boundary-value problem. The solution of these problems exhibit exponential boundary layers. To obtain the numerical solution of these problems, we apply numerical scheme. Numerical results are presented to support the theoretical results.

Key words: Singularly perturbed system of reaction-diffusion boundary value problems, Shishkin mesh, discontinuous

Galerkin finite element method, uniform convergence.
Subject Classification: 65L11, 65L20, 65L60, 65L70

Abstracts (Poster)

Mechanical

Molecular Dynamics Simulation of Nano- Indentation Process

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Molecular-dynamics (MD) simulation is a well-developed numerical technique that involves the use of a suitable algorithm to solve the classical equations of motion for atoms interacting with a known interatomic potential. MD is useful in comparing continuum models with quantum mechanics accurate results. MD has been used in the past for investigating atomic force microscope based nanometric cutting proceeses. Atomic forces and effects of surface roughness can easily be calculated from MD simulations. These simulations have helped study and obtain optimised process parameters for nano-lithography process. It is among the vital steps before performing any nanometer scale manufacturing. Dislocation dynamics and grain boundary processes can be predicted to reasonable accuracy using MD simulations. Various softwares have been used in the past for performing MD simulations. LAMMPS is a classical molecular dynamics code, and an acronym for Large-scale Atomic/Molecular Massively Parallel Simulator. LAMMPS is distributed by Sandia National Laboratories, a US Department of Energy laboratory. In this project we intend to use MD technique to perform simulations of nanoindentation process.

Three-Dimensional elasticity solution for a right cylindrical shell panel on any arbitrary boundary condition using the Extended Kantorovich Method

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An ingenious semi-analytical approach has been developed to obtain the closed form three- dimensional (3D) solution for elastic right cylindrical shell supported on any arbitrary boundary condition. This approach inculcates a mixed type Reissner's principle to obtain the corresponding governing equations from shell equilibrium and constitutive relations which are further solved using the recently developed multi-term Extended Kantorovich method (EKM) [1]. Two set of ordinary differential equations (ODE) are obtained from the governing partial differential equations (PDE) by applying the multi-term EKM. This solution technique not only simplifies the problem to solving first order ODEs, but also has provided very accurate results with single term in the series expansion and results were obtained after just 2 iterations. The stress and deformation field variables have been computed through this technique and close agreement is obtained compared to 3D finite element (FE) results obtained through ABAQUS [2].

References

[1] Kapuria, S., Poonam, K., 2011, Extended Kantorovich method for three-dimensional elasticity solution of laminated composite structures in cylindrical bending. J. Appl. Mech. 78(6), 061004-1.
[2] ABAQUS Inc., 2009, ABAQUS/STANDARD, Version 6.9-1, User's Manual.

Multi point calibration methodology for hypersonic flows

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A bluff bi-cone shaped aluminum model integrated with an accelerometer force balance system is tested in IITB-Shock Tunnel at various angles of inclinations with an intention to measure drag, lift and pitching moment. Soft computing based recovery technique viz. Adaptive Neuro Fuzzy Inference System (ANFIS) is adopted for force prediction from the acquired responses during the test duration. However as the technique uses calibration data for the training of the system, so the effect of the calibration data on the accuracy of force prediction can be significant. Current analysis incorporates existing single point calibration technique; conversely also a new calibration methodology is proposed which make usage

of optimization technique for force recovery. Both the calibration technique has been incorporated in the ANFIS algorithm to check the accuracy of the force prediction. Encouraging match has been observed between theory and ANFIS with the proposed calibration methodology at lower as well as higher angle of attack (AOA).

Adhesive Wear Behaviour Of Continuously Cooled Carbide-Free Bainitic Steel

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Ultra high strength bainitic steels have a number of desirable mechanical properties and have been viewed as candidate material for heavy wear applications. In the current work, an effort has been made to determine adhesive wear behaviour of ultra high strength bainitic steel. The wear tests were carried out on a pin-on-disc tribometer to study the behaviour of ultra high strength bainitic steel pins against EN 31 disc. The sliding speed was 1 m/s for all the tests and normal loads of 10 N & 20 N were used. The wear resistance was related to mass loss measured after the tests. Worn surfaces were characterized by using scanning electron microscopy and atomic force microscopy. Surface roughness was also obtained to familiarize the surface profile of samples after test. Microhardness profiles were also obtained in order to analyze the strain hardening effects beneath the contact surfaces. X-ray diffraction (XRD) technique was used to quantify if there is transformation of any phases under high mechanical loading during wear and to analyse level of strain and dislocation density generated for sets of parameters.

Keywords: Adhesive wear, Ultra high strength, Bainite, Strain hardening.

Camless Engine

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With increasing usage of automobile with 4.7 metric ton of emission gasses released every year into the atmosphere, there is a dire need for improvement in fuel efficiency and to reduce emissions of the internal combustion engine. A key step for this improvement is to optimize the air and fuel management system but the traditional systems use camshaft based mechanisms to actuate the intake/exhaust valves and have very little or no flexibility.

However there is an opportunity to improve the fuel management system by adopting the "Camless valve actuation systems". A camless valve actuation system has poppet valves operated by means of electromagnetic, hydraulic, or pneumatic actuators instead of cams. Actuators can be used to both open and close valves, or to open valves closed by springs or other means. Because there is no camshaft, there are fewer moving parts. The cam shaft rollers and push rods have been replaced by an electro-hydraulic actuator system which uses the existing fuel pumps

As a camshaft normally has only one lobe per valve, the valve duration and lift is fixed but even with modern engines using camshaft phasing, adjusting the lift and valve duration or using more than one cam lobe, the efficiency of fuel management didn't improved notably. This is not the case with the camless engine, where lift and valve timing can be adjusted freely from valve to valve and from cycle to cycle. It also allows multiple lift events per cycle and, indeed, no events per cycle—switching off the cylinder entirely.

Camless valve trains have long been investigated by several companies, including Renault, BMW, Fiat, General Motors, Ricardo, Lotus Engineering, Ford and Koenigsegg's sister company FreeValve.

The engine's Swedish designer FreeValve claims that the 1.6-litre turbocharged engine will produce 230 bhp and 320Nm of torque. They also claim that, compared to a similar traditional engine, it offers a 50% reduction in size (including a 50 mm

lower height), 30% reduction in weight, 30% improvement in power and torque, 30% improvement in fuel economy, and a 50% reduction in emissions.

Study of Effect of Grain Misorientation using Crystal Plasticity Finite Element Method.

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A theory of the mechanical properties of crystals must include first, the crystallographic and anisotropic nature of those mechanisms that create shear and second, the orientation(s) of the crystal(s) studied relative to the applied boundary conditions (e.g. loading axis, rolling plane).Early approaches to describe anisotropic plasticity under simple boundary conditions have considered these aspects, such as for instance the Sachs, Taylor, Bishop-Hill, or Kröner formulations. However, these approaches were neither designed for considering explicitly the complex mechanical interactions among the crystals in a polycrystal nor for responding to complex internal or external boundary conditions. Instead, they are built on certain assumptions of strain or stress homogeneity to cope with the intricate interactions within a polycrystals. For that reason variational methods in the form of finite element approximations have gained enormous momentum in the field of crystal plasticity. These methods, which are referred to as crystal plasticity finite element (CPFE) models, are based on the variational solution of the equilibrium of the forces and the compatibility of the displacements using a weak form of the principle of virtual work in a given finite volume element. CPFE method has evolved as an attempt to employ some of the extensive knowledge gained from experimental and theoretical studies of single crystal deformation and dislocations to inform the further development of continuum field theories of deformation. In this project, the effect of grain misorientation of metallic material under mechanical loading will be studied using crystal plasticity simulation.

Molecular Dynamics of Simulations of Second Phase particles

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Molecular-dynamics (MD) simulation is a well-structured, sophisticated numerical technique that helps in solving classical equations of motion for inter-atomic interactions and potential differences. It uses appropriate algorithms, best suited for this purpose. MD simulation is the best suited way to study the temperature and pressure dependencies of atoms in different states. The molecules or atoms are allowed for a while interact for a fixed period. The trajectories of atoms can be solved by numerically solving Newton's equations of motion. NAMD, LAAMPS, Tinker, CHARMM etc. are important software for MD computational work. The simulation procedure consists of seven steps as Initial coordinate system, Minimize Structure, Assign initial velocities, Heating Dynamics, Equilibration Dynamics, Production Dynamics, Analysis of trajectories. MD can applicable so much mechanical analysis like for the analysis of abrasive chip removal process, Carbon nanotube welding under electron beam irradiation, surface welding etc. MD simulation techniques have also been established as one of the suitable method for qualitative understanding the surface phenomenon like surface disorder, premelting, vibrational dynamics at surface, etc. Molecular Dynamics is a computational simulation process through which can predict the behavior of molecules. The advantages of MD are gives (in principle) complete knowledge of system, easily accommodates non-equilibrium states and other complex situations beyond thermal equilibrium. The most disadvantages is complete knowledge of all trajectories is often much more information than needed (e.g., equilibrium state of a fluid is characterized by just two variables, p and T). In this project, a precipitate, i.e. a second phase particle, will be modelled using MD technique to study the nano scale behaviour of a metallic material under mechanical loading.

Local-Search based Implementations of Genetic Algorithm for Vehicle Routing Problem

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Vehicle Routing Problem(VRP) is a deeply researched optimization problem which involves finding the best route satisfying the given con- straints. If a set of nodes, which are to be visited are given along with their coordinates and demand, the main aim of VRP is designing is set of paths, originating from the depot, such that the constraints are satisfied and the global cost is minimized. Finding the optimal set of paths is important because it can lead to major decrease in operating costs for the company/organisation using it. The study in the field of VRP has given rise to major developments of exact algorithms and heuris- tics. Highly sophisticated exact programming algorithms and powerful heuristics/meta-heuristics for the VRP have been put forward in recent years. We have focussed on a local-search based implementation of Ge- netic Algorithm(GA)for VRP. With increase in the size of the problem, the time complexity of the current algorithms increases greatly. Target- ing the local search operator, an algorithm has been developed with a reduced time complexity. Three strategies are conceived, each differing in the local search implementation. The proposed algorithm is tested on 3 Christofides instances and the results obtained for the three strategies are compared. It is observed that the implementation of local search, involving the same-trip swap operator performs comparatively better.

Computational investigation of fluid flow through pipe using finite volume approach

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In this paper, computational analysis of fluid flow within the pipe has been investigated using a computational tool ANSYS Fluent. The governing equation i.e. Naviers stokes equation has been solved by using SIMPLE algorithm. The fluid flow characterises have been visualized for laminar and turbulent flow regime. It has been observed that when fluid flows within the surface of the pipe, the interaction between the surface and fluid layer takes place, which in turn wets the surface. During fluid flow shearing takes place between the layers of fluid and the surface of the pipe due to friction. Moreover, the model includes the effect of thickness of each layer, the length of the layer, distance moved by each layer, the velocity of any layer etc. the behaviour of fluid have been seen by visualizing the flow characterises such turbulent intensity, skin friction, wall shear-stress, dynamic pressure..

Auto Pilot Mode Technology for Unmanned Vehicles

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The word “Auto pilot” mode here refers to the process of implementing the advanced technology in vehicles which enables it to self-drive in high way roads without the control of the humans. This process is going to be achieved by the use of Radars, Sensors and Advanced GPS maps. First a compact path of the place where user wants to go is selected on the GPS map.

When the engine is started, all equipment’s will start to take positioning. The readings are obtained from the radar every second. It detects the objects at the limit of 180’ angle and continuously feed the control unit. This control unit is built with

a lot of conditions that makes the vehicle to move in the possible safe directions. Here 50% of the job is done by the radar equipment's and rest of the job is done by the advanced GPS mapping to make a safe journey. Separate signals are obtained from the ground level to detect the speed breakers and conditions of the road. Same set of equipment's is fixed on the rear side of the vehicle to avoid other vehicles hit on rear side of the user's vehicle.

Keywords: Auto pilot; Unmanned vehicles; Self-drive

Finite Element Model and Experiment on Electro- Magnetic Terminal - Wire Crimping Process

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Crimping technology is widely used for making interconnections for low, medium and high power distribution channels. The important problem, which the crimping industry is facing, is spring back of terminals on the stress relaxation, which significantly influences the reliability of the electrical crimp connection. A fully coupled electro-mechanical coupled finite element analysis of aluminum terminal compression over aluminum seven wire strands was carried out using LS-DYNA Electro-Magnetic module. A unique type of solenoid coil with square groove geometry over the rectangular cross-section was analyzed for terminal-wire crimping process. Numerical results indicated no spring back and uniform compression over the entire terminal, which usually occurs in conventional crimping process showing the advantage of Electromagnetic crimping process. Validation was carried out using radial deformation and the metallurgical cross-section of the crimped terminal. A good agreement between the FEM and experimental results were observed

Three-Dimensional elasticity solution for a right cylindrical shell panel on any arbitrary boundary condition using the Extended Kantorovich Method

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An ingenious semi-analytical approach has been developed to obtain the closed form three- dimensional (3D) solution for elastic right cylindrical shell supported on any arbitrary boundary condition. This approach inculcates a mixed type Reissner's principle to obtain the corresponding governing equations from shell equilibrium and constitutive relations which are further solved using the recently developed multi-term Extended Kantorovich method (EKM) [1]. Two set of ordinary differential equations (ODE) are obtained from the governing partial differential equations (PDE) by applying the multi-term EKM. This solution technique not only simplifies the problem to solving first order ODEs, but also has provided very accurate results with single term in the series expansion and results were obtained after just 2 iterations. The stress and deformation field variables have been computed through this technique and close agreement is obtained compared to 3D finite element (FE) results obtained through ABAQUS [2].

References

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[2] ABAQUS Inc., 2009, ABAQUS/STANDARD, Version 6.9-1, User's Manual.

Title: Discrete Dislocation Dynamics Simulation Of A Second Phase Particle

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When crystalline solids undergo plastic deformation, line defects known as dislocations move, multiply, and react with one another. The overall mechanical properties of the crystal in the plastic regime are governed by these dislocation processes. Dislocation dynamics is a modelling approach that aims to simulate the motion and interaction of these dislocation lines to gain insights concerning the mechanical properties of the material. Dislocation lines are defects whose core widths are at the scale of the crystal lattice. The length scale over which dislocation structures evolve is, however, many orders of magnitude larger that the interatomic distance. A classic example is the formation of dislocation cells; at moderate to large amounts of plastic deformation, dislocation networks are known to form cellular structures, with an average cell size on the order of 1μm.
L. Kubin, Y. Brechet and G. Canova imagined the concept of 3D discrete dislocation simulation in the early 1990s. ParaDiS is a free large-scale dislocation dynamics simulation code to study the fundamental mechanics of plasticity. It was originally developed at the Lawrence Livermore National Laboratory. It is written in C (with a little C++) and uses the MPI library to communicate between the processes. It runs routinely on 100-1000 processors and scalability on 13200 processors of BlueGene/L has demonstrated. In this project, a precipitate, i.e. a second phase particle, will be modelled using discrete dislocation dynamics technique to study the dislocation activity around a precipitate under mechanical loading.

3D Analytical solution for functionally graded rectangular plate having longitudinal stiffness variation

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A three-dimensional analytical solution for a functionally graded plate with longitudinally varying material properties is developed the first time. By applying the EKM method, the system of 6n first order ordinary differential equation (ODEs) and 3n algebraic along the in- plane (x) and thickness (z) directions are obtained. The system of the equation along the thickness direction (z) having constant coefficient but the set of equations along the x- direction has variable coefficients. In thickness direction (z), exact closed-form solutions are obtained and along an x-direction, the system of ordinary differential equation with variable coefficients is solved by employing the modified power series. In this paper, specific predefined variation in mechanical property is assumed and their influence on bending response of plate, subjected to mechanical loading, is investigated. Benchmark results are presented for different boundary condition which can be used to validate approximate two- dimensional solutions and 3D numerical results.

GPU Computing Tool for Topology Optimization of 3D Continua

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Structural topology optimization is a procedure for determining optimal material distribution in the given domain so that it can optimally fulfill its function. Despite having many applications in various fields of engineering, the major bottleneck in its implementation for continuum structures is the large computation time. This makes its implementation prohibitive for complex and large-scale 3D structures. A viable remedy for this problem is to harness the power of parallel computation. By executing the entire process in many processors concurrently, the computational time can be reduced significantly. In the literature, the topology optimization process has been parallelized using traditional computing

architectures viz. shared and distributed memory architectures, and also by using multi-core architectures like GPU (Graphics Processor Unit). GPU offers certain advantages over traditional architectures and therefore, it has been used in various studies with a good speed-up. Many implementations using GPUs has been reported in the literature for various topology optimization problems. Some open-source tools for structural topology optimization also exist that allows solving some benchmark problems. In the present work, the scope, challenges and their remedies in topology optimization process of 3D continua are discussed. An open source GPU computing tool (known as GPUTop) is tested on a few examples. The performance of GPUTop is evaluated on the various GPU parameters for thorough analysis. From the analysis of results, the scope for further improving GPUTop is discussed.

Abstract of Couple Regenerative Braking & Suspension System

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In order to improve the vehicle fuel economy of off-road vehicles, this paper presents the design, modeling, and performance study of a coupled regenerative suspension and braking based on an energy recovery unit. This regenerative suspension and braking can transform the kinetic energy of suspension vibration and braking into unidirectional generator rotation which will generate electrical energy. A prototype of the system has been designed in CATIA V5R19, assembly and a series of experimental tests will be conducted to demonstrate its effectiveness to generate the damping characteristic, energy harvesting capability and the feasibility of the proposed approach. In this implementation scheme, operating electric circuits will be designed based on different working status and it is realizable to accumulate energy from road vibration and braking.

Study of Precipitate Behaviour using Crystal Plasticity Finite Element Method.

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Crystal Plasticity (CP) Finite Element Method is a powerful numerical simulation modeling tool that can be used for a wide range of mechanical problems in the field of materials. The plastic deformations of aggregates in a crystal depend on the loading direction. Hence, crystals are known to be mechanically 'Anisotropic'. Due to this property, the associated changes in shape, strength, crystalline texture, strain hardening, surface roughening etc are also orientation dependent. So, a theory is developed which includes both the anisotropic and crystallographic nature of such mechanisms with the knowledge of the orientation of crystals relative to the boundary conditions. However, to bring about certain simplifying assumptions of stress/strain homogeneity, the finite element approximations are adopted. These models are called Crystal Plasticity Finite Element Models (CPFEM). Some of the applications from using the constitutive laws in CPFE models are that allow us to map such complex deformation mechanisms like dislocation slip, martensite formation(in steel), twinning, grain boundary shear, and deformation via shear banding(in glass). Hence its highest advantage lies in the mesoscopic and microscopic regime. DAMASK — the Düsseldorf Advanced Material Simulation Kit is a software tool for the modeling of crystal plasticity within a finite-strain continuum mechanical framework. In this project we intend to analyze and simulate dislocations and the stress-strain behavior under various applied boundary conditions based on the crystal plastic theory. In this project, a precipitate, i.e. a second phase particle, will be modeled using crystal plasticity finite element method and the behavior of precipitate under mechanical deformation will be studied.

Development of core fundamental technology for membrane-less microfluidic microbial fuel cells

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Microbial fuel cells (MFCs) rely on metabolic activity of bacteria to generate electricity. The integration of microbial fuel cells with the micro-scale would result in more active bacteria per unit volume, thereby enhancing the power density significantly. In the present analysis, we have investigated the effects of flow conditions on the performance of a microfluidic MFC. The bacterial strain is stimulated the most in the presence of an optimal shear stress value thereby giving higher performance. Firstly, an experiment is performed which gives the target shear stress value for maximizing performance. Thereafter numerical simulations are carried out to obtain the optimal flow rates for varying channel aspect ratio. We report a favourable range of flow rate for the MFC to give maximum voltage output. When operated in the proposed conditions the power density of our MFC is found to increase 5 folds compared to conventional setup conditions.

Effects of geometric discontinuity and strain rate on the tensile behaviour of CNT reinforced Polypropylene composite

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Polypropylene is a thermoplastic which is widely used in engineering applications owing to its desirable mechanical properties, low weight and recycling characteristics. However, due to the inherent limitations associated with polymer microstructure, engineering properties such as peak strength, thermal stability etc., are inadequate. Though conventional fiber reinforcements are effective, the fiber volume fraction required to achieve the desirable qualities is quite high. In this regard, nano reinforcements are particularly effective due to the high aspect ratio, improving the material properties for minimal volume of reinforcement. The advancement in processing techniques and improved dispersion strategies has rendered carbon nanotube (CNT) as an exciting reinforcement material.

Notch sensitivity is an important attribute in design for fatigue loading. The stress concentration induced by geometric discontinuities contributes significantly to the notch sensitivity of a component. In this study, the combined effect of geometric discontinuity size and strain rate on the tensile behavior of unreinforced polypropylene (PP) and carbon nanotube reinforced polypropylene (CNT-PP) has been studied for the classical configuration of central circular hole. 0.5 wt% CNT reinforced PP material was prepared by diluting a 20 wt% CNT- PP master batch using melt compounding technique. A compatibilizer (PP-g-MA) was used to improve the dispersion and adhesion characteristics of CNT. The resulting material was injection molded into tensile specimens based on the dimensions recommended by ASTM D638. Holes of diameter 1 and 2 mm were drilled in the middle of the specimen. Tensile tests were conducted at strain rates of 1 and 10 mm/min. Post-failure morphological studies were carried out using scanning electron microscope (SEM).

Analysis reveals that hole has a decisive impact over the strength of the composite. In the absence of notch, CNT- PP exhibits higher strength compared to PP regardless of strain rate. However, in the presence of hole the strength of CNT decreases below PP for both strain rates. The plasticity induced by stress concentration increases the strength in the loading direction. However in CNT-PP the presence of reinforcements restricts the plasticity.

Distinctive deviations were observed between the failure elongation values of CNT-PP and PP. For unnotched specimens, for low strain rate (1 mm/min), the failure elongation was similar for both PP and CNT-PP specimens whereas in the case of high strain rate (10 mm/min), substantial difference was observed as CNT-PP specimens failed at low strain values. The difference in failure elongation between unnotched and notched specimens was higher for CNT-PP compared to PP specimens for both high and low strain rates. Increase in hole size resulted in reduction of failure strain for both PP and CNT-PP indicating that the failure was brittle. The failure strain values of notched specimens, both 1 mm and 2 mm were near to each other for high strain rate loading implying that during high rate of loading, notch of smaller size can inflict the same magnitude of failure compared to notch of greater size.

In order to comprehend the results, the region in the vicinity of the hole was observed under SEM. On the fractured

surface, features indicating ductile and brittle fracture were observed. Presence of elongated fibrils characterized ductile fracture. The ductile region could be attributed to the plasticity induced by the stress concentration. In CNT- PP specimens, the ductile and brittle regions were separated by a definitive crack. The extent of ductile region is lesser in CNT-PP specimens compared to PP, indicating that addition of CNT promoted brittle fracture which is confirmed by the low failure strain. The agglomerated CNT bundles were spotted near the hole which could have acted as a potential failure initiator. Voids were present near the hole revealing the material inhomogeneity in specimens which can initiate crack failure. Apart from these general features, from the images it could be inferred that for PP, the stress concentration due to hole initiate failure only when the size is higher whereas in CNT-PP even small hole induces failure for low strain rate. But for high strain rate, a small notch initiates crack failure for both unreinforced and reinforced materials as time available for the material to respond is minimum, reducing the ductility and the stress relieved by plasticization.

Application of laser for Surface Engineering to Improve Abrasion Wear Resistance of Aluminum

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Laser surface engineering is a technology of applying a high laser beam to improve surface of metallic material or to develop a new surface properties. This can be achieved using laser beam as a heat source to melt the metallic parts. In this poster presentation, two metallic powders of magnesium and manganese are used for surface alloying purpose. A continuous mode CO2 laser was used for alloying pure aluminum substrate with magnesium and manganese metals. A new surface was generated on the existing surface which has higher microhardness with improved wear resistance. Formation of fine dendrite microstructure in the alloy zone contributed the improvement of microhardness and wear resistance. The morphology of the alloy is free from any metallurgical defects. The abrasion wear test was conducted on the alloyed surface. The frictional surface reduced for laser surface alloyed samples.

Keywords: Laser, Surface engineering, aluminum, alloying

Ductile Fracture at High Velocity Impact of Tubes

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Study of impact problems is of great interest in many engineering fields, such as automotive industry, aircraft industry, defence industry etc. Orbital debris impact on space station, crash-worthiness of automobiles etc. are few examples of impact problems. Impact problems are characterized by short duration, large plastic deformation, high strain rates, rapid dissipation of energy, thermal softening etc. Contact-impact problems like crash-worthiness of vehicles, impact testing etc often involve ductile fracture. Ductile fracture is a mode of failure in which voids either pre-existing within the material or nucleated during deformation grow until they link together or coalesce to form a continuous fracture path. The continuum damage mechanics model of Lemaitre is one of the most commonly used approaches to study ductile fracture. A number of studies on damage growth and fracture simulation, in static processes like punch less piercing, stamping, bulk metal forming etc., have been carried out using this approach. However, number of such studies on the prediction of fracture in impact problems are limited. In impact problems, the effects of strain rate, Lode angle effect and temperature on material behaviour become significant. In the present work, damage growth, and effect of high strain rate are studied for ductile fracture during high velocity impact of cylindrical tubes using commercial finite element software ABAQUS/Explicit.

Understanding migration, viability and metastatic potency of cervical cancer (HeLa) cells through constricted microchannels

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To meet the burgeoning challenges of metastasis, in this work an attempt has been made to understand the migration of cancer cells by experimental studies in constricted microcapillaries that mimic in vivo capillaries. A microchannel of 35 μm diameter, constricted to 7 μm for a distance of 200 μm in a total length of 3 mm, was designed and fabricated using a mask aligner made of polydimethylsiloxane (PDMS). A thin glass cover-slide was mounted on top to monitor the motion of single or clusters of malignant HeLa cells (size 17–30 μm) microscopically through the constricted microchannel at a constant flow rate of 10-30 μl/h. Cells underwent reorientation and enhanced deformation on entering the constricted passage, where the cell clusters depicted proper queuing and sequencing. Morphological analysis of live and apoptotic cells by dual staining with Acridine Orange (AO)/ethidium bromide (EtBr) qualitatively demonstrated retention of a significant viable cell population after exit through the constriction. Finally, a quantitative cell viability index of 50% was confirmed by dye exclusion assay. The cumulative data for microfluidic parameters, morphology and relevant metastatic MMP2 gene expression efficiency of the flow cells obtained by real-time polymerase chain reaction (PCR) revealed retention of virulence potency that could possibly cause metastasis, which would be beneficial in developing future MEMS devices for cancer theranostics.

Keywords: Metastases, Constricted microchannel, Hydrodynamic parameters, Cell viability index, Cervical cancer cells, HeLa cells.

Significance of activation energy in process metallurgy slag

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A study of thermal behaviour, thermal degradation kinetics, and effect of composition on flow characterisation of blast furnace slag is important to Understanding the flow characteristics of blast furnace (B/F) slag. It is an important parameter for efficiency/productivity of a blast furnace.

In the present study flow characteristics of five different B/F slag (C/S: 1.04, 1.192, 1.107, 1.101, and 1.189) were investigated. This study was predominantly based on the estimation of activation energy. The activation energy was estimated using two methods: differential scanning calorimetry (DSC) and High temperature viscometer. DSC of different slag were measured at 30-1300oC @ 2o, 4o, 6o, 8o and 10oC/min. Activation energy was estimated from such DSC plots using Kissinger. It was observed that activation energy is largely dependent on C/S ratio of B/F Slag – the activation energy increases with increase in C/S ratio. The flow characteristics of different B/F slag were also investigated by high temperature heating microscope, X-ray diffraction (XRD) and scanning electron microscope (SEM). The estimated IDT (initial deformation temperature), ST (softening temperature), HT (hemispherical temperature) and FT (fusion temperature) of different B/F slag was shown in table 1. Phase analysis of XRD and SEM micrographs support the results of flow characteristics measured by heating microscope.

Keywords: DSC, Viscosity, B/F slag, heating rate, XRD.

Fabrication of Microchannel on Stainless steel 316L

Metal microchannel finds its wide applications in electronics industries, micro chemical reactor as well as in the process of food and pharmaceutical industries. Conventional micromachining of microchannel on metal is a difficult task as there are many tool related issues. In this present work, an attempt has been made to machine a clean microchannel on Stainless Steel (SS 316L) using Q- switched second harmonic Nd:YAG laser. Channel width of up to 51 μm and depth of up to 120 μm could be attained in this work.

Effect of Annealing on Tribo-Mechanical Properties of Plasma Sprayed Alumina-Chromia Coatings

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Plasma sprayed Al2O3 (alumina) is used as a heat resistant, corrosion resistant and hard coating. While spraying the Al2O3 feedstock powder of α-phase it forms different phases in the coatings. Considering the mechanical properties stable α-Al2O3 is desirable in coating. However, the other metastable phases formed due to the complexity of the spraying process and rate of solidification. It is expected that the prevention of these phases in the coatings will significantly improve the mechanical, electrical, and other properties of Al2O3 coatings. The result regarding the possibility of stabilization of Al2O3 through addition of Cr2O3 (chromia) has been already reported. When Cr2O3 is added in the feedstock of Al2O3, a solid solution (AlxCr1-x)2O3 forms in the deposit which is superior to other phases of Al2O3. Annealing of Al2O3 deposit at the temperature higher than its recrystallization temperature also improves the quantity of α-Al2O3 content.
This work is carried out on plasma sprayed Al2O3-Cr2O3 coatings to study the effect of annealing temperature on the phase transformation and other properties with different compositions. Plasma sprayed Al2O3 coatings with 1 to 6 wt.% Cr2O3 content is annealed at different temperature from 900o C to 1200o C and then characterized along with as-sprayed coatings. Analysis of phase formation of the coatings is studied with X-ray diffraction patterns. SEM micrographs are used to study the microstructure of the coatings. The effect of annealing on the coating properties is investigated in terms of vickers microhardness, wear resistance and coefficient of friction.
Cr2O3 addition influences the phase formation, and maximum solid solubility of Al2O3-Cr2O3 is found at Al2O3-4wt.% Cr2O3. It is observed with the XRD patterns that complete transformation in to stable α-Al2O3 phase obtain at 1200o C and it has the maximum hardness among coatings annealed at lower temperatures. Annealing at 1200o C leads to formation and propagation of cracks at very large extent which decreases its wear resistance. Hence the maximum hardness is observed for Al2O3-4wt.% Cr2O3 coating annealed at 1200o C and maximum wear resistance for Al2O3-4wt.% Cr2O3 coating annealed at 1100o C among all the coatings.

Title: Study of Precipitate Behaviour using Crystal Plasticity Finite Element Method.

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Crystal Plasticity (CP) Finite Element Method is a powerful numerical simulation modeling tool that can be used for a wide range of mechanical problems in the field of materials. The plastic deformations of aggregates in a crystal depend on the loading direction. Hence, crystals are known to be mechanically 'Anisotropic'. Due to this property, the associated changes in shape, strength, crystalline texture, strain hardening, surface roughening etc are also orientation dependent. So, a theory is developed which includes both the anisotropic and crystallographic nature of such mechanisms with the knowledge of the orientation of crystals relative to the boundary conditions. However, to bring about certain simplifying assumptions of stress/strain homogeneity, the finite element approximations are adopted. These models are called Crystal Plasticity Finite Element Models (CPFEM). Some of the applications from using the constitutive laws in CPFE models are

that allow us to map such complex deformation mechanisms like dislocation slip, martensite formation(in steel), twinning, grain boundary shear, and deformation via shear banding(in glass). Hence its highest advantage lies in the mesoscopic and microscopic regime. DAMASK — the Düsseldorf Advanced Material Simulation Kit is a software tool for the modeling of crystal plasticity within a finite-strain continuum mechanical framework. In this project we intend to analyze and simulate dislocations and the stress-strain behavior under various applied boundary conditions based on the crystal plastic theory. In this project, a precipitate, i.e. a second phase particle, will be modeled using crystal plasticity finite element method and the behavior of precipitate under mechanical deformation will be studied.

Study of Effect of Grain Misorientation using Crystal Plasticity Finite Element Method

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A theory of the mechanical properties of crystals must include first, the crystallographic and anisotropic nature of those mechanisms that create shear and second, the orientation(s) of the crystal(s) studied relative to the applied boundary conditions (e.g. loading axis, rolling plane) Early approaches to describe anisotropic plasticity under simple boundary conditions have considered these aspects, such as for instance the Sachs, Taylor, Bishop-Hill, or Kröner formulations. However, these approaches were neither designed for considering explicitly the complex mechanical interactions among the crystals in a polycrystal nor for responding to complex internal or external boundary conditions. Instead, they are built on certain assumptions of strain or stress homogeneity to cope with the intricate interactions within a polycrystals. For that reason, variational methods in the form of finite element approximations have gained enormous momentum in the field of crystal plasticity. These methods, which are referred to as crystal plasticity finite element (CPFE) models, are based on the variational solution of the equilibrium of the forces and the compatibility of the displacements using a weak form of the principle of virtual work in a given finite volume element. CPFE method has evolved as an attempt to employ some of the extensive knowledge gained from experimental and theoretical studies of single crystal deformation and dislocations to inform the further development of continuum field theories of deformation. In this project, the effect of grain misorientation of metallic material under mechanical loading will be studied using crystal plasticity simulation.

Comparative Tribological Performance of Graphite, CaF2 and MoS2 Coated Mechanical Micro-Textured Cutting Tool Material during Dry Sliding Test

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In recent years, micro-textured cutting have shown great potential to eliminate the use of cutting fluids during dry sliding contact to encourage dry machining for limited applications. However, at higher load, severe friction exists between dry siding contacts causes high temperature and wear. There is a great scope to further enhance the tribological performance of micro-textured surfaces during dry sliding contact for heavy load applications. One such way is to coat micro-textured surface with solid lubricants. In the present work, mechanical micro-textures were fabricated on the surface of the plasma nitrided high-speed steel (HSS) pins using scratch tester. Mechanical micro-textured HSS pins were coated with graphite, calcium fluoride (CaF2) and molybdenum disulphide (MoS2). Tribological performance of untextured, mechanical micro-textured and solid lubricants coated mechanical micro-textured HSS pins were investigated using pin-on-disc tribometer. The results shows that MoS2 coated mechanical micro-textured HSS pins performed best among all in terms of coefficient of friction, wear, weight loss of pin and wear rate.

Keywords: Mechanical micro-texture; Calcium flouride; Graphite; Molybdenum disulphide; Wear; Dry sliding.

Influence of Geometric Configuration on Charging Characteristics of MmNi4.6Fe0.4 Based Hydrogen Storage Device

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Abstract: Three dimensional mathematical model is developed and solved numerically for predicting the charging characteristics of MmNi4.6Fe0.4 based hydrogen storage device, using COMSOL Multiphysics 4.3a. This study investigates the transient heat and mass transfer phenomenon occurring during absorption of hydrogen by taking into account of pressure gradient between hydride bed and supply condition, diffusion of hydrogen and heat transfer between the bed and cooling fluid with emphasis on convective boundary condition. Using this model, charging characteristics of two cylindrical reactor configurations, each having 48 embedded cooling tubes (ECT) in a unique pattern, are predicted at the supply condition of 3.5 MPa and 298.K. One of the configuration is designed with an additional outer cooling jacket (OCJ). From the analysis, it is evident that ECT configuration highly influence the hydrogen absorption rate, which is further enhanced by OCJ. Due to inclusion of OCJ, average bed temperature dropped from 334.5 K to 305.8 K within a span of just 200 s, while 80% of hydrogen storage capacity is achieved within 165 s and observed maximum storage capacity is 1.15 wt% within 800 s.

Keywords: Metal hydride, Absorption, Thermal modeling, Coupled heat and mass transfer, Convective boundary condition.

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Autonomous tracking with octocopter

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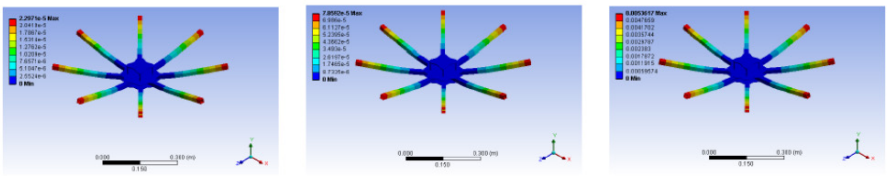
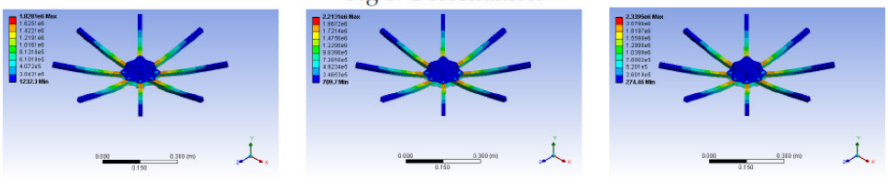
This report presents the thesis work on development of an octocopter towards autonomous tracking and following a target. In our pursuit of achieving this target, we develop a octocopter platform that is versatile and capable of many other task like autonomous onboard trajectory planning without human agent intervention. Intelligent transportation system and efficient surveillance framework are the demands of present day society. In this work, we have attempted
to develop an autonomous octocopter platform using both pre-existing resources and upgraded components. The entire architecture is based upon ROS. We have analyzed the structure performance of octocopter frame in different scenario like drop test, material change, thrust variation, etc. After proper reasoning, aluminum frame came out to be the appropriate material for our purpose.
The motion planning of the octocopter occurs on a companion computer on-board the flight, making this setup impeccable towards transmission losses and in-flight failures. This also ensure increased range for vehicle. Simulation and Tracking codes were tested for proof of concept and vulnerability detection.
We did Ansys analysis for different material used for making drones. Static structural analysis has been done by taking 10N per wing resulting 80N of total maximum thrust. Excluding the frame weight, battery and other electronic component's weight, this octocopter can carry maximum of 3kg weight as per this result.



Steel Aluminum Plastic

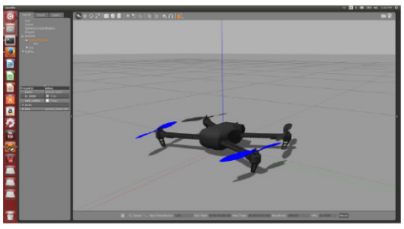
Fig 1: Deformation



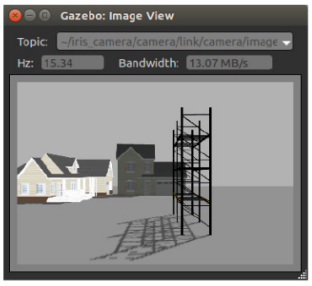
Steel Aluminum Plastic

Fig 2: Equivalent Stress

Following is the Simulation of PX4 Firmware on Gazebo Simulator. Specifically, for the simulation, we also created a camera model in Gazebo, which made our process of testing our concepts easily in Gazebo without using actual camera.

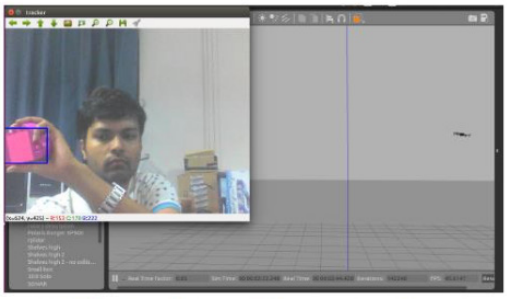


Simulation Model

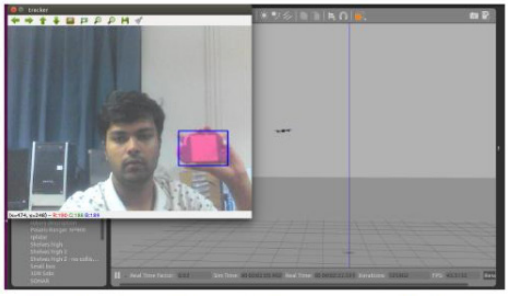


Camera feed from Simulated Camera

Following is the result of the KCF tracking using real camera, in the simulated environment of Gazebo with ROS. When the target is on right side of the image, the drone goes to right (due to lateral inversion, in the images it goes to left) and similarly for right side. All this computation is real time.



KCF Tracking (Drone to Left)



KCF Tracking (Drone to Right)

Electric field induced separation of water-ethanol solutions with nanoporous graphene membranes and carbon nanotubes

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Ethanol is a promising alternative for commercial biofuel technologies along with widespread application in medical and scientific products. The conventional process of separating ethanol from aqueous solution is through distillation which consumes a large amount of energy and forms the bulk of the production cost. In the present work, we demonstrate the separation of ethanol-water inside carbon nanotubes (CNTs) under the influence of applied electric field using molecular dynamics simulations. The simulation setup consists of a rigid CNT that connects two equimolar ethanol water reservoirs at the ends as schematically shown in Fig. 1(A). Two rigid graphene sheets with a pore equal to the CNT diameter are placed at each end of the tube and act as separating membranes. We apply an external homogeneous static electric field over the entire simulation domain and the angle between the direction of the external field and nanochannel axis, denoted as θ is varied from 0° to 90°. The variation of mole fraction of ethanol and water inside the CNT with variation of θ is shown in Fig. 1(B). In the absence of an electric field, ethanol molecules exhibit slight preferential occupancy inside the CNT. However, the simulations reveal that the occupancy inside the CNT can be efficiently tuned by varying the angle of inclination of electric field θ. At lower values of θ, the CNT is preferentially occupied by water molecules and with increase of θ, the ethanol molecules show higher tendency of filling the CNT. The separation effect is strongest for θ corresponding to 0° to 90° with complete separation of water and ethanol respectively. These findings may stimulate development of alternative separation technologies for ethanol-water solutions.

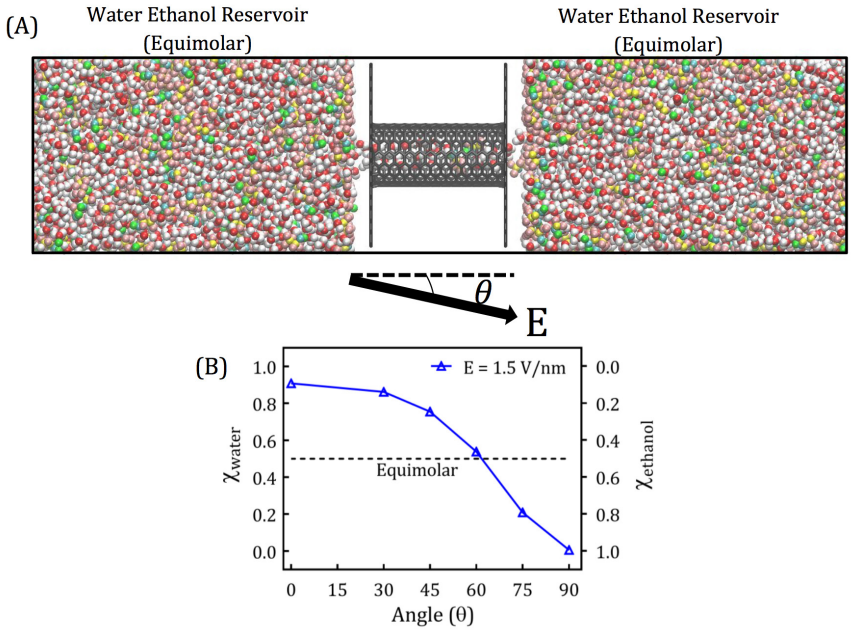

Figure. 1. (A) Schematic diagram of the molecular dynamics simulation setup. Red and white represent oxygen and hydrogen of water molecules respectively. Ethanol molecules are represented by yellow, blue-green and pink for carbon, oxy-hydrogen (OH) and hydrogen respectively. (B) Variation of mole fraction inside CNT with electric field inclination angle θ.

Electrowetting-on-Liquid (EWOL): A Novel Technique for Microfluidics Based Applications

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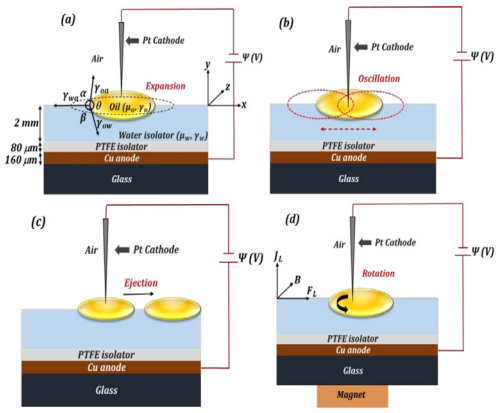
Figure 1. Images (a)-(d) schematically shows the various regimes namely spreading, oscillation, ejection as well as rotation for the present EWOL set-up. The Cu anode placed beneath the PTFE isolator acts as anode while the circuit was completed with Pt electrode acting as cathode. The magnet in image (d) was placed perpendicular to the plane of the paper. The notations γow, γoa, and γwa represent interfacial tensions at the oil-water, oil-air, and water-air interfaces, respectively. The notations μo, and μw denote the viscosity of the oil and water and α, β, and θ represent contact angles.

The increasing demand of lab-on-chip devices requires control over discrete liquid volumes and electrowetting (especially electrowetting-on-dielectric(EWOD)) is an interesting tool for manipulating individual droplets by altering their surface energies in presence of electric field. The horizon of electrowetting has been expanding continuously since the pioneering work of Sir Gabriel Lipmann on electrocapillarity in 18751. Electrowetting-on-dielectric (EWOD)2 and Electrowetting on liquid infused film (EWOLF)3 has already been used as a basic mechanism in numerous microfluidic applications starting from liquid lens4 to microfluidic mixing5. Most of the researches till date has been performed on solid di-electric film which add to the loss of electrical energy by constraining the movement of contact line. However, the present study primarily focuses upon a novel method of electrowetting developed by Kumar et al.6, which replaces the solid dielectric layer by a liquid isolator as shown in figure 1. The introduction of a liquid isolator beneath an oil drop facilitates free movement of the contact line beyond contact angle saturation and this lead to some of the beautiful dynamics of the drop after the expansion stage (see figure 1a) namely drop oscillation and drop ejection (see figure 1b and c). The regimes showed up gradually once we ramp up the intensity of the electric field from low to intermediate and finally to highe r values. Again, presence of a magnetic field in a direction perpendicular to the electric field forces the drop to rotate in the aforementioned set-up described as shown in figure 1d. The droplet rotates in presence of Lorentz force, which was generated due to the coupling of the weak leakage current with the externally applied magnetic field. The spreading, oscillation, ejection as well as rotation of the drop found out to be a function of oil-water interfacial tension, viscosity ratios and size of the oil droplet. Finally, the rotation of the drop at higher speeds lead to break up of the drop into multiple secondary drops owing to the competition between shear force and centripetal force, which can be further developed as a one-step method for producing emulsion of oil in water.



References:
1) M.G. Lippmann, Ann. Chim. Phys, 1875, 5, 494-549.
2) G. Beni and S. Hackwood, Appl. Phys. Lett., 1981, 38, 4, 207-209.
3) C. Hao, Y. Liu, X. Chen, Y. He, Q. Li, K. Y. Li, and Z. Wang, Scientific reports, 2014, 4, 6846.
4) D. Y. Kim and A. J. Steckl, ACS Appl. Mater. Interfaces, 2010, 2, 3318-3323.
5) F. Mugele, A. Staicu, R. Bakker and D. van den Ende, Lab Chip, 2011, 11, 2011-2016.
6) S. Kumar, B. Sarma, A. K. Dasmahapatra, A. Dalal, D. N. Basu, and D. Bandyopadhyay, Faraday Discuss., 2017,199, 115-128.

Transient study in a pressurized circulating fluidized bed

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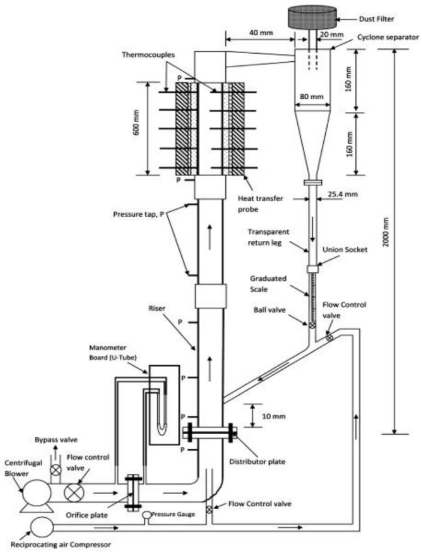

Pressurized circulating fluidized bed (PCFB) is the modern generation fluidized bed which is attracting the researchers for g eneration of power in future due to its compactness in size and high bed-to-wall heat transfer capability. It has got various applications in generation of power as well as in chemical industries. Therefore investigation of transient heat transfer and hydrodynamics in PCFB becomes critical. Transient heating and cooling also occur in PCFB during the start-up and shutdown process. However the behaviour of PCFB during these transient periods is not fully understood in spite of its high significance. The present work includes experimental and numerical simulation of the transient hydrodynamic behaviour of a PCFB unit. The riser of the PCFB in this study is fabricated with stainless steel pipe of height 2 m and an inner diameter of 54 mm. Fluidizing air is supplied by a compressor. The air flow rate is regulated by an airflow control valve and is measured using a rotameter and a orifice plate. Static pressures are measured along the riser column at heights of 13cm, 25cm, 49.5cm, 69.5cm, 91.5cm, 118cm, 142cm, and 176cm respectively using piezo resistive type pressure transducers. Fin e wire mesh (BS 400) and filters are used at the pressure tapings to minimize pressure fluctuations and prevent leakage of sand. Sand with mean particle diameter 400 μm are used as the bed material for the solid phase for different numerical conditions. The mass and momentum conservation equations for both the solid and gas phases are solved by using finite volume approach. The flow model is simulated using the commercial software ANSYS FLUENT-14. The boundary conditions are applied based on the data of earlier experiments. The second order upwind scheme is applied in the spatial discretization method except volume fraction as QUICK. The results obtained from the model show a good agreement with the available experimental data under various operating conditions.

Key words: Bed voidage, Suspension Density, Transient behavior, Heat Transfer

Fig.1. Experimental setup used for present work

Selected References

Kalita, P., Saha, U.K., Mahanta, P., 2013. "Parametric study on the hydrodynamics and heat transfer along the riser of a pressurized circulating fluidized bed unit", Experimental Thermal and Fluid Science, 44, pp. 620–630.

Peng, B., Zhang, C., Zhu, J., 2011, "Numerical study of the effect of the gas and solids distributors on the uniformity of the radial solids concentration distribution in CFB risers". Powder Technology, 212, pp. 89–102

Influence of plunge speed on the hook geometry in friction stir spot welding of polymer core sandwich sheets

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The sandwich sheets have emerged as a great alternative of monolithic material towards light-weighting in automobile industries. These lightweight sandwich sheets are mainly used in body panels [1]. Sandwich sheets are composed of two metallic skin separated by a less stiff polymeric core. Due to diverse property of core and core and skin material, it is possible to attain unique combination of properties such as high formability, better damping characteristics [2, 3]. The joining of sandwich sheet is not easy because of variation in layer properties. In this work, Friction Stir Spot Welding (FSSW) is used for joining Al/HDPE/Al sandwich sheets. FSSW is a process variant of Friction Stir Welding (FSW) process, where a rotating tool is plunged into and out of the overlapping sheets[4]. For parametric study, tool plunge speed is varied from 2 mm/min. to 12 mm/min. at an interval of 2 mm/min. The effect of plunge speed is observed on the hook geometry. Hook is a characteristic feature of FSSW and forms on the faying surface [5]. The hook geometry is an important factor which decides the mechanical performance of FSSW joint [6]. Two hooks are forming during FSSW of sandwich sheets as shown in Fig. 1. Aspect ratio of these hooks are measured at different plunge speeds and shown in Fig. 2. The results suggests that the aspect ratio of upper hook is always lesser than that of lower hook. Further the upper hook aspect ratio increases while lower hook aspect ratio decreases with increasing plunge speed. However, the change in upper hook aspect ratio is less significant than lower hook aspect ratio. It is believed that changing plunge speed affect the heat input, which in turn govern the material flow during welding results in changing hook geometry. Further experiments can be carried out to correlate the hook geometry with mechanical behaviour of the FSSW joint.

Fig. 2 Change in hook aspect ratio with plunge speed

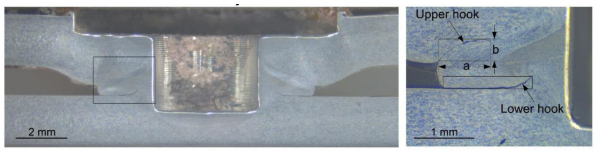
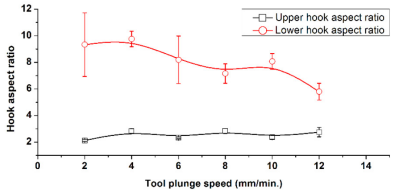


Fig. 1 (a) Cross-sectional view of joint, (b) formation of two hooks



References:

1. Burchitz I, Boesenkool R, van der Zwaag S, Tassoul M (2005) Highlights of designing with Hylite - A new material concept. Mater Des 26:271–279 . doi: 10.1016/j.matdes.2004.06.021
2. Kim KJ, Kim D, Choi SH, et al (2003) Formability of AA5182/polypropylene/AA5182 sandwich sheets. J Mater Process Technol 139:1–7 . doi: 10.1016/S0924-0136(03)00173-0
3. Rao MD (2003) Recent applications of viscoelastic damping for noise control in automobiles and commercial airplanes. J Sound Vib 262:457–474 . doi: 10.1016/S0022-460X(03)00106-8
4. Gerlich A, Avramovic-Cingara G, North TH (2006) Stir zone microstructure and strain rate during Al 7075-T6 friction stir spot welding. Metall Mater Trans A 37:2773–2786 . doi: 10.1007/BF02586110
5. Badarinarayan H, Shi Y, Li X, Okamoto K (2009) Effect of tool geometry on hook formation and static strength of friction stir spot welded aluminum 5754-O sheets. Int J Mach Tools Manuf 49:814–823 . doi: 10.1016/j.ijmachtools.2009.06.001
6. Yin YH, Sun N, North TH, Hu SS (2010) Influence of tool design on mechanical properties of AZ31 friction stir spot welds. Sci Technol Weld Join 15:81–86 . doi: 10.1179/136217109X12489665059384

Finite element modelling of plastic deformation behaviour of High entropy alloys under variable strain-rates

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High Entropy Alloys are solid solutions typically containing five or more principal equiatomic or near-equiatomic elements (Fig 1). These alloys have drawn significant attention in the field of materials science and metallurgical engineering for its outstanding mechanical properties like high strength, excellent fracture toughness, considerable thermal stability, high corrosion resistance, good cryogenic application compared to conventional alloys. High entropy alloys have been observed to exhibit different properties when subjected to different strain rates. A material under high strain rate fails due highly localised heat generation. The localised heat generation leads to sudden rise in temperature which ultimately fails by the formation of adiabatic shear bands. The inertia effects also come into picture when a material is in a state of dynamic loading. Materials have shown much higher yield strength and ultimate strength under high strain rate loading condition. A detailed microstructural analysis of plastic deformation of the material has been done by dislocation density based crystal plasticity Finite Element Modeling (Fig 2). Precipitation strengthening mechanism is basically studied under this work along with which mesh sensitivity analysis is done. For different strain rate the output parameters such as dislocation density, lattice rotation, shear slip rate, stress concentration, localized temperature sensitivity etc. are observed and compared.

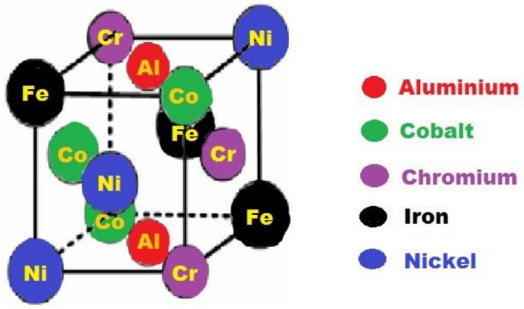
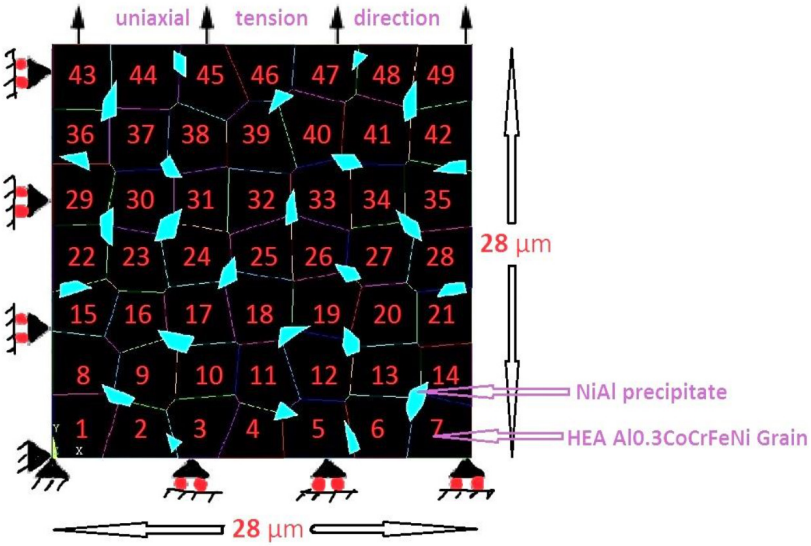


Fig 1: Unit cell of a high entropy alloy



Constitutive equations of a continuous model of crystal plasticity Using Discrete Dislocation Dynamics.(DDD)

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When crystalline solids undergo plastic deformation, line defects known as dislocations move, multiply, and react with one another. These dislocation processes govern the overall mechanical properties of the crystal in this plastic regime. Dislocation dynamics (DD) is a modelling approach that aims to simulate the motion and interaction of these dislocation lines to gain insights concerning the mechanical properties of the material.
The dislocation mobility in BCC materials can be related to the core of the dislocations. Such information can be obtained from atomic simulations. (MD) .The basics of a DD Simulation involve finding out how driving forces are exerted on the dislocations and dislocation velocities are dependent on these forces, Discretization and adaptive Re-meshing of the dislocation lines, Time integration of the equations of motion and how dislocations collide and react.
This DD code is used to identify constitutive equations of a continuous model of crystal plasticity. Visco-plastic modelling of crystals taking into account both isotropic and kinematic hardening can be performed. Dislocation microstructure into the typical persistent slip bands that is observed in experiments ,can be explained by DD simulations studying the crack initiation in fatigue . Further , Prediction of the fatigue life can be obtained through a simulation campaign of DD simulations. In many cases, DD simulations need information from a lower scale in order to specify local rules that cannot be fulfilled by elastic theory. The DD simulations can be used to analyze the collective effect of a large population of dislocations and fill the gap between atomic and continuum scales.

Experimental investigation on the forming behaviour of sheet materials using shock tube

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The growing demand for fuel efficient vehicles which is having lesser energy consumption is a great challenge in automotive industry. It has been resulted in a renewed interest in aluminium alloy sheet as a replacement of conventionally used steel in automotive bodies due to its higher strength to weight ratio, higher formability, increased resistance to corrosion and better recycling potential. Generally the formability of aluminium sheet is lower than steel under normal processing conditions, but as it has been shown that the formability can be enhanced if the forming process is performed at higher strain rates instead of forming material at an elevated temperature [Rohatgi et al. 2014].

The strain rate has a significant effect on the material behaviour during the deformation process as well as on the final properties of the product. Almost all materials have significant strain rate dependence at rates above the threshold. Due to this reason, determining the mechanical properties accurately is one of great issues during analysing the deformation behaviour of materials at higher strain rates. Traditionally, for the case of materials, quasi-static tensile test and Split Hopkinson Pressure Bar (SHPB) are the two standard experiments have been widely used to extract the plastic behaviour of the materials at lower and higher strain rate, respectively, but limitations occur in these tests is due to obtaining the results only at a uniaxial direction. In order to understand the forming behaviour of a material in multi-axial direction, several studies have been performed in combination with SHPB to create a dynamic bulge test, but in a limitation several complexities have been observed in the experimental set up during experiment [Grolleau et al. 2008].

In last few years, blast or shock loading has been used in many cases to extract the material behaviour under a dynamic multi-axial loading, but the use of explosives create a high strain rate loading environment generates deficiencies such as complexity in instrumentation and difficulties in handling. To recover from these limitations, shock tube has been introduced in various studies to study the dynamic response of thin metallic plates subjected to varying levels of shock loading. In this study it has been used to extract rate dependent multi-axial material properties.

The present work involves a comparative study of the forming response of 304L stainless steel and AA5052 at different strain rates using a shock tube to understand the influence of rate dependent properties on the forming response of both the sheet metals. In order to obtain higher strain rate loading, a nylon rod having hemispherical end has been considered during the study as shown in figure 1. A scale of higher strain rate loading over the surface of the material can be generated by applying different magnitude of shock wave to the projectile which travels at different velocities and hits the material surface. It is decided by the thickness of the diaphragm material that ruptures and creates different scale of pressure change. The shock tube is equipped with pressure transducers along the driven tube to capture the pressure-time history of the shock wave which impacts the plate specimen. The forming responses like dome height, strain evolution, strain-rate evolution, hardness after forming and mode of failure has been monitored and understood. From the results it is clearly obtained that the forming limits are enhanced for both the materials when it is deformed at higher magnitude of strain rate. The effect of inertial force because of high strain rate deformation results in to increase in elongation. AA5052 has shown almost 80-90 % increase in limiting strain relative to quasi-static forming which is clearly depicted in figure 2. Under the

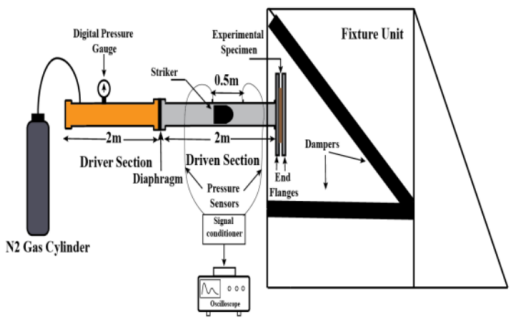

Figure.1. Schematic of Shock tube with instrumentation

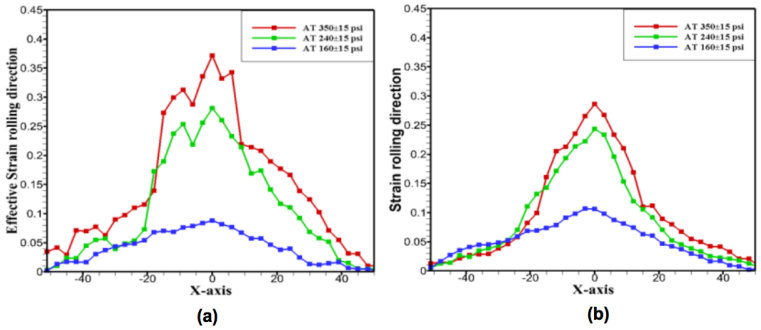

Figure. 2 Effective strain distribution across rolling direction for (a) AA5052 & (b) SS 304L

same experimental conditions, AA5052 has shown better forming behaviour comparing to 304L stainless steel.

References:
Grolleau V., Gary G., Mohr D., "Biaxial Testing of Sheet Materials at high strain rates using Viscoelastic Bars", Experimental Mechanics, 48(3),293–306(2008).
Rohatgi A., Soulami A., Stephens E. V., Davies R. W., and Smith M. T.: "An investigation of enhanced formability in AA5182-O Al during high- rate free-forming at room-temperature: Quantification of deformation history", Journal of Materials Processing Technology, 214(3), 722 732(2014).

Modelling and testing of fiber reinforced composites under impact

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The main aim of this present work is to review the damage prediction in composite laminates under impact tests. Notably, fiber reinforced composites of particular stacking sequences have been fabricated and tested under impact loads to evaluate the toughness followed by the non-destructive tests to quantify the damage. Further, numerical models have been used to simulate the delamination behavior of composite laminates. However, there is not much correlation between the simulation and the experimental observations under variety of impact loads. In this work, a flowchart describing the numerical and experimental testing process has been outlined.

Summary

Composite materials, despite the desirable physical properties, are susceptible to damage and failure arising from defects due to the manufacturing process and service loading conditions. Low velocity impact damages will reduce the performance of the composites even though they are not visible outside (Fig .1). Bowles investigated the low velocity impact resistance for graphite fiber reinforced composite and found out that laminate impact resistance is related to specimen thickness linearly [1]. Hong proposed a linear relationship between delamination area and impact energy, and showed that the mismatch of bending stiffness between adjacent laminae can be correlated with the delamination region [2].

There have been several studies in composite plate like structures under high energy impact loads. The basic mechanism for hard body projectiles is initiation of compressive wave and reflection of tensile wave at contact region and back-face respectively. This results in back-face damage and inter-ply delamination [3].

There have been several numerical tools that have been used to simulate damage in fiber reinforced composites; FEM is the most popular tool used. Further, there have been many approaches to model damage in composites such as VCCT, CZM, DPDM.

References

1. He Ran Wang, Shu Chang Longa, Xiao Qing Zhang, Xiao Hu Yao. Study on the delamination behavior of thick composite laminates under low energy impact. Composite Structures,184 (2018), 461–473.
2. Hong S., Liu D., On the relationship between impact energy and delamination area,Exp Mech, 1989,29(2):115–20.
3. Pedro P. Camanho, Stephen R. Hallett, Numerical Modelling of Failure in Advanced Composite Materials,2015, Woodhead Publishing.

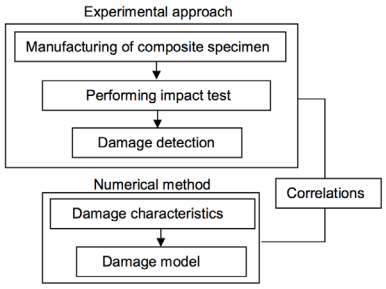

Fig.1 Schematic view of testing of composites

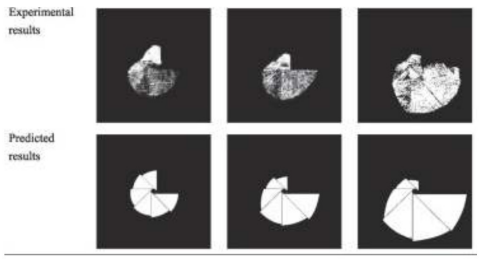

Fig.2 Delamination comparison of numerical and experimental testing results under low energy impact test

Bioresorbable Composites for Ankle and Talonavicular Arthrodesis Applications

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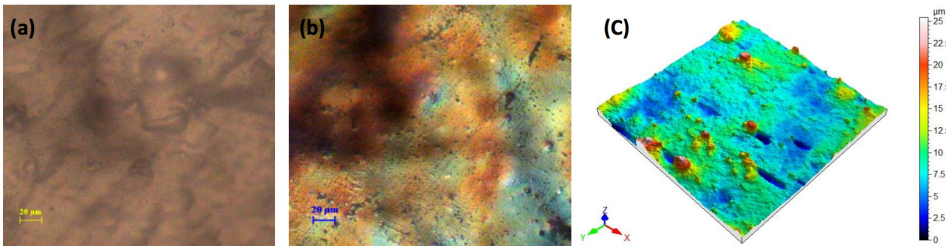
Arthrodesis is an artificial ankylosis in which induction of joint ossification between two bones is done through surgery. Ankylosis is generally caused due to abnormal adhesion and rigidity of the bone at the joints, which may be results in injury or diseases. The rigidity may be complete or partial and may be due to inflammation of the tendinous or muscular structures outside the joint or of the tissues of the joint itself. The trend of arthrodesis is increasing every year due to many reasons such as living life style, sudden jerk at the site, calcium deficiency and due to improper sports activities. To fix the arthrodesis, an orthopaedic surgeon generally do the surgery by fixing the metallic implants. Metallic implants are associated with lots of disadvantages like stress shielding, accumulation of met als ions in the nearby tissues, stress palpability, corrosion and lots of inflammation near the metallic implants due to weared metallic debris. Resurgery is also one of the major problems felt by the patient after the bone fracture healing. In this present work, biocompatible bioresorbable composite is fabricated for fixation of arthrodesis applications. The bioresorbable polymer like Polylactic acid (PLA) is melt blended cum extruded in a twin screw extruder with nano bioceramics fillers for producing the bioresorbable composite. The mechanical results showed that elastic modulus of the composite lies in the range of 0.7-2 GPa, which is sufficient for the fixation of bone and to avoid stress shielding. The hydrolytic degradation studies has also been performed as per ASTM F1635-11 in order to tune the mechanical and degradation behaviour of the composite to target its applicability to various aged group peoples. The parameters for processing the composites is shown below the table 1. The figure 1 (a) show the optical image (surface profile) of neat PLA and figure 1 (b) PLA/nHAp composite after 3 weeks. The figure 1(c) shows the surface profile of the composite after 3weeks hydrolytic degradation

Figure: 1(a) Neat PLA surface profile after 3 weeks degradation (b) PLA/nHAp composite surface profile after 3 weeks degradation (c) PLA/nHAp surface image through optical profilometer after 3 weeks degradation.

Table1: Processing parameters for extrusion cum injection molding process

Processing Temperature	190°C
Screw speed	100 rpm
Residence time	1min
Cylinder Temperature	210°C
Mold Temperature	95°C
Compressed air pressure	700-710 bar



Acknowledgement:

The Authors acknowledge the Centre of Excellence for Sustainable Polymers (CoE-SusPol) and Central Instrumental Facility at IIT Guwahati, for providing the research facilities.

References:

1. Gupta, A. et al., 2017. Multifunctional Nanohydroxyapatite-Promoted Toughened High-Molecular-Weight Stereocomplex Poly(lactic acid)-Based Bionanocomposite for Both 3D-Printed Orthopedic Implants and High-Temperature Engineering Applications. ACS Omega, 2(7), pp.4039–4052.

2. Prasad, A., Bhasney, S., et al., 2017. Biowastes Processed Hydroxyapatite filled Poly (Lactic acid) Bio-Composite for Open Reduction Internal Fixation of Small Bones. Materials Today: Proceedings, 4(9), pp.10153–10157.

3. Prasad, A., Sankar, M.R. & Katiyar, V., 2017. State of Art on Solvent Casting Particulate Leaching Method for Orthopedic ScaffoldsFabrication. Materials Today: Proceedings, 4(2), pp.898–907.

Effect of fuel preheating and injecton pressure for improving thermodynamic efficiency of diesel engine run with methyl ester oil

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Nowadays, biodiesel considered as the most desirable alternatives for substitute of fossil diesel fuel partly or entirely to share the burden a fast depleted diesel fuel and reduce environmental issues [1,2]. A direct use of pure biodiesel in existing diesel engine is constrained due to its higher viscosity and density, poor cold flow properties, and lower heating value than diesel fuel which affects the fuel atomization and vaporization which leads combustion inefficiency [3,4]. Most of biodiesel fuel properties are similar to diesel but it has a relatively higher viscosity and density, which leads poor fuel atomization, mixing process and combustion efficiency leads decreased engine performance parameters. However, if this biodiesel is preheated prior to fuel injection into the engine, then there will be significant improvements of fuel injection characteristics. In this regards, a biodiesel preheater is attempted to designed, fabricated and used in a diesel engine for heating biodiesel. The preheating is achieved through waste exhaust gas passing through the preheater with subsequent integration to the diesel engine. It was seen that viscosity and density of Palm Oil Methyl Ester (POME) decreased with increasing fuel inlet temperature, and the POME requires a minimum of 90 0C heating temperature to bring down its viscosity to that of diesel fuel at 400C. It has been found that the viscosity and density of POME are substantively reduced (8.71 mm2s-1 and 946 kg/m3 at 270C) to (4.32 mm2s-1 and 871 kgm-3 at 102 0C), respectively, which are very close to diesel fuel viscosity (3.47 mm2s- 1) at 400C and density (842 kgm-3) at 15 0C. The useful energy of preheated POME significantly improved with a reduction of uncounted energy loss by 5.68 % compared to diesel fuel. The exergy destruction drops with increased fuel injection pressure and load for preheated POME. The amount of exergy output of diesel engine for preheated POME slightly improved as compared with diesel fuel. The thermal and exergetic efficiency of diesel engine run with POME was improved with increased fuel injection pressure. The exergetic efficiency of the diesel engine for preheated POME was lower by 6.77 % than thermal efficiency. It was concluded that POME preheated to between 90-102 0C temperature ranges could be used as a diesel fuel substitute for engine operation.

The experimental setup consists of a single cylinder, four stroke, variable compression ratio, direct injection, diesel engine rated at a constant speed of 1500 RPM and 3.5 kW power output. It is connected to an eddy current dynamometer for loading engine crankshaft. The setup contains two fuel storage tanks for diesel and biodiesel with important measuring metric glass burettes. The primary objective of the study is to investigate the combined effect of varying fuel injection pressure and preheating biodiesel for maximizing the thermodynamic efficiency of a diesel engine run with neat methyl ester oil (biodiesel). The experimental parameters are set to conduct the effect of varying injection pressure (224 212, 200 and 188 bar) at varying engine load (0–12 kg) with an increment of 2.4 kg (20 %). Table1: The engine brake thermal efficiency (%).

Table1: The engine brake thermal efficiency (%).

Fuel Injection Pressure (bar)	Fuel	Engine Thermal efficiency (%)					
		0% Load	20% Load	40% Load	60% Load	80% Load	100% Load
224	D100	0.95	11.30	18.41	23.32	25.15	27.76
	PBD100	0.81	9.39	15.72	20.33	23.76	26.46
212	D100	1.01	10.24	16.96	21.68	23.64	26.26
	PBD100	0.87	8.64	14.69	19.12	22.48	25.11
200	D100	0.82	8.55	14.52	18.97	22.28	24.96
	PBD100	0.80	7.97	13.77	18.10	21.39	24.02
188	D100	0.67	7.90	13.61	17.87	21.15	23.77
	PBD100	0.69	7.43	12.92	17.09	20.35	21.99

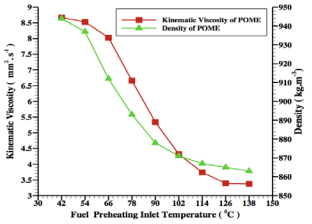

Fig.1: The effect of fuel preheating on kinematic viscosity and density of POME

References

[1] Rimos, S., Hoadley, A. F., and Brennan, D. J., 2014, "Environmental consequence analysis for resource depletion," Process Safety and Environmental Protection, 92(6), pp. 849-861.

[2] Nogueira, L. A., 2011, "Does biodiesel make sense?," Energy, 36(6), pp. 3659-3666.

[3] Joshi, R. M., and Pegg, M. J., 2007, "Flow properties of biodiesel fuel blends at low temperatures," Fuel, 86(1), pp. 143-151.

[4] Hazar, H., and Aydin, H., 2010, "Performance and emission evaluation of a CI engine fueled with preheated raw rapeseed oil (RRO)–diesel blends," Applied Energy, 87(3), pp. 786-790.

ANFIS Based Kinematic Analysis of a 4-DOFs SCARA Robot

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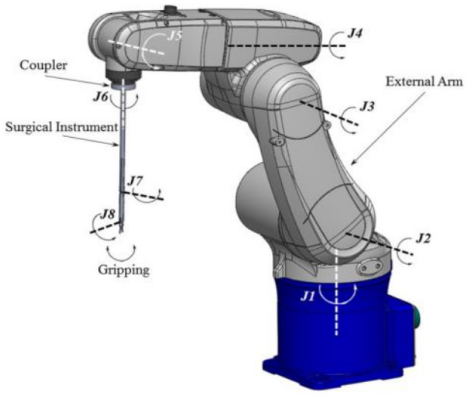
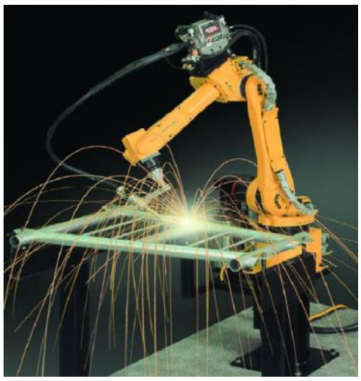
Robot kinematics plays a crucial role in recent advancements within industrial sectors and numerous medical applications. Finding forward kinematics, using DH convention is an easy task. As compared to forward kinematics, finding the inverse kinematics solution is far more challenging problem, especially when degrees-of-freedom (DOFs) are more. That is why; there is no general solution to the inverse kinematic problem of a given serial manipulator. This led to the development of alternate technique like fuzzy inference system (FIS) and neural network approach (NNA). This idea uses the combination of above two techniques, called as adaptive neuro fuzzy inference system (ANFIS), along with Gaussian membership function, in order to address the kinematic analysis of a 4-DOFs SCARA robot. The inverse kinematic solutions obtained using ANFIS are further utilized for desired path generation by the SCARA robot. Further, the complete analytical solution is developed in MATLAB environment for the validation purpose. It has been demonstrated with simulation runs that ANFIS results are satisfactory and are found in close approximation with analytical solutions.

In medical assisted surgery, importance of end effector's position of a robotic device is really appreciable for better accuracy and precision [1]. It is a well-known that robots perform a vital role in many industrial applications like pick and place operations, welding, soldering, painting etc. [2]. The protein position in the metabolism of human being can also be determined using robot kinematics [3].





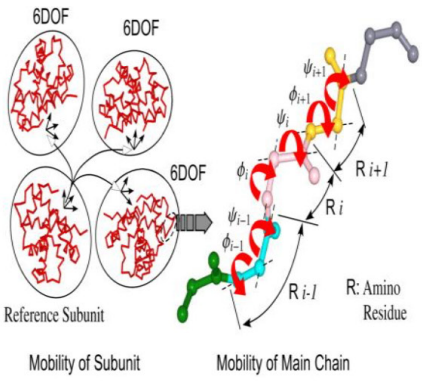


Figure 1: Surgical Robot [1] **Figure 2: Arc Welding by Robot [2]** **Figure 3: Protein Structure [3]**

With the consideration of robot applications, in this work, it is concluded that finding inverse kinematic solutions for 4-DOFs SCARA robot with conjugation of fuzzy logic and neural networks as an artificial intelligent technique supports potential conformity with respect to the analytical approach at much lower computational cost. One of the remarkable advantage of this artificial intelligent technique is the avoidance of non-linear and non-closed form solutions for higher DOFs manipulators. Even, inverse kinematic equations are not required in this approach for finding the joint parameters, unlikely in analytical one. Thereafter, path generation by the same manipulator for desired path within the trained workspace has been done by ANFIS approach, showing quite less error. However, if the desired path is out of the trained domain, the ANFIS solutions may behave erratically. Further work can be done on the training parameters like number and type of membership functions, number of epochs etc. Moreover, complex shape path and obstacle avoidance using ANFIS approach is possible and will be presented in future.

Design of a Motorized Wheelchair Exoskeleton for Paraplegic People

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Mobility is a fundamental element of an individual's daily life. An independence of motion allows a person to perform the basic daily needs of life. Unfortunately, damage to the nervous system due to medical conditions, such as stroke, nerve injury, Parkinson's disease, or even genetic disorders, may lead to a person losing his/her muscle function, and as a result the ability to move. Such a condition of inability to perform motion is known as paralysis.
In India due to economic and social factors, majority of the paralytic patients opt for manual wheelchairs as a means to restore their mobility. But these pose a few limitations such as use on uneven terrain, bruising, and limited independent use by elderly because of the lesser body strength needed to drive the wheelchair. Thus the need is to develop a cheaper, more efficient solution in the form of a motorized wheelchair exoskeleton, which can restore mobility in a much better way, and simultaneously act as a means of rehabilitation, while keeping the overall cost less.
The present work proposes the design of a novel motorized wheelchair exoskeleton mechanism to provide locomotive assistance and physical rehabilitation to paraplegic patients in the age group of 20 years to 75 years. The aim is to come up with a device which along with fulfilling all the mobility requirements, stays lighter in comparison to the already existing exoskeletons in the market. Moreover, the mass and cost reduction should not be achieved at the cost of decreased strength and safety of the device. A thorough review of literature was performed to come up with design objectives and specifications. These were used as a basis for design of all parts associated with the mechanism. Height adjustability has been achieved by use of telescoping leg links. Cost reduction has been achieved by multi-use of actuators, which involves use of same set of motors for both rear wheel and hip joint actuation, and another set of linear actuators for knee actuation and transformation from sitting to standing position. A cam and cam-follower based mechanism for passive actuation of foot while walking has also been proposed. A MATLAB programme was written to study the human gait cycle required for producing an ergonomically correct motion of the leg exoskeleton mechanism. Mathematical calculations to estimate the maximum torque requirements at hip and knee joints in static conditions were also conducted. Further static structural analysis using ANSYS software was conducted for various parts of the mechanism to ensure safety under static conditions.

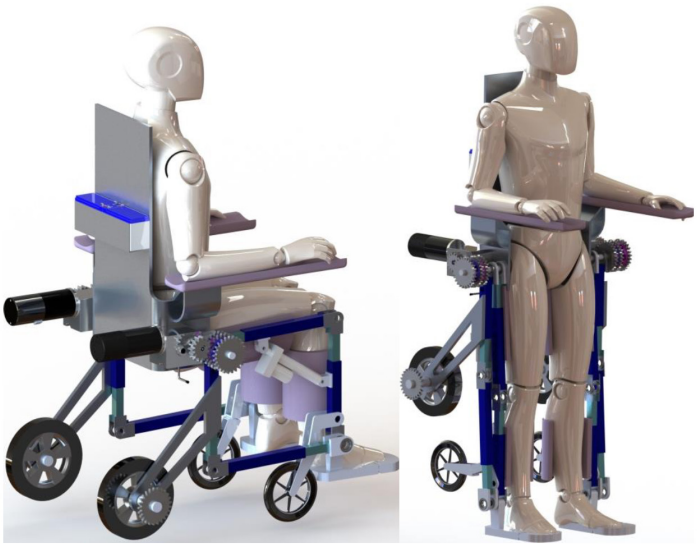

Figure1: Current design in wheelchair and exoskeleton modes

Calcium phosphate coating on Ti-6Al-4V alloy using RF magnetron sputtering process

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Demand for artificial implants for orthopaedic and dental applications has been tremendously increasing in recent days. Thus different studies have been carried out to develop and improve the quality of implant regarding its functionality, durability and biological response. Titanium alloy (Ti-6Al-4V) is widely used as load bearing material for orthopaedic implant due to its lightness, high specific strength and corrosion resistance [1]; however, it cannot exhibit any positive influence on tissue and cell behaviour. Therefore bonding between host tissues and the implants are not formed easily, which leads to poor osseointegration [2]. So, in the current study, the morphology and composition of Ti-6Al-4V surfaces are modified by calcium phosphate (CaP) coating to overcome the above mentioned problems. Radio frequency (RF) magnetron sputtering process is used to coat CaP on Ti-6Al-4V for 6 hour, as shown in Fig. 1(a). The molecular phase, surface morphology and elemental composition are analysed using X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM) and energy dispersive spectroscopy (EDS), respectively. A thin film with thickness of 700 nm is obtained for sputtering time of 6h and the surface morphology is shown in Fig. 1 (b). The surface roughness and wettability are investigated using non- contact type profilometer and goniometer, respectively and compared with that of uncoated Ti-6Al-4V. The contact angle decreases from 89.6±2° to 61.2±2° with CaP coating, indicating enhancement of hydrophilicity. The scratch resistance behaviour CaP coating is studied by scratch tester. There is a remarkable improvement in wt% HA on the film after immersion in simulated body fluid (SBF) for 7 days. Small globular-elliptical as well as bone like structure are nucleated and grew on the sputtering film, after SBF immersion, indicating formation of apatite layer (Fig. 1 (c)). These results suggest that sputtering of CaP film improves wettability, mechanical properties as well as bioactivity of Ti-6Al-4V, which can be applied for orthopedic implants.

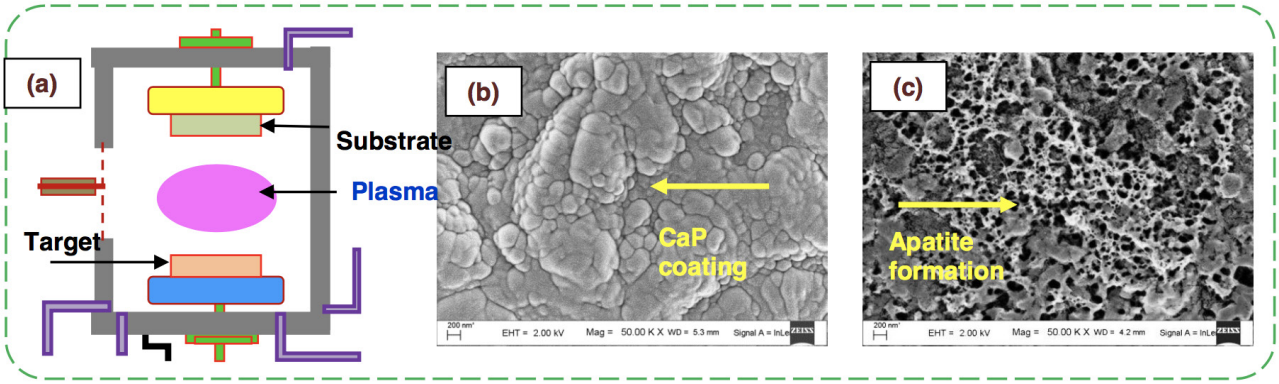

Fig. 1 (a) Schematic diagram of RF magnetron sputtering process, surface morphology of CaP coating film (b) before and (c) after immersion in SBF

References

[1] Adeleke, S.A., Ramesh, S., Bushroa, A.R., Ching, Y.C., Sopyan, I., Maleque, M.A., Krishnasamy, S., Chandran, H., Misran, H., Sutharsini, U., 2018. The properties of hydroxyapatite ceramic coatings produced by plasma electrolytic oxidation. Ceram. Int. 44, 1802-1811.

[2] Meng, L.N., Wang, A.H., Wu, Y., Wang, X., Xia, H.B., Wang, Y.N., 2015. Blind micro-hole array Ti6Al4V templates for carrying biomaterials fabricated by fiber laser drilling. J. Mater. Process. Technol. 222, 335-343.

Abstracts (Poster)

Nanotechnology

Studies on Antimicrobial Activities of Some of the Indigenous Herbs Against Aureimonas altamirensis, an Opportunistic Human Pathogen Associated with Cotton Fabric

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The inherent properties of the textile fibers provide scope for growth of various forms of microorganisms. In some cases, these microorganisms lead to unpleasant odors, staining, fabric deterioration, and even can cause physical irritation, such as skin allergies, skin infections and other medical issues.Aureimonasaltamirensis is an aerobic Gram-negative bacillus and is a potential opportunistic pathogen of humans, causing inflammation of the lining of the inner wall of the abdomen (peritoneum). The bacterium was recently found to be associated with used cotton fabrics of hot and humid climatic conditions of Assam and was reported to be associated with cotton fabric deterioration. This raises potential scope for the microorganism to enter into the elementary canal of the user from cotton fabrics.

Bioremediation is a natural and cost effective method to deal with microorganisms and can be perceived by public as an acceptable treatment process for different microbial agents. Therefore, we initiated this work to test antimicrobial susceptibilities of Aureimonasaltamirensis against 22 local herbs with known ethno-medicinal values using the agar diffusion method. Syzgiumcumini and Phyllanthus fraternusshowed the best results against the pathogenic bacterium A.altamirensis. It was also found that the antimicrobial properties of the two plant extracts can remain till 11 washes and laundering procedures. These results will help to formulate herbal extract recipes to stop microbial contamination in cotton fabrics and will assist the community to get rid of humidity related health issues.

Key Words - Aureimonasaltamirensis, Bioremediation, Human, Opportunistic pathogen.

Development of docetaxel loaded nanoliposomes for the treatment of brain tumor

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Docetaxel (DTX) delivery to brain to treat solid tumor of brain (glioma) is very difficult and challenging due to the physicochemical and pharmacological characteristics of the drug. To overcome this challenge and having effectiveness in glioma cell line in vitro, nanoliposomes of docetaxel have been developed by lipid layer hydration technique to attain ability to cross blood brain barrier and were characterized in vitro. Cellular uptake by C6 glioma cells was also investigated. The vesicles were unilamellar with around 50 nm size with smooth surface. Drug released slowly and in a sustained manner from the liposomal formulation. The pharmacokinetic data shows more extended action of DTX from liposomes in experimental rats than the free drug and marketed product. Thus, nanoliposomes (as vehicle for DTX) may be a promising approach to treat glioma with DTX.

In-Situ polymerization of aniline with GO/RGO using exfoliated MnO2 dispersion based nanocomposites for the fabrication of supercapacitors

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Ternary nanocomposites of polyaniline (PANI), MnO2 and graphene oxide (GO) or reduced graphene oxide (RGO) have been prepared via in-situ polymerization of aniline monomers. The growth of entire nanocomposite formation is prepared by following a two-step method. In the first step, aniline was polymerized in the presence of GO (or RGO) dispersion, followed by the addition of MnO2 nanoflakes in the second step. The optical and structural properties of prepared nanocomposites were characterized by using UV-Vis and FTIR spectroscopy. The morphological analysis was done by using FETEM and FESEM microscopic images. The transition metal Mn exhibits a paramagnetic behaviour with low magnetic moment, which were analyzed by vibrating sample magnetometer (VSM)3. The ternary nanocomposite of MnO2 exhibits an excellent specific capacitance (690 F g-1), compared to the PANI/RGO binary nanocomposite. Such excellent capacitive performance is attributed to the exclusive microstructures, such as, nanorods, and nanoflakes shape of the nanocomposites. Further, pseudo capacitance and supercapacitance behaviour in low and high frequency region were recorded by using the electrochemical impedance spectroscopy.

Uptake and intracellular fate of nona-arginine cell penetrating peptide in yeast

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Cell-penetrating peptides (CPPs) comprise a group of peptides of about 8 to 30 amino acids in length that can be efficiently taken up by cells and mediate the uptake of the conjugated cargo (Milletti, 2012). Different mechanisms of cellular uptake of CPPs depending on their nature, concentration and experimental conditions have been proposed in literature (Madani et al., 2011). However the two most common uptake mechanisms are direct entry/energy-independent pathway and various endocytosis mechanisms (Madani et al., 2011).
In this study we analyzed the uptake of nona-arginine CPP in Saccharomyces cerevisiae cells using two methods: fluorescence microscopy and flow cytometry. The effect of different conditions like pH, temperature, and peptide concentration was studied. In addition to this we also report the subcellular localization of the peptide after internalization. Furthermore we investigated the influence of endoosmolytic agents and endocytic inhibitors on the entry of the peptide into the cell. Our results suggest that the efficiency of internalization of the peptide in yeast depends on conditions like pH, temperature and media compositions. However, no significant alteration in fluorescence intensity after a particular time point also suggests a probable saturation point for the entry of the peptide. These findings will enable us to understand in detail the mechanism of entry of arginine CPP in yeast cells which can be used as a promising tool for several cell biology related studies.

References

Madani, F., S. Lindberg, Ü. Langel, S. Futaki, and A. Gräslund. 2011. Mechanisms of cellular uptake of cell-penetrating peptides. Journal of Biophysics. 2011:414729.
Milletti, F. 2012. Cell-penetrating peptides: classes, origin, and current landscape. Drug discovery today. 17:850-860.

In Vitro Models to Study Mechanisms and Circumvention Approaches to Radioresistant Pancreatic Cancer Cells

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Research Idea: Radiotherapy has been widely used for the pancreatic cancer (PC) treatment. Despite numerous efforts in the cure of pancreatic cancer in the last decade the overall survival rate (< 5 years) has not significantly improved. The poor success in the management of pancreatic cancer is due to frequent late diagnosis of pancreatic cancer, scarcity of effective therapeutic agents and most significantly the frequent occurrence of chemo and radioresistance in pancreatic cancer. The main purpose of the research project is to develop and characterize radioresistant human pancreatic cancer cell lines, to identify genes which are differentially expressed (mRNAs and miRNAs) and proteins which play key roles in conferring the radioresistance behavior in pancreatic cancer radiotherapy. The human pancreatic cancer cells Panc1, BxPc-3, Pk-1 and MiaPiaCa2 will be treated with fractionated irradiation to establish radioresistant pancreatic cancer cells. The microarray and proteomics analysis followed by bioinformatics data processing will be employed to identify the key genes and their related functions in the complex mechanisms of radioresistance which will provide new insights into the development of potential strategies to overcome the radioresistance. The in vitro and in vivo functional analysis of identified genes will help to develop selective targeted treatments in combination with radiotherapy and to find novel combinations of existing chemotherapeutic agents with radiotherapy in treatment to prolong the survival rate in patients diagnosed with pancreatic cancer. The research project will also include concurrent in vitro chemoradiation treatment to investigate novel combinations of chemotherapeutic agents (Chk inhibitor, Akt inhibitors and gemcitabine) with radiotherapy which may radiosensitize the pancreatic cancer cell lines.

Key words: Pancreatic cancer, radioresistance, proteomics, gene expression analysis.

Nano-materials Based Field Effect Transistor for Sensing Applications

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Abstract: Monitoring any phenomenon, be it physical or chemical, demands its proper quantification. Sensors are the only way towards achieving that end and electrical sensors are by far, the most superior among all of them. Field effect transistors (FET) are at the heart of any electronic integrated circuit. However, since its introduction, it has been implemented for a plethora of sensing applications, ranging from gas sensing to bio-sensing. [1-4] In comparison to a resistive device configuration, the FET in itself has the advantage of an extra electrode, the gate. On one hand, it gives extra control over the device and on the other, sensing through multiple parameters like current, threshold voltage etc. is made possible. Nanotechnology is the current buzzword; new materials and their nano-technology aspect has opened up new horizons of research in every fields of science. While the materials provide a selective nature to the sensors, the 'nano' dimension presents a large surface area to volume ratio. These make them very effective either as the active transducer or as the harbour for immobilising the relevant sensing elements. The conjugation of FET and nano-materials have attracted a lot of research in the recent times, but a comprehensive study is necessary in this direction. In view of that, the present study discusses the existing chemical and bio-sensors which have implemented the synergistic interaction of FET configuration and nanotechnology.

Refernces:

1. Torsi, L., Dodabalapur, A., Sabbatini, L., Zambonin, P., 2000. Multi-parameter gas sensors based on organic thin-film-transistors. Sens. Actuat. B Chem. 67, 312–316.
2. Liu, S., Guo, X., 2012. Carbon nanomaterials field-effect-transistor-based biosensors. Npg Asia Mater. 4, e23.
3. de Moraes, A., Kubota, L., 2016. Recent Trends in Field-Effect Transistors-Based Immunosensors. Chemosensors 4, 20.
4. Feng, P., Shao, F., Shi, Y., Wan, Q., 2014. Gas sensors based on semiconducting nanowire field-effect transistors. Sensors 14, 17406–17429.

Paper-based self-propelling microcleaners for efficient water purification

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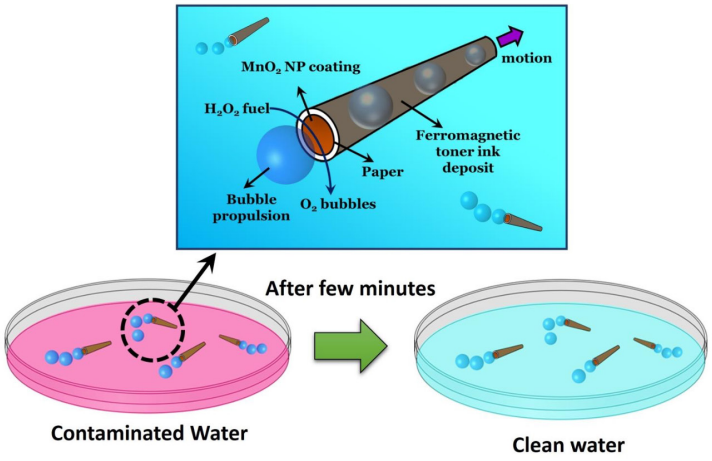
In the recent past, researchers have shown enormous interest in the development of self-propelling tubular microengines and employed them to perform promising applications ranging from drug delivery applications to environmental remediation. Clearly, a facile and cost-effective technique can be thought of for the fabrication of these tubular microengines. In this context, we report the synthesis of a paper-based microcleaners, which shows self-motility under chemical and magnetic controls. These self-propelling microcleaners were prepared from the printed office waste papers coated with self-assembled manganese dioxide (MnO2) nanoparticles. The magnetic remote control was achieved due to the ferromagnetic coating of the printer ink on the microengine's exterior wall. The presence of the MnO2 nanoparticles in the inner core of the microjet exhibited the catalytic reaction between the core and the supplied peroxide (H2O2) fuel, giving rise to the oxygen (O2) bubble formation and subsequent forward propulsion of the motor. The increase in peroxide fuel concentration improved the bubble-ejection rate, which in turn elevated the velocity of the microcleaners. This reported fabrication protocol provided an economical procedure for the development of bubble-propelled catalytic microcleaners, which are capable of chemo-magnetic locomotion. We performed a series of experiments to demonstrate the efficiency of microcleaners for the removal of water contaminants. These biodegradable chemo-magnetic microcleaners were able to degrade the organic water pollutants with high efficiency in the presence of peroxide fuel, hence making them an economic and efficient material to clean natural water sources.

Figure 1: Schematic diagram of the paper-based tubular microcleaners in action. The manganese dioxide nanoparticle



(MnO2NP) coated inner wall (lighter brown shade) activated the catalytic decomposition of H2O2 to accumulate the O2 bubbles inside the tubular cavity. The bubbles grew in size along the length of the tube and detached at the end. The issuance of the O2 bubbles out of the microjets provided the required thrust for motion. The toner ink of printer led to the magnetic layer (darker grey shade), which facilitated magnetic control of the microcleaners. The microcleaners were able to degrade the dye pollutants the presence of peroxide fuel within few minutes.

Development of diagnostic device employing nanoparticle based sensor

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Nanoscience and nanotechnology have given immense opportunity to develop specific and sensitive sensors for biomedical applications. A major portion of recent day's research is directed towards the development of nanoenabled point -ofcare diagnostic devices to detect different diseases at their early stages. Among many other diseases, chronic obstruction pulmonary diseases (COPDs) are also one of the common diseases that have influenced the health condition of the society by and large. Increasing rate of air pollution in urban as well as sub-urban areas, is effecting the lung health of the inhabitants at an alarming rate. Many of the city-dwellers now a days suffer from lung congestion which leads to asthma attack in frequent intervals. Moreover, in a country like India, the lung problem is very highly prevalent among children and is a major cause of childdeath.

In this direction, a humidity sensor based POCT device has been developed to detect lung diseases at its early stage. [1, 2] The sensor has been fabricated using CdS nanoparticle on paper substrate. The proposed system shows a change in resistance across the sensor in presence of humid air. A significant change in resistance ($\Delta R \sim 80\%$) has been observed in presence of 96% of humid air. It has been reported that the human exhaled air is highly humid and thus a forced exhalation on the sensor could detect the peak flowrate of the lungs, which is an important parameter to diagnose lung health. The sensor h as also been integrated with a Cu-wire based heater to improve the recovery time. Hence, the proposed device is capable of detecting lung diseases at its early stages.

References:

1. Mitradip Bhattacharjee, Harshal Nemade and Dipankar Bandyopadhyay, "Nano-Enabled Paper Humidity Sensor for Mobile Based Point-of-Care Lung Function Monitoring", Biosens. Bioelectron., 2017, 94: p. 544-551.
2. Mitradip Bhattacharjee, Dipankar Bandyopadhyay, and Harshal B. Nemade, "A lung condition monitoring device.", Indian patent application number: 201631033190A dated 28-09-2016. [PCT Appl.No. PCT/IN2017/050363 dated 29-08-2017]

MWCNT, AuNP nanocomposite based POCT sensor for quantitative detection of urea in biological samples

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Presence of urea in blood is an important parameter and is a basic criterion to foresee human health and related biochemical activities. A lot of disorders can be anticipated by amount of urea present in blood1,2. Present work deciphers a technique of developing nanomaterial based chemi-resistive sensor to quantify urea in aqueous solution. Multiwall carbon nanotube (MWCNT) is used as a channel material. MWCNT has inherent semiconducting property which had been exploited here to make the base resistor with aluminium at the both ends as electrodes3-5.

A 1cm×1cm glass slide had been taken and aluminium electrodes were deposited by thermal beam evaporation. MWCNTs are functionalized using oxidation of MWCNTs in a (1:3) HNO3/H2SO4 mixture followed by ultra-sonication for 4 hours at room temperature to enhance the sensitivity and selectivity of chemi-resistive sensors. The acid oxidized MWCNTs are washed thoroughly with deionized water until the pH of the filtrate became neutral. 10 µl of aqueous solution of carboxylic substituted MWCNT is dispensed between the two electrodes and dried for 30 min in a hot air oven. The I-V characteristics of the sensor has taken by using sourcemeter. Now, 10 µl of starch coated gold nanoparticle solution was dispensed on top of the MWCNT layer and was dried for 30 min. A considerable depression of current and hence the increment of the resistance was observed after putting the payer of starch coated AuNP layer which is quite obvious because of the low conductivity of the starch. Different concentration of urea solutions was dispensed on the sensor surface and allowed to react at 220° C to ensure the complete reaction.

Starch urea reaction exposes the capped AuNP and the changes were detected by I-V characteristics and quantification of urea owes to the change of I-V characteristics because of the reaction. Fabrication of these kind of sensor is very much cost effective and also easy to detect. An electronic circuit can be integrated with this sensor and the device can be made a portable digital device.

Keywords: MWCNT, AuNP, Sensor, Urea.

References:

1. Gowda, S.; Desai, P. B.; Kulkarni, S. S.; Hull, V. V.; Math, A. A. K.; Vernekar, S. N. Markers of renal function tests. North American Journal of Medical Sciences 2010, 2 (4), 170-173.

2. Rachoin, J.-S.; Daher, R.; Moussallem, C. The fallacy of the BUN: creatinine ratio in critically ill patients. Nephrol Dial Transplant 2012, 27.

3. Hu, H.; Zhang, T.; Yuan, S.; Tang, S., Functionalization of multi-walled carbon nanotubes with phenylenediamine for enhanced CO2 adsorption. Adsorption 2017, 23 (1), 73-85.

4. Fennell, J. F.; Liu, S. F.; Azzarelli, J. M.; Weis, J. G.; Rochat, S.; Mirica, K. A.; Ravnsbæk, J. B.; Swager, T. M., Nanowire Chemical/Biological Sensors: Status and a Roadmap for the Future. Angewandte Chemie International Edition 2016, 55 (4), 1266-1281.

5. Bannov, A. G.; Jašek, O. r.; Manakhov, A.; Márik, M.; cas, D. N.; cková, L. Z., High-Performance Ammonia Gas Sensors Based on Plasma Treated Carbon Nanostructures. IEEE sensors journal 2017, 17 (7), 1964-1970.

Affordable Medical Diagnostics

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The modern era demands bio-devices which are easily accessible, portable and as cheap as possible. Accordingly, the fabrication methods along with the materials used have to be conditioned. In this regard, a microfluidic system provides novel functions due to smart geometries. Fabrication of a microfluidic device is mostly done with polydimethylsiloxane (PDMS) owing to its exceptional elastic property, optical transparency, ease of operation and biological compatibility. Most frequently used detection technique of biological samples is electrochemistry and fluorescence. Although these methods are effective, they are mostly being fabricated for research purpose. Further explorations in these areas need to be made as they show great biosensing potential. Certain factors such as sensitivity, selectivity, response time and stability of the biosensor should be improved. Environmental concern and disposal of biological tools are some of the important issues which need attention. With the rising population, cities have become more and more polluted. There is a specific disregard of proper waste disposal. Even, there is no dutiful system for medical disposals. Also, most of the medical devices may consist of carcinogenic elements which could prove to be harmful. As such, a high risk to human live arises. The biosensors which are developed should not be confined to laboratories alone. It should be commercialized and made readily available for improving the healthcare condition of patients. Our work involves developing such cost effective flexible biomedical devices for green sensing.

Adverse Effect Of Processed Food On Human Health

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Today, the majority of foods that humans consume are processed to some extent. "The term 'food processing' is mainly defined as a process of mechanical or chemical operations to change or preserve it by various methods like grading, , concentrating, pressurizing, irradiating, microwaving, sorting and packaging" (Floros et al.,2010). Food processing industry is one of the largest industry in India and is ranked 5th in terms of production, consumption and export (Anwar et al.,2017). Both fresh and processed foods make up vital parts of the food supply. Processed food has a bad reputation and some consider it to be not good for health, as they are loaded with sweeteners, salts, artificial flavors, factory – created fats, coloring chemicals- that alter texture & preservatives. Regular consumption of processed foods has a tremendous negative effect on our digestive system and is known to play a vital role in our nation's increasing rates of obesity, hypertension and Type II diabetes. But sometimes, processed foods are advantageous and not all of them are bad. Based on the degree of processing, all foodstuffs classified into three groups: such as "minimally processed" foods, "culinary ingredients", or "moderately processed" and "ultra-processed foods" (Monteiro et al.,2011).Ultra- processed products are unhealthy as compared with the combination of minimally processed foods and processed culinary ingredients. This method of food classification that recognises the significance of different types of food processing is essential. We believe the classification is a sound basis for the work needed to protect and improve food, nutrition and public health in all societies and circumstances worldwide.

References:

Anwar, M and Hussain, Z.(2017). Is all processed food harmful? J Nutrition health and food engineering.,6: 6-20 Floros, J.D. Newsome, R. Fisher, W. Canovas, G.V. Chen, H. Dunne, P. German, J.B. Hall, R.L. Heldman, D.R. Karwe, M.(2010) Feeding the world today and tomorrow: the importance of food science and technology. An IFT Scientific Review. Compr Rev Food Sci Food Saf.,9: 572–99. Monteiro, C.A. Levy, R.B. Claro, R.M.(2011) Increasing consumption of ultra-processed foods and likely impact on human health: evidence from Brazil. Public Health Nutr.,14: 5–13.

Magnetoresistance based nano-sensors sputtered deposited ZnO: Al thin film

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In the last few decades, magnetism coupled with nanotechnology has unlocked vast areas of research and thus nanomagnetism have elevated modern microelectronics several levels higher. Of late, magnetoresistance-based devices encompassing Giant magnetoresistance (GMR), Anisotropic magnetoresistance (AMR) and Tunneling magnetoresistance (TMR) have been used in the fabrication of nanosensors with metals, semiconductors and oxides nanoparticles. It is well known that Magnetoresistance is a phenomena that relates the externally applied magnetic field to the resistance of the material [1]. AMR effect is observed because of the change in resistivity in ferromagnetic materials with change in current direction and magnetization. GMR effect is seen in multilayers and granular structures due to antiferromagnetic exchange coupling between ferromagnetic and non-magnetic materials [2] whereas the TMR effect relies on the tunneling effect in presence of external magnetic field. The resolution and range of the response of magnetoresistive sensors can be controlled and they have shown soundly high sensitivities, portability, low cost, rapid assay because of which it has been used extensively in sensing applications especially in clinical diagnostics and computer hard drives [3]. In this study, we show the recent advancements in the field of
magnetoresistance and their applications in sensing. The study has been performed to provide a broader outlook about the phenonmenon and their applications as different sensors.

References:

1. Aguilar, Z.P., Chapter 4 - Nanobiosensors, in Nanomaterials for Medical Applications2013, Elsevier. p. 127-179.
2. Jogschies, L., et al., Recent Developments of Magnetoresistive Sensors for Industrial Applications. Sensors, 2015. 15(11): p. 28665.
3. Diana, C.L., et al., Magnetoresistive nanosensors: controlling magnetism at the nanoscale. Nanotechnology, 2016. 27(4): p. 045501.

A Novel genosensor for Invasive Aspergillosis

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Invasive Aspergillosis (IA) is one of the leading infectious disease worldwide caused by Aspergillus fumigates especially in the third world. The early detection in miniaturized settings has utmost importance to combat the disease in such demography. In this context, we have fabricated a novel electrochemical biosensor for its detections in early stages by targeting the glip gene found in virulent strains. The sensing probe has been fabricated with the nano-material assisted modified composite biomaterial. This sensor has been extensively characterized using various surface as well as electrochemical characterization techniques. The excellent analytical performances have been obtained where dynamic range was found to be $1 \times 10{-}14$- $1 \times 10{-}2$ M with the detection limit of $0.32 \pm 0.01 \times 10{-}14$ M.

Pretreatment optimization of Lantana camara for the lignocellulosic bioethanol production

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Lignocellulosic bioethanol, the second generation and environmental sustainable biofuel. High crystallinity of cellulose and presence of lignin in lignocellulosic biomass results less yield of bioethanol by direct fermentation. Pretreatment makes the cellulose and hemicellulose more accessible for enzymatic hydrolysis. In present study, Lantana camara is used as biomass, because it is a weed and not used even as fodder and has easy availability. Holocellulose content of stem and leaves were 66.75±1.06% and 58.25±1.76%, respectively. Various pretreatment methods for Lantana camara were screened. The physical pretreatment methods such as mechanical comminution and uncatalyzed autohydrolysis at neutral pH, the chemical pretreatment methods such as acid, alkali, oxidizing agent and ammonia treatment and the physicochemical pretreatment such as the combination of physical and chemical pretreatment were used. Among these pretreatments, the acid pretreatment resulted high yield of total reducing sugar (TRS). The process parameters investigated for acid pretreatment were; biomass loading 10% (w/v), H2SO4 concentration 2% (v/v) for stem and 3% (v/v) for leaves, temperature 121oC, pressure 15 psi and duration for treatment was 20 min. The TRS yield of 0.275 g/g of raw stem and 0.185 g/g of raw leaves were obtained. The ammonia pretreatment showed lowest TRS yield of 0.005 g/g of raw stem and 0.022 g/g of raw leaves. The composition analysis of pretreatment and crystallinity of pretreated biomass are being carried out. The results in details will be presented.

Keywords: Bioethanol; Lignocellulosic biomass; Holocellulose; Acid pretreatment; Total reducing sugar (TRS)

References:

1. Kumar, P., Barrett, D. M., Delwiche, M. J., & Stroeve, P. (2009). Methods for pretreatment of lignocellulosic biomass for efficient hydrolysis and biofuel production. Industrial and Engineering Chemistry Research, 48(8), 3713-3729.
2. Singh, S., Sarma, S., Agarwal, M., Goyal, A., & Moholkar, V. S. (2015). Ultrasound enhanced ethanol production from Parthenium hysterophorus: a mechanistic investigation. Bioresource Technology, 188, 287-294.

Reusable Arsenic Filtration Unit for Water Purification

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Arsenic is found in the groundwater of 20 districts of Assam which is higher than the permissible limit recommended by World Health Organisation (10μg/L). Drinking of arsenic contaminated water mainly causes lung, bladder, kidney and skin cancer. The present work describes the development of low cost water filter and the role played by CuO nanoparticles in arsenic removal from contaminated water. Nanoparticles show an excellent adsorption property due to their unique structures. Structural and spectroscopic properties of prepared CuO nanoparticles (NP) were confirmed by XRD pattern, UV-absorption spectra, FTIR spectra and Raman spectra. Morphology of prepared CuO nanoparticles were studied by SEM. Adsorption of arsenic took place on the surface of the nanoparticles which was confirmed by FTIR spectra. Arsenic concentrations were determined by using spectroscopic method. Desorption of arsenic from the surface of CuO nanoparticles were studied by treating the used CuO nanoparticles by NaOH aq.solution

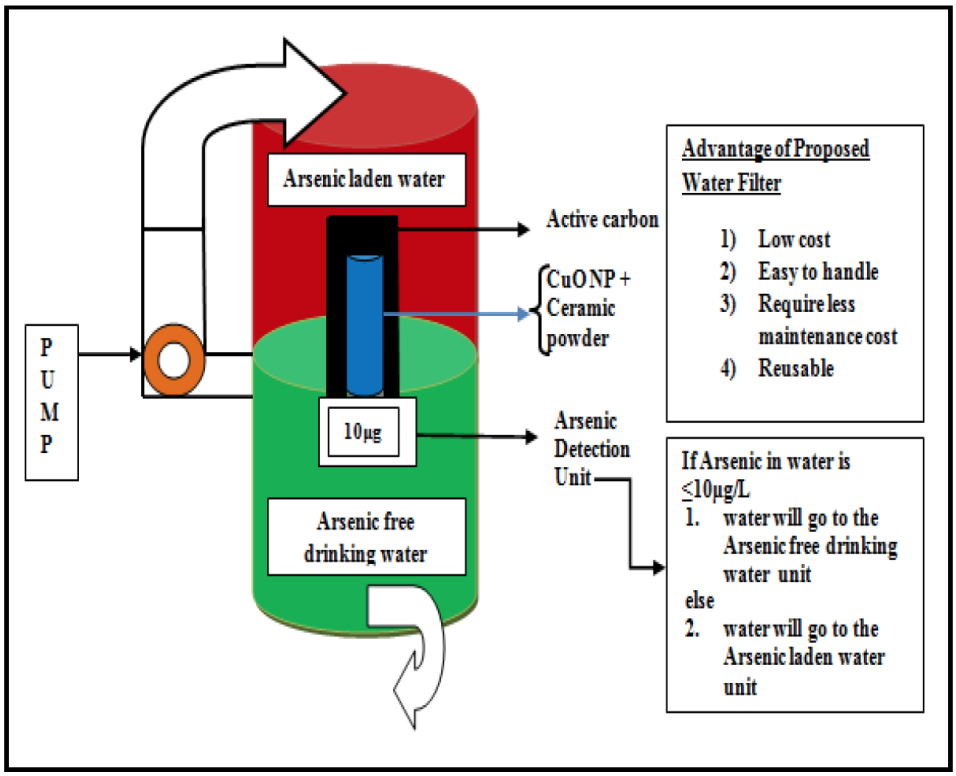

Figure1. Proposed Arsenic Filtration Unit for Water Purification as Home Appliance

Coupled resonance in SH-SAW resonator with S1813 micro-ridges for high mass sensitivity biosensing applications

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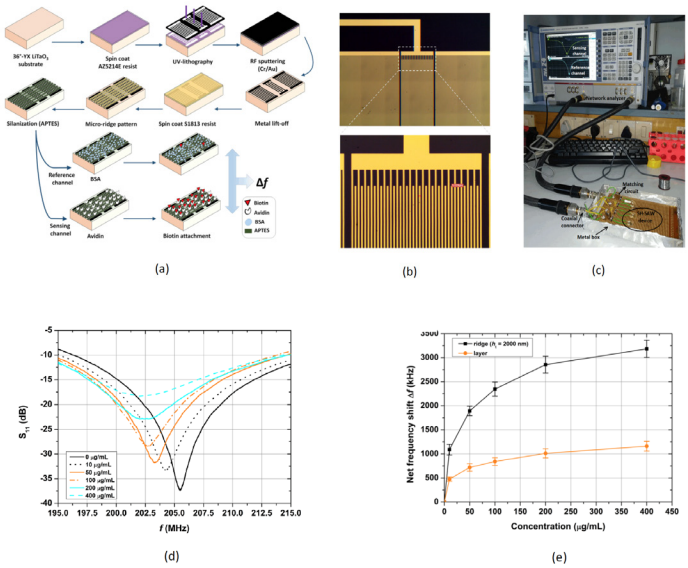
The paper presents 3D finite element simulation and fabrication of SH-SAW resonator to investigate coupled resonance in the device with S1813 micro-ridges and its potential application as a sensitive biosensor. Polymer ridges of fixed width and various heights are designed along the wave propagation direction on the surface of the resonator. The ridges are designed by photolithography and the height variation is attained by varying the spinspeed during spin coating the polymer. At a critical ridge height of about 2000 nm, the ridges and the substrate vibrate in unison causing coupled resonance with a transition between inertial and elastic loading regimes. The coupled resonance effect showing a sharp decrease and an increase in the resonance frequency of the device at the critical ridge height is observed in the experiments as well as FE simulation results. Two similar devices with critical ridge height are made as sensing and reference for detection of biotin. The S1813 ridges are silanized by
APTES and the subsequent protein attachment is confirmed by confocal microscopy. Different concentrations of biotin solution are applied on the sensing and reference devices immobilized with avidin and BSA, respectively. The device with coupled resonance offers high mass sensitivity of 6.4 kHz/(μg/mL) which is about three times greater than the mass sensitivity offered by a layered SH-SAW device.

Fig. (a) Process flow for device fabrication and biofunctionalization (b) Optical microscope image showing the fabricated IDT and the reflector grating pattern of the resonator design after the lift-off process. An electrode width of about 5 μm is realized. (c) SH-SAW devices connected to the
VNA through a matching circuit comprising a series variable capacitor and a shunt variable inductor. The frequency shift is measured by monitoring the S11 of the sensing and reference devices (d) Variation in S11 (dB) of the sensing device with frequency on adding different concentrations of biotin. (e) Net frequency shift because of mass loading with different concentrations of biotin considering device with S1813 ridges of height 2000 nm and device with plain S1813 layer of same height. Three independent measurements were performed. The error bars represent the standard deviation.



Fabrication and Development of High Performance Light Emitting Diodes

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Organic optoelectronic devices have been the most promising candidates in today's emerging technology. Since the milestone study of light-emitting diodes (LEDs), enormous efforts following the pioneering work have been focused on the improvement of devices in terms of their efficiency, stability and color tunability, making them ideal for the future display and ambient lighting. Therein, LEDs have drawn particular attention owing to their favorable merits of high efficiency, low cost, easy flexibility, large area, high resolution, and low energy consumption in the full-color display and solid-state lighting applications. OLEDs with a structure of ITO/TPD/ Alq3/BCP/LiF/Al . we got the brightness above 5000 cd/m2 , EL Spectra at 540nm and CIE coordinates(0.37,0.54).In Perovskite Based LED structure ITO/PEDOT:PSS/Perov/TPBi/ LiF/Al. Perovskite Solution made with (1:1) ratio of MACl and PbI2. PEDOT:PSS acting as a Hole transporting layer & TPBi acting as a Electron transporting Layer.

A Novel Nano-Fiber of Polycaprolactone-Silver-Zirconium Composite for Wound Healing Applications

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Electrospinning is known for its versatility to fabricate nano fibrous membranes. We are going to focus on the fabrication of nano fibers which has antibacterial property and rapid hemostasis which is suitable for wound healing. For this we are using composite of Polycaprolactone-Silver-Zirconium.

Polycaprolactone (PCL) is a biodegradable polyester with low melting point and also compatible with range of other materials. By using this we can produce porous nano fibers with large surface to volume ratio to create a moist environment around the wound area to promote healing.

Silver Nano particles extensively have characteristics like antibacterial, antifungal, antiviral. Zirconium phosphate is inorganic material that has layered structure. It is chemically stable and gives excellent results in wound healing. This study is mainly useful for first two stages of wound healing i.e.

Hemostasis and Inflammation. As healing of wound achieved in less time the total time taken for overall healing will be less. Now, using this composite material to produce nano fiber for bandage preparation, we can achieve better results in wound healing applications.

Keywords: Electrospinning; Composite of Polycaprolactone-Silver-Zirconium; Wound healing; Bandage.

Suspended Gate MOSFET as A Biosensor with Exponential Sensitivity : A Theoretical Study

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In this study, A novel method for detection of biological species based on measurement of cantilever deflection has been proposed and numerically evaluated. In this method, the ultrahigh sensitivity is achieved due to the nonlinear electromechanical coupling and thus it overcomes the fundamental limits of classical electrical or mechanical nanoscale biosensors. The stiffness of the Suspended Gate changed upon capture of the biomolecules and the corresponding changes in the gate shape or **deflection in translated to change in the gate current.** Thus with different concentrations of the target molecules, the deflection varies and results in different current voltage characteristics of the device which can be easily measured using simple apparatuses. To achieve the high sensitivity , **the gate is biased near pull in stability and the MOSFET channel is biased in sub threshold regime.** In order to verify the proposed method, the performance of system has been theoretically analysed **using COMSOL multiphysics platform. This method also gives the advantage of label-free detection of biomolecules.**

References:
1. Arlett J, Myers E, Roukes M (2011) Comparative advantages of mechanical biosensors. Nat Nanotechnol 6:203–215
2. Gao X, Zheng G, Lieber C (2010) Subthreshold regime has the optimal sensitivity for nanowire FET biosensors. Nano Lett 10:547–552.
3. Bunimovich Y, et al. (2006) Quantitative real-time measurements of DNA hybridization with alkylated nonoxidized silicon nanowires in electrolyte solution. J Am Chem Soc 128:16323–16331.
4. Wee K, et al. (2005) Novel electrical detection of label-free disease marker proteins using piezoresistive self-sensing microcantilevers. Biosens Bioelectron 20:1932–1938
5. Ankit Jain, Pradeep R. Nair and Muhammad A. Alam .PNAS 2012 June, 109 (24) 9304- 9308. https://doi.org/10.1073/pnas.1203749109

Biological removal and recovery of selenium from wastewater

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Selenium (Se), an essential toxin is now becoming a matter of increasing concern to natural ecosystems due to its bioaccumulation potential. Industrial activities that include energy generation, metal and oil refining, mining and agricultural irrigation generate effluents tainted with Se. Biological selenium reduction has emerged as the leading technology for removing selenium from wastewaters since it offers a cheaper alternative compared to physico-chemical treatments as it has overcome the overlying limitations of separation and appropriate disposal of the solid phase, relatively high cost, energy consumption and so on. Moreover, biological treatment has the advantage of forming elemental selenium nanospheres which exhibit unique optical and spectral properties for various industrial applications, i.e. medical, electrical, and manufacturing processes. Microbial reduction of soluble oxyanion (SeO_3^{2-}, SeO_4^{2-}) to insoluble nanoparticulate elemental selenium (Se0) can be achieved in a number of bioreactor configurations that are emerging as a viable bioremediation option as an efficient large scale basis. Various bioreactors such as upflow anaerobic sludge blanket (UASB), fluidized-bed bioreactors (FBBR), packed-bed bioreactor, membrane biofilm reactor (MBfR) systems have been adapted for Se treatment. This review highlights the significance and efficiency of different bioreactor configurations in treating Se contaminated wastewaters.

Keywords: Selenium, Wastewater, Biological treatment, Bioremediation

Abstracts (Poster)

Physics

Exoplanets: The Era Beyond Earth

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The universe is a harsh cold empty place that doesn't allow life to form but somehow earth created a sanctuary that made our existence possible. It is incredibly unlikely but the fact that it happened once means that may be it happened again. Up until 1995, exoplanet was just a theoretical concept but all that changed after the discovery of 51 Pegasi b, a sun like star which supported a hot Jupiter like planet[1]. Due to the reflexive motion (wobbling) of the star and the planet we can observe the blue and the red shifts caused by the light from the star. The size, density and number of planets orbiting the star are determined using the Radial velocity method - one of the first methods that led to discovery of exoplanets but it was limited to only hot Jupiter like planets[2]. Recent technique like studying light curves using transit photometry has contributed significantly in this field.

In this presentation we describe various methods that are involved in order to identify an exoplanet. We discuss how to predict the planet's size, density, speed, distance from the star and composition of the atmosphere (if present). We also discuss the missions conducted by NASA like the Kepler Mission and the K2 mission and their contributions to finding of exoplanets. We also throw some light into discoveries which are nearly earth like planets like the Kepler 438b, Kepler 442b, Kepler 452b, Gliese 667c[3,4,5]. The future prospect of exoplanet hunting looks promising. We deliberate over the development of new techniques and technology. With the development of ground based Extremely Large Telescopes (ELTs) and the James Webb Space Telescope the viewing of the universe will be much resourceful. We discuss the newer methods like gravitational microlensing, astrometry and simulation methods which are game changing in planet hunting[6,7,8].

2. References

[1] M. Mayor & D. Queloz, Nature, (1995), 378, 355
[2] L. Doyle et al, Journal Geophys. Res, (1996), 101,14823
[3] I. Crossfield et al, The Astrophysical Journal, (2015), 804, 10
[4] G. Torres, The Astrophysical Journal, (2015), 800, 99
[5] J.M. Jenkins et al, The Astronomical Journal, (2015), 150,56
[6] K.C. Sahu & R.L. Gilliland, The Astrophysical Journal, (2003), 584,1042
[7] www.nasa.gov/kepler/discoveries
[8] http://exoplanetarchive.ipac.caltech.edu

Hydrogenated amorphous silicon based thin film solar cells on low cost photo paper and polyimide sheets

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Flexible substrates are light weight, low cost and compatible with the roll-to-roll printing process. Here we report hydrogenated amorphous silicon (a-Si:H) thin film solar cells fabricated at substrate temperature 150 oC on flexible photo paper and polyimide substrate using plasma enhanced chemical vapor deposition (rf-PECVD) multichamber system. The influence of i-layer thickness on the solar cell efficiency was studied. It was observed that for solar cell on photo paper substrate best efficiencies were observed for i-layer thickness at ~ 200 nm with short-circuit current density (Jsc), open circuit voltage (Voc), fill factor (FF) and efficiency (η) as 7.17 mA/cm2, 610 mV, 0.35 and 1.54% respectively. Whereas on polyimide substrate i-layer thickness at ~ 700 nm showed best performance with Jsc, Voc, FF and η as 11.22 mA/cm2, 787 mV, 0.52 and 4.38% respectively. Our studies show that it is possible to fabricate solar cells at low substrate temperature on cheap and flexible substrates. The study show that PP could also be a potential flexible substrate for the fabrication of cheap and stable silicon based solar cell. Further optimization is expected to increase the efficiency on photo paper substrate.

2. Acknowledgment:
The PECVD system used for deposition of Si films and solar cells is supported by the funds received from DST (Grant No. DST/TM/SERI/2K11/78(G)) and DRDO. (Grant No. ERIP/ER/0900376/M/01/1297) New Delhi, India. We thank central instrument facility (CIF), IIT Guwahati for spectroscopic ellipsometry and Raman measurements.

3. References

1. H.-M. Lee, S.-B. Kang, K.-B. Chung and H.-K. Kim, Appl Phys Lett 102 (2), 021914 (2013).
2. S. Y. Myong, L. S. Jeon and S. W. Kwon, Thin Solid Films 550, 705-709 (2014).
3. M. Trifunovic, T. Shimoda and R. Ishihara, Applied Physics Letters 106 (16), 163502 (2015)

Constructing Kinetic Network Model of Thrombin-Binding Aptamer Using Master-MSM approach in Constant-Force Experiment

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Thrombin-binding aptamer (TBA), a 15-mer (5´-GGTTGGTGTGGTTGG-3´) oligomer can form G-quadruplex (G4) structure, which binds to Thrombin and has anticlotting activity against Thrombin. The G4 structures are commonly found in the human telomere region and oncogene promoter region which are highly Guanine rich and formation of such structure at the telomere region by any means may be able to treat cancer by blocking the action of telomerase. Therefore, a deeper insight into the molecular kinetics of TBA system carries implication not only for cardiovascular therapy, but also can predicts the mechanism of G4 structure formation in Guanine-rich nucleic acids. Herein, we construct a kinetic network model of TBA system by using Master-Markov State Model (master-MSM) formalism employed in constant-force experiments in a Force-Spectroscopy set up. An equal and opposite constant forces are applied to the both ends of the molecules to elucidate the long-timescale conformational changes at lower computational cost by a handful of simulations at various stretching forces. Thereafter, the intrinsic kinetic properties of the system are recovered from non-equilibrium system. The current kinetic network model gives a detailed insight into kinetic, thermodynamics, mechanical properties of the system and provides a quantitative description of the unfolding mechanism.

Engineering the resonances based on near field electromagnetic coupling in planar terahertz metamaterials

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1. Brief discussion about problems:

In terahertz metamaterials, the coupling between the split ring resonators is crucial to determine its role and performance in the device design and its construction[1]. There are several studies which has been recently reported including sensing, polarization rotation, antennas etc. where near field coupling between the resonators is the crucial factor. Although investigations on near field coupling in terahertz metamaterials have been dealt successfully with several hurdles, but still there are other challenges which are required to be addressed in order to actualize terahertz devices. In first problem we present the effect of vertical displacements between the resonators inside the unit cell of planar coupled metamaterials on their near field coupling and hence on the terahertz (THz) wave modulation. The metamaterial design consists of two planar split ring resonators (SRRs) in a unit cell which are coupled through their magnetic fields. The numerically simulated transmission spectrum is found to have split resonances due to the resonance mode hybridization effect. With the increase in displacement between the near field coupled SRRs, this metamaterial system shows a transition from coupled to uncoupled state through merging of the split resonances to the single intrinsic resonance [2]. In second problem we discuss near-field coupling between the pair of split ring resonators (SRRs) in broadside coupled terahertz (THz) metamaterials and examine resonance split and tuning of resonances in such metamaterials system. The metamolecule design is comprised of two orthogonally twisted broadside coupled SRRs separated by a thin microscale polyimide layer. We analyze the interaction between the meta layers numerically and analytically by displacing the top resonator w.r.t. the bottom resonator both in the horizontal and vertical directions. The THz transmission through proposed configuration results in the split of fundamental resonances due to the resonance mode hybridization effect. In the case of successive horizontal displacements between the resonators, we observe a complete shift from the coupled to uncoupled state, however, in vertical displacements, we notice the transition from coupled to uncoupled state at much larger displacements [3] [4].

3. References

[1] Chowdhury DR, Singh R, Taylor AJ, Chen H-T, Azad AK. Ultrafast manipulation of near field coupling between bright and dark modes in terahertz metamaterial. Applied Physics Letters 2013;102:011122.
[2] Rao SJM, Kumar D, Kumar G, Chowdhury DR. Modulating the near field coupling through resonator displacement in planar terahertz metamaterials. Journal of Infrared, Millimeter, and Terahertz Waves 2017;38:124-34.
[3] Rao SJM, Kumar D, Kumar G, Chowdhury DR. Probing the Near-Field Inductive Coupling in Broadside Coupled Terahertz Metamaterials. IEEE Journal of Selected Topics in Quantum Electronics 2017;23:1-7.
[4] Islam M, Rao SJM, Kumar G, Pal BP, Chowdhury DR. Role of Resonance Modes on Terahertz Metamaterials based Thin Film Sensors. Scientific Reports 2017;7.

Origin of High Photoluminescence Quantum Yield and Enhanced Air Stability of CH3NH3PbBr3 Nanoparticles Grown on Mesoporous Si NW Template

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Organic-inorganic halide perovskites have drawn tremendous research attention over the past few years for their extraordinary performance in solar cell, LED, photodetector and other emerging optoelectronic applications. Herein, we have reported the fabrication of CH3NH3PbBr3 nanoparticles (NPs) on a mesoporous Si nanowire (NW) template and its superior photophysical properties and air stability over its bulk counterpart. Perovskite NPs were synthesized by spin coating of perovskite precursor on the surface of metal assisted chemically etched mesoporous Si NWs followed by annealing in ambient condition. It is revealed that the porous sites of the Si NWs acted as the nucleation sites for the perovskite NPs.. With the systematic studies by scanning electron microscopy, X-ray Diffraction and Energy Dispersive X-ray spectroscopy, we have shown that crystalline perovskite NPs are uniformly decorated over the entire surface of the mesoporous Si NWs. The perovskite NPs on Si NWs show enhanced photoluminescence quantum yield (PL QY) as compared to the bulk CH3NH3PbBr3. The center of the PL peak of perovskite NPs is also blue shifted as compared to the bulk perovskite. It is argued that the quantum confinement in perovskite NPs is primarily responsible for the enhanced PL intensity as well as blue shift of PL from the perovskite NPs. The reabsorption of the fluorescence emission of mesoporous Si NWs by the perovskite NPs followed by the re-emission by perovskite NPs (photon recycling) also partly contributed to the enormous PL intensity enhancement of perovskite NPs on NWs. The systematic studies of perovskite NPs on NWs by Uv-vis absorbance analysis and time resolved PL analysis are presented in support of our explanation. We have studied and compared the degradation of the perovskite NPs confined on NW surface and bulk perovskite by XRD and PL study. Interestingly, due to self-encapsulation by the Si NW, CH3NH3PbBr3 NPs on NW shows higher stability than the bulk perovskite. This study demonstrates the mechanism behind the superior photophysical properties and air stability of the perovskite NPs, which are fabricated by an easy, cost-effective and novel template based on mesoporous Si NWs. Our report is expected to stimulate further investigation of mesoporous templated growth of perovskite NPs and its applications in light emitting devices, solar cell etc.

2. References

[1] Chowdhury DR, Singh R, Taylor AJ, Chen H-T, Azad AK. Ultrafast manipulation of near field coupling between bright and dark modes in terahertz metamaterial. Applied Physics Letters 2013;102:011122.

[2] Rao SJM, Kumar D, Kumar G, Chowdhury DR. Modulating the near field coupling through resonator displacement in planar terahertz metamaterials. Journal of Infrared, Millimeter, and Terahertz Waves 2017;38:124-34.

[3] Rao SJM, Kumar D, Kumar G, Chowdhury DR. Probing the Near-Field Inductive Coupling in Broadside Coupled Terahertz Metamaterials. IEEE Journal of Selected Topics in Quantum Electronics 2017;23:1-7.

[4] Islam M, Rao SJM, Kumar G, Pal BP, Chowdhury DR. Role of Resonance Modes on Terahertz Metamaterials based Thin Film Sensors. Scientific Reports 2017;7.

Entanglement Dynamics of Two Coupled Mechanical Oscillators in Modulated Optomechanics

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The generation of quantum entanglement between two macroscopic massive objects has been a task of paramount importance, both in the aspects of fundamental research, in particular for the fundamental test of quantum mechanics and in numerous futuristic potential applications. Thanks to the fast growing field of cavity optomechanics which provides a versatile platform to prepare such an entangled states in mechanical motion. In this work, we have proposed a scheme to entangle two directly coupled mechanical oscillators, in an optomechanical system. Our scheme exploits the periodic modulation technique, in both the external driving and mechanical coupling strengths. We find that, depending on the strength of the mechanical coupling, one could observe either a stationary or a dynamical behaviour of the mechanical entanglement, which is extremely robust against the oscillator temperature. Moreover, we have shown that this entanglement dynamics is strongly related to the stability of the normal modes. Taking mechanical damping effects into account, an analytical expression corresponding to the critical mechanical coupling strength, where the transition from stationary to dynamical entanglement occurs is also reported. The proposed scheme is analysed with experimentally realistic parameters, making it a promising mean to realize macroscopic quantum entanglement within current state-of-the-art experimental setups.

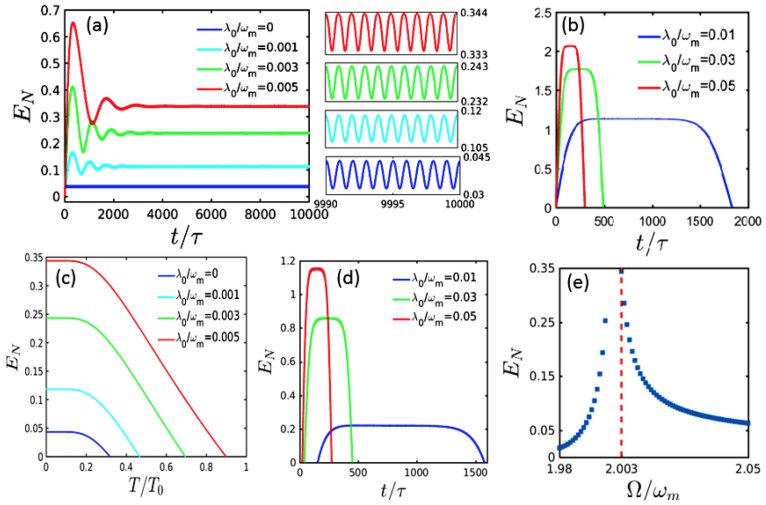

Fig.1: Entanglement dynamics of two coupled mechanical oscillators for coupling strength (a) λ_0/ω_m=[0,0.005] and (b) λ_0/ω_m=[0.01,0.05]. (c) Temperature dependence of the stationary mechanical entanglement. (d) Dynamical mechanical entanglement at temperature T/T_0=3. (e) The dependence of the stationary mechanical entanglement on the modulation frequency.

2. References

[1] M. Aspelmeyer, et al. Rev. Mod. Phys. **86**, 1391 (2014).
[2] D. Vitali, et al, Phys. Rev. Lett. **98**, 030405 (2007).
[3] F. Galve, et al, Phys. Rev. Lett. **105**, 180501 (2010).
[4] A. Mari et al, Phys. Rev. Lett. **103**, 213603 (2009).

The Accelerated Expansion of the Universe (A Rudimentary study of the 2011 Noble Prize winning discovery)

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S.Perlmutter, A. Riess and B. Schmidtare profoundly known for their path breaking discovery of the Accelerated expansion of the universe. Being one of the towering achievement of the 21st-century standard Cosmology it led them to the 2011 Noble PrizeinPhysics.7 years after its discovery it has set a benchmark as one of the leading advancement in the field of Cosmology. They used a Type Ia Supernovae (SNeIa as standard candles to measure their luminosity distances and finally put forwarded that the rate of expansion of the universe is increasing with time.

Investigating the implications of their work and the far reaching consequences, we are trying to provide the ideas behind the Accelerated Expansion of the Universe in a rudimentary level discussing the basics of it-General Theory of Relativity, FRW Cosmology,luminosity distance, cosmological constant and its problem. Within the framework of the General Theory of Relativity we had described the possible explanation assuming Dark Energy is used in the current standard model of Cosmology.

Capture of CO2 From Flue Gas Using Metal Organic Framework

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The amount of CO2 in the atmosphere is increasing day by day. One reason of this is the continuous emission of CO2 from anthropogenic sources. Flue gas from power plant is composed of CO2-(~15-16%), water vapour-(~5-7%), N2-(~70-75%) at 1 bar [1]. 63.5% of the green house gases is the CO2. Therefore it is very necessary to separate CO2 from the flue gas before it reaches the atmosphere. Several conventional methods are being applied for capturing CO2 from flue gas. One of them is the monoethanol amine(MEA) based solvent aqueous solution [2]. But this method has drawbacks like requirement of high energy foe regeneration of the adsorbent and environmental issues due to volatility of MEA. Another method which is based on silica, zeolite etc. solid adsorbent. But this method has also some drawbacks like limited surface area, limitation in structural design and surface modification[3]. But these drawbacks can be overcome by using METAL ORGANIC FRAMEWORK (MOF) based CO2 capturing method. MOFs is a crystalline hybrid materials consisting of inorganic metal ions or ion clusters and organic bridging ligands. Here we have used mmen-Mg2-(dpbpdc) MOF based adsorbent for selective adsorption of CO2 from flue gas [4].

Keywords: CO2 capture, metal organic framework

2. References

[1-2] Hye Ryeon Kim,Tae-Ung Yoon,Seung-Ik Kim,Jihyun An,Youn-Sang Bae and Chang Yeon Lee, RSC Adv., 2017, **7**, 1266.

[3] Bjørnar Arstad,Helmer Fjellvåg,Kjell Ove Kongshaug,Ole Swang,Richard Blom, Adsorption,2008, **14**, 755–

[4] Dónal Ring,Junior Sophister,Trinity Student Review, **2**, 162

Dielectric and Piezoelectric Properties of $Bi_{0.5}(Na, K)_{0.5}TiO_3$ Ceramics for High Power Device Applications

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1. Brief discussion about problems

Lead free $Bi_{0.5}(Na_{1-x}K_x)_{0.5}TiO_3$ (BNKT; x = 0, 0.1, 0.2 and 0.3) ceramics fabricated by using conventional solid-state reaction method and the detail study on structural, microstructural, piezoelectric, dielectric and AC-conductivity analysis were investigated. The XRD and Raman analysis revealed that $Bi_{0.5}(Na_{0.80}K_{0.20})_{0.5}TiO_3$ and $Bi_{0.5}(Na_{0.70}K_{0.30})_{0.5}TiO_3$ ceramics exhibited a mixture of rhombohedral and tetragonal structures. Morphological analysis indicates the decreases in average grain size from 1.405 – 0.667 μm with an increase in K concentration. Two transitions at ~ 330°C and 150°C were observed from ε′ versus T curve in pure BNT are associated with the ferroelectric tetragonal to paraelectric cubic phase (T_C) and ferroelectric rhombohedral to ferroelectric tetragonal phase (T_d), respectively. Further, the T_C and T_d shifts towards the lower temperature with a rise K concentration. Frequency dispersion of Td and T_C suggests that BNKT ceramics exhibits a weak-relaxor behavior with diffuse phase transition, which is supported by Uchino-Nomura criteria (1.48 – 1.89; for x = 0 – 0.30). The AC-resistivity ac(T) follows the Mott's variable range hopping (VRH) conduction mechanism of charge carriers between the localized states. A significant enhancement of dielectric and piezoelectric properties were observed for x = 0.20 system: dielectric constant (ε′ = 1273 at 1 KHz), dielectric loss (tanδ= 0.047), electromechanical coupling coefficients (k_{ij}: k_{33}, k_t ~ 60%, k_{31}~ 62% and k_p ~ 46%), elastic coupling coefficients (S^D_{33}= 6.40 x 10^{-13} m2/N and E S_{33}= 10.06x10^{-13} m^2/N) and piezoelectric constants (d_{33} = 64.23 pC/N and g_{33} = 5.69x10-3 Vm/N). The obtained large electromechanical coupling and high dielectric constant of BNKT (x = 0.20) ceramics are promising for high power elctromechanical applications.

Key Words: Dielectric properties, conductivity, variable range hopping, density of states, resonance and anti-resonance frequency, piezoelectric properties.

Preparation and Characterization of Mg_2TiO4-$xBa_5Nb_4O_{15}$ composite ceramics by solid state reaction method

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(1-x)Mg_2TiO_4(MMTO)-$xBa_5Nb_4O_{15}$(BNO) (x = 0.2 to 1 mole wt%) composite ceramics has been prepared via solid state reaction method. The structural, microstructural and electrical studies of the composites have been carried out for different compositions of the composites. The structural studies revealed presence of independent crystalline MMTO and BNO phases along with minor secondary peaks. The vibrational modes of the composites are recorded by Raman Spectroscope. The FESEM micrographs showed well packed grains with uniform microstructures. The electrical properties were studied using LCR meter for (100Hz – 100kHz). The dielectric constant of composites found to be increasing with increase in BNO concentration.

Morphotropic Phase Boundary Engineering and Dielectric Excitations in $NaNbO_3$-$MgMnO_3$ Composites

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Sodium-Niobate ($NaNbO_3$) and its composites gained enormous attention due to their fascinating physical properties such as giant dielectric permittivity (εr > 500 at ~ 300 K), enhanced piezoelectric coefficients (d_{33} ~ 40 pC/N) with electromechanical coupling factor Kt ~ 0.28 [1-2]. An intriguing feature of $NaNbO_3$ is that it shows largest number of structural phase transitions between the temperatures 190 K and 700 K [1]. Across the morphotrophic phase boundaries (intermixture of phases), $NaNbO_3$ exhibits anomalous dielectric behaviour due to the co-existence of Tetragonal and Orthorhombic domains [1-4]. Due to this reason NaNbO3 based compounds are considered as potential candidates for the microwave-devices, sensors, piezoelectric actuators and ferroelectric random-access memories [4]. Therefore, an attempt has been made here to investigate the structural and dielectric response of NaNbO3 and spinel MgMnO3 composites (i.e. (1-x) $NaNbO_3$ + x $MgMnO_3$ ($0 \leq x \leq 1$)). The crystal structure analysis carried out by X-ray diffraction reveals that the orthorhombic crystal structure is stable at room temperature in undoped NaNbO3 with lattice parameters a = 5.513±0.02 Å, b = 5.529±0.02 Å and c = 15.581±0.02 Å (space group Pbcm). However, substitution of spinel MgMnO3 leads to significant change in the crystal structure and alters the morphotrophic phase boundaries. The temperature dependence of relative dielectric-permittivity εr(T) exhibit two giant transitions across 271-278°C and 472-478°C which are strongly dependent on the ac-driving frequency and MgMnO3 doping concentration. The origin of such giant transitions in εr(T) will be discussed.

2. References

[1]. H. D. Megaw, Ferroelectrics **7**, 87 (1974).
[2]. Y. Saito et al., Nature **432**, 84 (2004).
[3]. I. Lefkowitz, K. Lukaszewicz and H. D. Megaw, Acta Crystallogr. **20**, 670 (1966).
[4]. Y. Yu et al., J. Phys.: Condens. Matter **17**, 4977 (2005).

Different types of Gaussian beams and their point spread functions.

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Since the invention of laser, it has found its influence in almost all the fields of science and technology. It has a wide spectrum of applications ranging from spectroscopy to bar-code scanning, due to its unique properties such as monochromaticity, directionality and coherence. The propagating laser beam can be approximated to have an ideal Gaussian intensity profile that corresponds to the theoretical TEM00 mode. Coherent Gaussian beams have their own identical transformation properties depending on the different types of optics used. Gaussian beam on the other hand is a light beam where the intensity distribution in a plane perpendicular to the beam axis can be described by the Gaussian function. The above stated coherent transformations require special considerations so as to study the beam propagation. In order to select the best optics for a particular laser application, it is important to understand the basic properties of Gaussian beams and their transformations. The TEM00 mode is the fundamental mode representing a simple Gaussian beam. However, there are higher order Gaussian modes denoted as TEMmp mode, where m and p are two arbitrary integers defining the mode numbers of the beam. In this paper we will discuss about the Gaussian beam and its propagation through an optical medium. We will further discuss about the higher order Gaussian modes and present their point spread functions at the focal plane of a lens obtained numerically and experimentally.

Structural and optical properties of Pulsed Laser deposited Indium Tin Oxide thin films

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Pulsed Laser Deposition (PLD) is one of the most versatile technique for growth of high quality novel thin films. The underlying properties that sets apart PLD from other deposition techniques are stoichiometric transfer of the constituents from target to the substrate, capability of reactive deposition in ambient gases, growth of multi-layered heterostructures, precise control over the film thickness etc. We have deposited indium tin oxide (ITO) thin films of various tin oxide concentration (0, 5, 10 wt%) on to n-type silicon(100) and corning glass substrates by using PLD technique. The deposition was carried out by a Q- switched Nd-YAG (2nd harmonic) laser having a pulse duration ~ 8 ns and a repetition rate ~ 10 Hz. Constantly rotating ITO target were ablated by a fixed laser fluence of ~ 7 J/cm2. During deposition substrate temperature was kept constant at 500 °C, but ambient oxygen gas pressure was varied between 0.01 mbar to 10mbar. Thickness of the thin films was varied in the range 30nm to 100nm by varying the deposition time. We have analysed XRD and Raman spectroscopy data to get the structural information of all the films. Surface morphology studies of the films was done by using FESEM and AFM images. Lastly, the optical properties of the films were characterized by UV-Visible-NIR spectroscopy and Surface Ellipsometry.

Enhanced Photo-electrocatalytic Hydrogen Evolution by Plasmonic Pd Nanoparticle Decorated CuO Nanocrystal/TiO2(B) Nanobelt Heterostructure

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In recent times, solar energy harvesting by TiO2 based plasmonic nanoheterostructures has received a great deal of attention for its promising application in catalysis, especially in hydrogen generation by water splitting and decomposing toxic and hazardous organic pollutants from contaminated water and air [1,2]. Herein, we have grown crystalline TiO2(B) nanobelts (NBs) with diameters ~ 30-100 nm and lengths up to a few μm via a low temperature hydrothermal method, which provides a high degree of tunability on the surface morphology and defects that strongly accelerates it photocatalytic performance. CuO nanocrystals (NCs) with size range 40-60 nm have been decorated on the NBs via a co-precipitation method followed by a calcination at 500˚C in air. Subsequently, the CuO/TiO2 heterostructure (HS) was decorated with monodisperse Pd nanoparticles (NPs) with an average size ~6 nm, as confirmed by high resolution transmission electron microscopy images. Optical absorption capability of the HSs has been enhanced after loading of Pd NPs, which is highly beneficial for the visible light photocatalysis. Detailed photoelectrochemical measurements demonstrate the enhanced hydrogen evolution reaction with the catalyst Pd@CuO/TiO2, with much lower on-set overpotential and Tafel slope. Thus, the high interfacial charge transfer and prolonged carrier life time in the HSs are believed to play the major roles for the organic pollutant degradation and H2 production by solar light driven photo-electrocatalytic water splitting.

Nonlinear optical properties of MOS2 films deposited at various argon gas pressure

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The nonlinear optical properties of MoS2 thin film can be assessed experimentally by various techniques. Among them Z-scan technique is one of the most simple and reliable tool for this measurements. In this technique, the sample is translated along the optics axis on either side of the focal plane of the lens. The transmitted beam through the sample is recorded as a function of its position 'z' with respect to the focal plane. The schematic of experimental setup is shown in fig. 1. The He-Ne laser beam (632.8 nm) was focused on the sample (MoS2 thin films on corning glass substrate) using a convex lens of focus length 5 cm. The peak intensity of the laser beam at lens focus point was 7.46× 103 w/cm2. The thin films were scanned from -20 mm to +20 mm w.r.t to the focus point of the lens along the beam direction. The transmitted beam from the sample was recorded on a CCD interfaced with a computer. During recording the images neutral density (ND) filter was placed accordingly in front of the CCD to avoid its saturation. From the CCD images, the integrated intensity was obtained for open aperture Z-scan using Matlab program. The closed aperture Z-scan data was obtained by implementing a software aperture using Matlab program on the open aperture images. Thus both, open and closed aperture Z-scan data could be retrieved by this single recording via CCD.

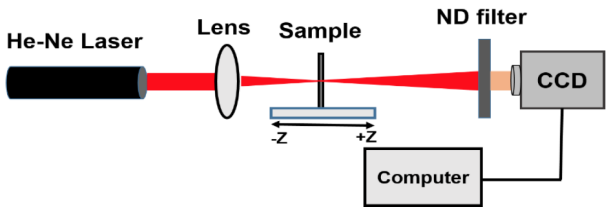

Figure 1. Schematic diagram of Z-scan experimental setup

The nonlinear absorption (β) for the MoS2 films decreased from 10.5 cm/W to 3.13 cm/W, with increase in Ar pressure from 10^{-5} to 10^{-1} mbar. The nonlinear refractive index (n_2) for the MoS_2 films decreased from 13.68× 10^{-4} cm2/W to 6.89× 10^{-4} cm^2/W, with increase in Ar pressure from 10^{-5} to 10^{-1} mbar.

Magnetic properties and magnetic domain structures in amorphous FeTaC thin film

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The tendency to miniaturizing the dimensions of future magneto-electronic devices has fashioned a demand for searching new materials and new methods for their production. In this connection, magnetic thin films with enhanced soft magnetic properties and simple domain structure are required. However, the properties of magnetic films strongly depend on film thickness (x). Hence, we report systematic investigation of thickness dependent magnetic properties of amorphous Fe80Ta8C12 (x nm) films with x = 5 – 100 nm fabricated on thermally oxidized Si substrate using dc magnetron sputtering technique. The shape of the magnetic hysteresis loop strongly depends on x, i.e., films having x ≤ 40 exhibit rectangular shaped loop which turns into transcritical one with increasing x (≥ 50). This is correlated to the formation of stress induced effective magnetic anisotropy during deposition process. This also changes magnetic domain structure from in-plane magnetization to stripe domain pattern beyond a critical film thickness of x ≥ 50 as evidenced from magnetic domain images. Coercivity (HC) increases slowly from 0.03 kA/m to 0.13 kA/m with increasing x from 12 nm to 30 nm followed by an abrupt increase of 0.27 kA/m for x = 50 film. Similarly, the field required for saturation (HS) is constant for x < 20 but increases suddenly with increasing x upto 100 nm. The remanence ratio (MR/MS) is gradually decreased with increasing x resulting in transition of magnetic domain structure. High temperature magnetization data show that Curie temperature for different x lies between 475 K and 517 K. A detailed and systematic analysis of thickness dependent magnetic properties, change in magnetic domain structure, and magnetic anisotropy in amorphous FeTaC films suitable for magnetic recording would be presented.

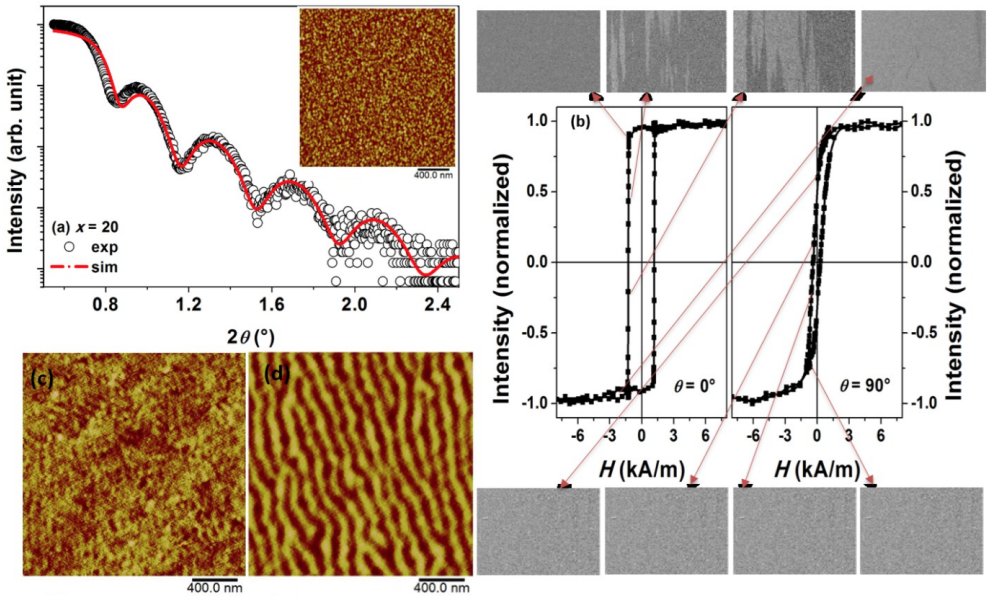

Fig.1: Room temperature (a) XRR pattern for the FeTaC film with x = 20; Inset: AFM image for x = 50, (b) normalized Kerr loop and domain images for x = 20 along easy (θ = 0°) and hard axis (θ = 90°) and MFM image for (c) x = 50 and x = 100.

Dynamic phase manipulation and wavefront estimation of a laser beam using Computer Generated Hologram

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A hologram is a recording of the interference pattern formed when the light from a monochromatic source (the reference beam) of a particular wavelength encounters light of the same wavelength arriving from an object (the object beam). The fringe width, fringe orientation and shape of the fringes are associated to the phase profile of the object beam. By defining these three parameters mathematically we can compute the hologram numerically which is called the computer generated hologram (CGH). Now by applyi ng a desired form of these three parameters we can generate a user defined phase profile of the object beam. The CGH can also be employed in wavefront sensing. The first part of the paper is based on CGH, its construction and ability of phase manipulation. In the second part we will discuss about a grating array based zonal wavefront sensor (GAZWS) that uses the principal of computer generated holography. A GAZWS uses an array of binary CGHs. The array of the grating can be easily implemented with a liquid crystal spatial light modulator (LCSLM). When a collimated laser beam with a plane wavefront is incident on the grating array , an array of diffracted spots are obtained at the focal plane of a lens placed just after the grating array. The periodicity and orientation of each grating are chosen in such a way that it can be made to form a regular pattern of focal spots. Presence of any aberrations in the incident wavefront will shift the focal spots from their reference positions. The information of this shift in the focal spots used to retrieve the information of the incident wave front. In this paper we will introduce CGH as a technique to manipulate the phase profile of the laser beam and later extend the same to implement the zonal wavefront sensor. Computer simulation and experimental results will be incorporated to facilitate the explanations.

Development of a standalone confocal imaging system with CGH based as well as galvanometer scanner based beam scanning mechanism

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The confocal imaging is an important imaging technique well known for its ability of producing high resolution and high contrast optically sectioned images of the sample. The performance of such imaging system is highly dependent on the accurate positioning of the illumination beam. The galvanometer based beam scanning offers imaging at high frame rate, but has limited accuracy in beam positioning as indicated by the parameters short term repeatability and long term thermal drift. On the other hand, computer generated holography (CGH) based beam scanning offers extremely accurate beam steering. In this paper, we introduce a standalone confocal imaging system with CGH based as well as galvanometer scanner based beam scanning mechanism. Here we present some of the preliminary results to highlight the relative advantage in terms of beam steering of CGH based beam scanning system over galvanometer based beam scanning system.

``Fluctuation-dissipation relation in accelerated frames"

Krishnakanta Bhattacharya and Chandramouli Chowdhury

An uniformly accelerated (Rindler) observer will detect particles in the Minkowski vacuum, known as Unruh effect. The spectrum is thermal and the temperature is given by that of the Killing horizon, which is proportional to the acceleration. Considering these particles are kept in a thermal bath with this temperature, we find that the correlation function of the random force due to radiation acting on the particles as measured by the accelerated frame, shows the fluctuation-dissipation relation. It is observed that the correlations, in both (1 + 1) space time and (1 + 3) dimensional space times, are of Brownian type.

Abstracts (Poster)

Rural Technology

Promoting rural livelihood utilizing waste produced by Areca (Tambul) plate making industry

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The poverty rate is fast increasing in North East India and per capita income is in decline especially in the rural areas. The unemployment rates are increasing and there is too much dependence on the primary sector. The way out of unemployment is to promote self-employment amongst the rural youth of this region by encouraging and supporting them set up their own, micro enterprises. Agro wastes are organic in nature and comprises of various agricultural crop and horticultural residue that can be mobilized in varied fields viz. value added products, enhancement of employment generation and environment protections. This study would help to organize the existing, mostly informal, handicraft centres/clusters in rural areas, improve quality and diversify the products, increase productivity and efficiency and extend the centres memberships to include more poor families. The specific objective is to increase income and job opportunities for poor youth as well as women of rural areas of Assam.

Keywords: Waste management, self-employment, value added products, income generation

A review on management of invasive terrestrial weeds and its utilization for agricultural purpose

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Weed is an unwanted plant that is dominant and has grown over the other local species. Due to dominant nature of such weeds it causes detrimental effects on other species and habitat including human being. Nowadays, management of terrestrial weed is an important issue owing to its rapid growth. It has been observed the species such as Mikania micrantha kunth, Saccharum spontaenium, Chromolaena odorata, Galinsoga purviflora, Daleira odorata were invaded globally over the two decades due to favourable temperate conditions. North eastern part of India consists of these invasive weeds covering a huge area. The control methods such as biological, chemical and physical has been adopted by earlier researchers, however, they were found to be detrimental. These weeds have the capacity to secrete harmful toxins and hence need to be treated. This study reviews the impact of terrestrial weeds on agriculture and other plantation along with control measurement. Moreover, this study also reviews on one of the finest method for the management of such terrestrial weed i.e. composting. Composting is the degradation of organic matter that occurs in the presence of oxygen. The end product from this treatment can be further applied as a soil conditioner.

Keywords: Terrestrial weed, toxins, control methods, composting, agriculture.

Effect on soil biological properties in okra cultivation as influenced by combine application of organic, inorganic and biofertilizers

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A field experiment was conducted at the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during March to July 2016 to study the "Effect on soil biological properties in okra cultivation as influenced by combine application of organic, inorganic and biofertilizers". The experiment was laid out with Randomized Block Design and replicated three times. There were seven treatments consisting of T1 [RDF (50:50:50 kg N,P,K ha-1 + FYM @ 10 t ha-1)], T2 [75% RD of N,P,K + Vermicompost @ 1 t ha-1 (mixed with microbial consortium)], T3 [50% RD of N,P,K + Vermicompost @ 2 t ha-1 (mixed with microbial consortium)], T4 [75% RD of N,P,K + Microbial consortium as seed coat + Vermicompost @ 1 t ha-1], T5 [50% RD of N,P,K + Microbial consortium as seed coat + Vermicompost @ 2 t ha-1], T6 [FYM @ 10 t ha-1 (mixed with microbial consortium)] and T7 [Microbial consortium as seed coat + FYM @ 10 t ha-1]. The results of the study indicated that there was the improvement in soil biological properties and soil enzymes in all plots over the initial value. However, the highest biological properties like MBC (244.86 µg g-1), bacterial population (8.24 log cfu g-1 soil) and fungal population (3.89 log cfu g-1 soil) and soil enzymes like fluorescein di-acetate (FDA) (7.28 µg fluorescein g-1 soil hour-1), phosphomonoesterase (PME) (50.15 µg p-nitrophenol g-1 hour-1), Deydrogenase (DH) (136.90 µg TPF g-1 soil 24 hour-1), Arylsulphatase (14.16 µg p-nitrophenol g-1 hour-1) and Arylesterase activity (113.92 µg p-nitrophenol g-1 hour-1) was found in the treatment T3 [50% RD of N,P,K + Vermicompost @ 2 t ha-1 (mixed with microbial consortium)]. Increased in microbial population and soil enzymatic activity is the indicator of good soil condition for crop growth. Therefore the addition of organic manure and biofertilizers along with the reduced amount of inorganic fertilizers should be advocated for maintaining high soil quality for longer the period.

Keywords: Phosphomonoesterase, Deydrogenase, Arylsulphatase, Arylesterase, MBC, bacterial population, fungal population

Problems and prospects of agro-forestry systems in ne india

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Acceleration in human and livestock population growth necessitated acquisition of more and more land under cultivation. The area under agriculture and forest has been reduced drastically due to population pressure and this has resulted in a wide gap between demand and production of agricultural and forest products viz. food, fodder, vegetables, fuel wood, timber medicines etc. Hence, an interest in agroforestry has therefore become necessary in order to encourage sedentary. Agroforestry is of great importance in recent times primarily because of meeting the diversified needs of people and for sustaining the frazzle ecosystem for generations to come. Agroforestry is a land use management system in which trees or shrubs are grown around or among crops or pastureland. About 80% of the people of north-east (NE) India are directly or indirectly concerned with agriculture. Farmers, in this region, are generally small holders and thus, an attempt with agroforestry practices can result an increase in their earnings without endangering the fragile ecosystem (Gogoi, 2015). In the NE region, trees are deliberately integrated with the crop and livestock production system (Chauhan and Dhyani 1990). A number of crops like maize, ginger, pineapple, coffee, and vegetables are grown with tree species such as Pinus kesiya, Alnus nepalensis, Schima wallichii, Pyrus communis, Prunus domestica, Areca catechu etc. (Rao and Bhattacharyya, 2005). Though different problems such as lack of knowledge, credit facilities, saplings availability etc., were present in this region, prospects are available. Different agroforestry models are available in respect to the different locations are need to be studied through different researches. So, an effective strategy based on agroforestry with scientific introduction of suitable tree species with crops on farm lands require not only for feeding the increasing population but also for conservation of land resources for the future generations to come.

Biomass briquetting using grass and saw dust with wild taro (colocasia esculenta) tuber as binder

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Forest waste and agricultural waste are widely available biomass that are often considered as waste as they often create problem related to disposal. They have low bulk density and cannot give controlled flame while burning so they cannot be used as fuel. Loose biomass are difficult to transport to places. Therefore they are mostly burnt in the open fields when the land has to be cleared for the next cultivation thus creating unnecessary pollution. Briquetting can be seen as a viable method to solve these issues as it is a simple and cost- effective technology. This paper presents a technique for preparing biomass briquette using taro (Colocasia esculenta) tuber as binder. Briquettes were made from Eleusine indica grass and sawdust bonded with gelatinized taro tubers. Briquette samples were prepared using low power screw press machine. The first sample consisted of 3:1 Grass and sawdust ratio; the second sample consisted of 1:1 grass and sawdust ratio. In, both the sample 40% taro (Colocasia esculenta) tuber in weight basis was gelatinized and added. The physical and thermal properties of both the samples were tested and reported in this paper. The result showed that the test sample 1 showed a higher calorific value of 15.539MJ/Kg compared to sample 2 having a calorific value of 14.683MJ/Kg. The bulk density was found to be 0.234gm/cm3 and 0.233gm/cm3 for sample 1 and 2 respectively. This paper also reports the differences in proximate analysis of two different samples made using taro starch and gelatinized taro tuber.
Keywords: Briquette, Colocasia esculenta(Taro), Thermal properties, Physical Properties

Agripreneurship: A new horizon for the emerging youth

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Post independent Indian agriculture has witnessed unprecedented paradigm expansion, growth and development in order to feed the ever increasing population of the country and also due to increasing demand for new technologies. Entrepreneurship has been considered as one of the major factor for economic development. During an economic crisis, when development tends to be negative, the importance of entrepreneurship development increases. There are two parts to entrepreneurship. The first is the managerial skills needed to start and run a profitable farm business. The second is 'entrepreneurial spirit'. Both are important. Managerial skills can be taught, but an entrepreneurial spirit cannot be taught. The World Trade Organization (WTO) agreements have started new vistas for agricultural development and diversification and, in turn, agri-business in the member countries including India. As such, opportunities have increasingly emerged for developing entrepreneurship in agri-business sector especially agriculture, horticulture, floriculture, sericulture, animal husbandry and veterinary, fishery, etc. Agriculture has always been the backbone of the Indian economy and despite concerted industrialization, in the last six decades; agriculture still occupies a place of pride. Entrepreneurship development in rural industries appears to be the best potential alternative to find employment avenues for the rural population. The importance of entrepreneurship development in agricultural sector and business planning for agricultural firms requires a thorough business plan. Successful farmer- entrepreneurs need to be technically competent, innovative and plan ahead so that they can steer their farm businesses through the stages of enterprise development – from establishment and survival to rapid growth and maturity. Nonetheless, there are many challenges that these agripreneurs have to face: social barriers, economic barriers, regulations, access to finance and information, and their own managerial capacity to cope with risks and changes and to seize opportunities.

Key words: Entrepreneur, Agriculture, Innovation, Planning, Horticulture

Rejuvenation Rural Industry through Need Based Intervention of Technology

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Rural industry has been affected badly due to rapid change in global economy, role of new technologies and intense competitive pressure for last couple of decades. With the passage of time, traditional methods and processes of earnings for villagers are becoming obsolete in terms of productivity, efficiency and energy requirement. Artisans are moving away to some other economic avenues in search of more income. One of the important outcomes is unemployment in the villages. To overcome such ill effects, need based intervention of technology in the rural sector is very much essential. Due to scarcity of resources, instead of thinking for sophisticated machinery, location specific technology intervention with semi automization to the existing methods of production is the only solution to rejuvenate the sector. It is essential to have coordination among the industries, enterprises and research & development laboratories /academia to rejuvenate rural cottage industry so that a holistic approach of technology development and diffusion can be generated in the country. The authors have developed a Potter's wheel for the rural artisans associated with Pottery busines in Assam. The newly developed tool has been tested at different parts of of Assam and found more productive with user friendly features. Field testing results of the newly developed tool are encouraging as women workers are very much interested to use such a safe and cost effective tool. In this article, our approach in design the tool as well as importance of the tool to improve productivity is discussed.

Effect of bio-fertilizers on crop production and soil quality

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Sustainable agriculture and horticulture production is a challenge of present day. To produce more food from less land indiscriminate use of chemical fertilizers and pesticides have been encouraged. As a result we could increase our production but environmental degradation has nullified that positive effects. Unprecedented use of chemical fertilizers and pesticides has deleteriously impacted soil fertility and consequently, the crop productivity. Use of bio- fertilizers are being seen as a potential option to address this ongoing menace. But, not much site specific information are available on the impact of bio-fertilizers on yield and soil quality. Plant-growth-promoting rhizobacteria (PGPR) is an important group of micro-organisms have been extensively used in the field of agriculture. This enhances the crop production while improving the soil fertility and promoting the plant growth rate. PGPR helps the crop through the direct and indirect mechanism. Other than PGPR, organic fertilizers are also rich in nutrient elements. PGPR alone or in combination with various organic inputs could enhance soil physical properties, improve soil biological and biochemical properties and optimize soil microbial community structure and thus enhance overall soil quality.

Present article attempts to collate the information about mechanisms of different bio-fertilizers and their effects on the wide range of crops globally and locally. It also further encompasses the combined use of organic inputs with it. In developing countries poor and marginalised people largely depends upon agriculture and in most of the cases which is their sole livelihood option. Utilizing bio-fertlizer will not only help them in increasing productivity but also could lead the way towards sustainable agriculture.

Keywords: Bio-fertilizer, plant-growth-promoting rhizobacteria,, organic inputs, soil quality.

Effect of Farmyard Manure/Compost on Heavy Metal Availability in different Agricultural Soils

Heavy metal contamination of soils has become a severe issue in agricultural production in the past few decades because of various anthropogenic activities and improper use of heavy metal-enriched materials in agriculture. Farmyard manure or compost can be applied to soil to supply nutrients required for crops and improve soil physical properties. The presence of non-biodegradable and toxic heavy metals in composts impedes agricultural land application resulting in increasing concern among farmers about heavy metal accumulation in agricultural soils. A pot study has been carried out on two types of agricultural soils (alluvial and laterite) amended by compost to study various physico-chemical properties like pH, electrical conductivity and cation exchange capacity. Periodic experiments have been carried out on bioavailability and leachability of heavy metals (Pb, Cd, Ni, Hg, Fe, Cu, Mn and Zn) on soil samples collected at specific depths from the top surface of soils in the pots. The bioavailability has been investigated in the form of water soluble and diethylenetriamine penta-acetic acid (DTPA) extractable. The Tessier sequential extraction method has been used to investigate the changes in heavy metals speciation (Pb, Cd, Ni, Hg, Fe, Cu, Mn and Zn) during the pot study in the similar manner. Results have shown some heavy metal accumulation in (0-20) cm of soil depth in the potted experiment.

Keywords: Compost, soil, heavy metal, bioavailability, leachability, speciation

Abstracts (Poster)

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Every summer morning one of our group members used to notice a lot of water being spread all over the area below the air conditioner next to his house. Hence we came up with the idea whether we can use this water instead of wasting it simply. Then we tried to see why water is produced from an air conditioner. After knowing this we assumed that water from air conditioner is completely pure. In order to check whether it is completely pure, we tried to pass electricity through it as pure water cannot conduct electricity. Then we checked Ph level. It was confirmed that water from air conditioners is actually pure. So we assumed that we can use this water as distilled water, for watering plants in plant nurseries, as a good source of drinking water in the flood affected areas of Assam and also for washing clothes especially white clothes. But in our PRESENTATION it will be based only on the use of ac waste water as distilled water. After this, we tried to see what actually distilled water is. So we tried to produce distilled water through the process of distillation. We could collect only 23 ml of water in about 9 minutes. This reason brought us into a situation that if we can collect only 23 ml of distilled water in about 9 minutes then whether the distilled water we are buying from factories is purely distilled. So we collected various samples from various distilled water factories. Then we checked their ph level. The result was an unexpected one.
We are in such a condition, where a small invention or innovation can bring about a drastic change. There are some areas in our country where children even cry for a small drop of water and also there are some areas where there is water, but no one can consume it. Apart from all these, more than half of the Indian population is jobless and also there are some Indian factories where product is manufactured only for money but not for quality. Seeing all these conditions we tried to develop this small concept on the potentiality of waste water from air conditioners.
HOPE THIS PROJECT WILL SURELY HELP TO DEVELOP OUR PRESENT CONDITIONS ATLEAST TO SOME EXTENT.

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International Participants

Plants used in Religion

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This study intends to determine quantitative ethnobotany and variation in knowledge of indigenous people of Samdrupcholing (Bhangtar), Samdrupjongkhar. Parallel to the increasing decline in plant biodiversity is the inherent loss in traditional knowledge of use of these plants. Today, the effect of modernization have raised additional concern about erosion of this forms of knowledge in Bhutan. For example, in parallel to rapid depletion of tropical forests and related biodiversity is the disappearance of traditional cultures which has basic attributes to social, economic and cultural changes due to development. The study focus on documentation of different plants species used in religion by people of Samdrupcholing (Bhangtar). Collect a minimum of two voucher specimen from field and put inside the newspaper and press using Herbarium press (made of wood) and tag the specimens and record the information such as geo-coordinates (using global positioning system), altitudes, habit, habitat, aspects, season of collection, etc. Use various reference for identification (Flora of Bhutan Flora of China, Flora of Pakisthan and flowers of Himalayas to name three. Deposit voucher specimens to Sherubtse College and National herbarium in Thimphu for future reference. Examine the plant knowledge variation within and between communities under study and analysis data using parameters (frequency of plant family and frequency of plant used based on habitat). Hence, there is wide spread recognition that traditional people have much more to teach western science and despite this recognition, traditional knowledge is declining at an unprecedented rate.

Antifungal Formulation

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The study aims to formulate an antifungal against Mulberry rust by mixing the crude extract of leaves of two plant species (Tropaeolum majus and Parasassafras confertiflorum) and heavy metal, Ni. The fungi will be tested by loading the disc (sterilized disc made from whatmans paper) with the mixture of different concentration of Ni and crude extract of plant leaves. The study helps us to find the minimum fungicidal concentration (MFC) that will have advantage to environment and cost less compared to those synthetic fungicides. The plants are selected based on their reported medicinal values (Tropaeolum majus) and local usages (Parasassafras confertiflorum). Thus, this antifungal formulation can be used as an alternative and eco-friendly method for controlling rust diseases in mulberry plant.

Cyberbullying in Universities of Bhutan

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Cyberbullying is real and a fast-growing problem in Bhutan. Cyberbullying takes place over digital devices like cell phones, computers and tablets. With the rapid development in Science and technology Cyberbullying is a rising concern for countries around the world as the use of electronic communication technologies has become core method for communication. Extensive studies on cyber-crimes and Cyberbullying have been carried out by researchers around the world, so far, no proper research studies have been carried out in Bhutan. Newsletters from different newspaper are released based on cyber bullying in Bhutan but no proper research study have been carried out in Bhutan. This paper will report the finding of cyberbullying at the university level by focusing primarily on graduate students studying in various colleges of Royal University of Bhutan (RUB). In this paper we will also present the differences and similarities in bullying on the basis of gender, their opinions on cyberbullying, experiences on cyberbullying and solutions to the problem. It also includes basic measures and electronic medium used by the college student to cyber bully or harass the victim. It identifies unique adverse effect of cyberbullying such as long-term damage to student's self-esteem, academic achievement and emotional well-beings of the students. We will also figure out which college in Bhutan leads in cyberbullying and the cause of bullyings. Cyberbullying is growing issues in university colleges of Bhutan, as increasing number of youths are likely to participate in cyberbullying. Thus, prevention and intervention of cyberbullying should be proposed based on differences of gender and the age group.

Bioevaluation And Efficacy Of Ageratina Adenophora In Plant Disease Control

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In Bhutan, apart from fulfilling the food requirement of the growing population, agriculture plays pivotal role in improving the economy of the nation. However, with the damage and destruction inflicted on the crops by various pest and pathogens such as insects, microbes (bacteria, fungi, viruses and mycoplasmas), nematodes, weeds, animals and birds has lead to serious challenges to farmers. The import of pesticides from neighboring countries has helped a lot in battling the pest and pathogens. However, it has resulted in the development of insecticidal resistance in pest species and pesticide residue in the food. The pesticide residues in the food chain are leading to bioaccumulation and degradation of ecosystem and human health.

By nature, all plants have ability to synthesis and produce numerous secondary metabolites, which enable them to defend against the pests, pathogens, and animal attacks. Similarly, Ageratina adenophora produces numerous secondary products, which have been used as antimicrobial (antifungal and antibacterial activity), antiseptic, insecticidal and has molluscicidal potential. Thus, it has a great potential to control plant diseases, especially the diseases caused by bacteria and fungi, but none of the study has evaluated its potential.

Now a days, extensive work on the allelopathic activity, medicinal properties, chemical constituents, and the composition of the essential oil of A. adenophora is reported in the numerous literatures, however its efficacy on plant disease control is not yet evaluated. A. adenophora contains numerous biochemicals and has great potential in controlling plant disease, especially disease caused by bacteria and fungi. Thus, this study intends to determine and evaluate the efficacy or of A. adenophora in plant disease control.

Gypsum Mining at Pemagatshel: Assessment of Social and Environmental Impact.

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The study intents to assess mining and its impacts on communities within mining activities areas. The focus has been on mining community in Khothakpa where mining is vigorously carried out by Druk Satair Mining Corporation. The only gypsum (CaSO4A.2H2O) Mining Company in Bhutan located in Khothakpa under Pemagtshel, which is the one of the 20 dzongkhag constituting Bhutan. It has a total mine area of 26.67 hectares. The study investigates the real and latent impacts of mining activities on the environment and community. Mining served as an important component of countries revenue source especially for developing countries that have been endowed with the mineral wealth. If properly managed, countries can grow their economies with proceeds from mining activities in the form of royalties and foreign exchange earnings for the export of mineral related products. Such benefits from the mining sector have in most cases been used as justification and a social license for exploration and exploitation of minerals in most communities. The research examines the environmental and community's health impact of Gypsum Mining activities on the people of Khothakpa and the surrounding communities. This research also study about the effect of mining in the local food production and the agriculture purpose and pollution which has affected the many water resources and in the areas.

Changing Pattern of Agricultural Productivity in Eastern Bhutan.

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B.A. Geography (Honours)

The research paper highlights the overview of the changing pattern of agriculture and its productivity in eastern Bhutan to interpret the inter and intra zonal variation of crop production, analyze the changing pattern and suggest some of the measure for increasing the agriculture production considering 2010 as base year and 2016 as current year. The totals of six Dzongkhag were selected in which 30 gewog represent as sample. The intra regional changes are interpreted by considering agro ecological zones of the study area. The intra zonal pattern of base year as well as current year is elaborated in details to find out the changes in the factors. The agricultural statistics are collected at randomly selected Gewog wise to show the intra zonal and inter zonal variations which are purely on the basis on secondary data. Agricultural land productivity is influenced directly by the physical condition of land and modern technology (seed-fertilizer package). Therefore, crop intensity and index of modern technology help in understanding the changing pattern of land productivity. The determinants incorporated in analyzing the overall result are modern agricultural techniques that include irrigation, use of chemical fertilizer and use of high yielding varieties seeds, total number of cultivators, fertilizer consumption and related agriculture machineries. The coefficient of variation and standard deviation techniques are used to interpret the results of areal variability. GIS based map will be prepared to show the intra and inter zonal variations of agricultural productivity.

Assessing Climate Change Impact on Glaciers, Glacial Lakes and Economy of Bhutan

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The Himalayas are known as the water tower of the world - the source of major river systems in Asia, and the lifeline of more than 1.3 billion people living downstream. The mountains store water in the form of snow, glaciers, permafrost, wetlands, and rivers, and supply ground water recharge to watersheds as well storehouses of biological diversity. However, due to recent alterations in temperature and precipitation patterns, mountain regions have been vulnerable to various impacts of changing climate. Variance in the melting of glaciers, change in the number and volume of glacial lakes, erratic and unpredictable weather conditions, changing rainfall patterns, and increasing temperatures, shift in precipitation patterns, erratic and/or late arrival of the rain, and geographical shifts in rainfall distribution resulting in flashfloods and drought in the dry season are some of the concerns associated with climate change and its impact in the Himalayas.
Bhutan, out of which 562 are associated with glaciers. In addition, 24 glacial lakes are potentially dangerous. As a result, changes in the hydrology of Bhutanese rivers due to de-glaciation could have regional consequences for water resource availability. Therefore, monitoring the spatio-temporal pattern of change in glaciers and glacial lakes, and other sources of water is important for countries like Bhutan, which relies almost solely on Hydro-electricity for revenue generation and agriculture. Thus, this will be important for formulation of climate change adaptation, policies and plans, and creating awareness about vulnerability and resilience to climate change amongst various stakeholders.

Assessment of Empty Households in Bartsham Gewog at Trashigang: Its Socio-economic Impacts and Suggested Remedies

Rinzin Choden
B.A Geography Honours

Bhutan has highest rate of rural-urban migration in South Asia. Some of the districts like Trashigang in Eastern Bhutan experienced as high as 12% households (983 households out of 8, 610 households) that have completely abandoned their homes and moved to urban areas. The figures are more surprising at micro-level, i.e. Bartsham, one of the Dzongkhag (administrative unit below the district) in Trashigang district recorded 150 empty households out of 462 total households. Apart from migration of the entire family members, most of the Bhutanese migrants are dominated by the age group of 10 to 34 years, which constitute the most productive age group. Moreover, richer class of people tends to move out of rural areas than the poorer group. This has caused several social and economic impacts such as depopulation of rural areas, shortages of agricultural labourers, increase in human-wildlife conflict, fallowing of agricultural land, decline in food production, and old age destitution. At the same time, rural-urban migration also leads to overcrowding in urban areas that puts pressure on the available social amenities and other resources. The migration of rural population to urban areas has intensified the urban unemployment and leads to increase in the rate of urban poverty. Further food insecurity suffered by the Bhutanese is due to low agriculture products owing to decline in labour force in the agriculture sectors.

Climate Change Impacts and Adaptation- A Case Study in Kawang Geog

The Earth's climate is changing. Some of the change is due to natural variations that have been taking place for million years, but increasingly, human activities that release heat-trapping gases into the atmosphere are warming the planet by contributing to the greenhouse effect. The IPCC, 2007 concludes that best estimate for global average surface air warming over the current century ranges from 1.8°C to 4°C. This rate of temperature change is without precedent in at least the 10,000 years. Consequently, historical climate no longer provides an accurate gauge for future climate conditions (IPCC, 2007). Climate and land use changes are the two major global ecological changes predicted for the future. Since Bhutan is a small country, our contribution to climate change is nil but we are bearing the brunt of it. The glaciers are retreating fast, causing flash floods. We no longer find the snow on the mountains which used to be around ten years ago. We have had two devastating flash floods so far, one in 1994 and the other in 2004 (Paliwal, 2013). There is a clear sign of danger to nature and humans. Species are also getting lost. Sub-tropical diseases which were unknown to us are beginning to emerge in the temperate climate of Bhutan (Lotay, 2015). Agriculture is also bearing the brunt. The size of the land holdings is reducing because of erosion and degradation. Monsoon has become very erratic. Bhutan always had clear four seasons but now weather is quite unpredictable. There are very clear signs of cyclones and mini-cyclones, which were unheard of earlier because we are far away from the sea. All this is because of climate change, which at least we did not contribute to (Paliwal, 2013). The impacts are more severe on the livelihood of Kawang Geog under Thimphu Dzongkhag, where the societies largely rely on conventional self-subsistent agriculture activities. Thus, this paper describes the climate change impacts on agriculture and livestock in Kawang Geog and the impacts of climate change on livelihoods. Secondly it identifies the adaptation strategies undertaken by this community, including assessment of vulnerabilities. The study was carried out using both the primary and secondary data sources. So to carry out the research work questionnaires were framed and sampling was done with simple random sampling with the size of 100 households. For secondary data collection, all the materials related to climate change were collected.


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