INTERNATIONAL CONFERENCE ON ENGINEERED MATERIALS FOR SUSTAINABLE DEVELOPMENT

(EMSD 2024)

24-26 JULY 2024

Abstract Book

Organized by
Punjab Engineering College (Deemed to be University)
&
National Agri-Food Biotechnology Institute (NABI)
Chandigarh

frontiers

BEILSTEIN JOURNAL OF NANOTECHNOLOGY

ELSEVIER

INTERNATIONAL CONFERENCE ON ENGINEERED MATERIALS FOR SUSTAINABLE DEVELOPMENT

EMSD 2024

July 24-26, 2024

Venue

Auditorium

Punjab Engineering College (Deemed to be University)

Chandigarh

Abstract Book

Organized by

Punjab Engineering College (Deemed to be University)

&

National Agri-Food Biotechnology Institute (NABI)

Chandigarh

ABOUT PEC

Punjab Engineering College (Deemed to be University) (PEC), originally established as Mugalpura Engineering College in Lahore in 1921, relocated to its current campus in 1953 and became affiliated with Panjab University as PEC. In 2003, it attained the status of Deemed University through a notification by the Ministry of Human Resource Development (MHRD) and was renamed PEC University of Technology in 2009. Operating as a Grant-in-Aid institution under the administration of the Union Territory of Chandigarh, Government of India, PEC boasts a sprawling 146-acre campus that also houses the Chandigarh College of Architecture. The academic and administrative procedures are aligned with those of the Indian Institutes of Technology (IITs). The institute is governed by a dynamic Board of Governors, chaired by the renowned industrialist, Sh. Rajinder Gupta, and is led by a Director with a five-year tenure, a position equivalent to the Vice-Chancellor of universities. PEC offers eight undergraduate B.Tech. programs and fourteen postgraduate M.Tech. programs in various engineering and technology disciplines. Following its transition to university status, the institute also introduced PhD programs in engineering, science, management, humanities, and social sciences. Admissions to the undergraduate and postgraduate programs are conducted through national-level examinations, namely JEE (Mains) and GATE, respectively. The institute comprises nine academic departments and two centers of excellence. The faculty members are actively engaged in cutting-edge research and development activities and collaborate closely with research organizations, industries, alumni, and academic institutions both within India and internationally. PEC has established numerous MoUs to pursue joint research in specialized areas. Graduates from this institute are frequently recruited by highly reputed companies, often receiving attractive salary packages. With a legacy spanning 100 years, PEC has produced numerous distinguished alumni who have brought honor and recognition to both themselves and the institute.

ABOUT NABI

The National Agri-Food Biotechnology Institute (NABI), established on 18th February 2010, is India's pioneering institute dedicated to the advancement of agri-food biotechnology. With a mission to transform the agri-food sector in India, NABI aims to be a central hub for knowledge generation and translational science, driving the development of value-added products through innovative agri-food biotechnological solutions. The institute's primary research focus spans Agriculture Biotechnology, Food Biotechnology, and Nutritional Biotechnology. By leveraging cutting-edge biotechnological tools, NABI seeks to address the challenges of food quality and nutrition, providing sustainable and novel solutions that benefit both the agricultural sector and consumer health.

ABOUT PHYSICS DEPARTMENT

The department offers core courses in Physics. In addition to three compulsory common courses in Physics for first-year B.Tech students, several open electives such as Quantum Mechanics, Solid State Physics, and Physics of Solar Photovoltaics and Technologies are available to undergraduate engineering students. Starting with the cohort admitted in 2014, minor specialization courses in Physics have been introduced for undergraduate students. The department boasts well-equipped laboratories to provide practical training in Physics. Research facilities are available for pursuing a Doctor of Philosophy degree in areas such as Ferroelectrics, Multi-ferroics, Thermoelectric Materials, Advanced Functional Materials, and Nanomaterials-based devices for environmental and healthcare applications. The department is staffed by 4 regular and 2 contractual faculty members.

Director's message, PEC

Office of the Director
Ph : (0172)2746074
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Email : director@pec.edu.in

MESSAGE

I extend a warm welcome to all the eminent speakers and participants of International Conference "Engineered Materials for Sustainable Development (EMSD 2024)" at Punjab Engineering College (Deemed to be University), Chandigarh. As we gather to explore and discuss the latest advancements in healthcare, energy, environment, materials, and sustainable development, we stand on the brink of groundbreaking innovations that will shape our future. Punjab Engineering College, with its rich history dating back to 1921, has always been at the forefront of technological education and research. Our commitment to excellence is reflected in our robust academic programs, cutting-edge research, and vibrant collaborations with industry and academia, both nationally and internationally. The EMSD 2024 Conference is a testament to our dedication to fostering an environment where ideas flourish and knowledge is shared. This platform brings together brilliant minds from diverse fields, offering an opportunity to engage in meaningful dialogue, exchange innovative ideas, and forge collaborations that will drive progress in sustainable development. I am confident that the discussions and deliberations at this conference will inspire new perspectives and solutions to the pressing challenges we face today. The participants will be greatly benefitted from the insights and opportunities generated during this conference and will provide a solid foundation for future collaborations. Let us work together to advance the frontiers of science and technology, and contribute to a sustainable and prosperous future for all.

Once again, congratulations to the entire organizing team and convenors for their exceptional efforts, dedication and vision for planning this event.

15/07/2024

Prof. Rajesh K. Bhatia
Director(Ad-interim)

PUNJAB ENGINEERING COLLEGE
Sector 12, Chandigarh - 160012 www.pec.ac.in

Director's message, NABI

राष्ट्रीय कृषि–खाद्य जैव प्रोद्यौगिकी संस्थान
(जैव प्रोद्यौगिकी विभाग, भारत सरकार)
सैक्टर–81 (नॉलेज सिटी), पी.ओ. मनौली
एस.ए.एस. नगर, मोहाली–140306
पंजाब (भारत)।

National Agri-Food Biotechnology Institute
(Department of Biotechnology, Govt. of India)
Sector-81 (Knowledge City), P.O. Manauli
S.A.S. Nagar, Mohali-140306
Punjab, (INDIA)

प्रो. अश्वनी पारीक
कार्यकारी निदेशक
Prof. Ashwani Pareek
Ph.D. FNASc., FNAAS
Executive Director

MESSAGE FROM DIRECTOR

I am pleased to extend a warm welcome to all delegates attending the International Conference on "Engineered Materials for Sustainable Development (EMSD 2024)". This event, jointly organized by Punjab Engineering College (Deemed to be University) and the National Agri-Food Biotechnology Institute (NABI), is scheduled at PEC Chandigarh from July 24th to 26th, 2024.

EMSD 2024 is dedicated to the advancement of knowledge, the promotion of research breakthroughs, and the intellectual development of 21st century scholars in the realm of engineered materials for sustainable development. These materials are crucial in propelling progress toward environmentally responsible and socially equitable technological solutions.

The scientific sessions, featuring distinguished scientists and academicians from India and abroad, will provide a comprehensive platform to address global challenges. The conference will focus on identifying, synthesizing, characterizing, and applying engineered materials across various domains, emphasizing sustainability.

This conference will be an excellent platform for professionals with advanced engineered materials, nanotechnology, and related interfaces to network and collaborate with eminent peers. The extensive and impressive list of speakers is expected to lead to intense discussions and spark new ideas among young researchers.

I am delighted that two premier institutions from the tri-city area have collaborated to organize this outstanding event. I extend my best wishes to all participants and warmly invite them to visit our NABI campus.

Prof. Ashwani Pareek
Executive Director, NABI
Professor of Plant Molecular Biology and Biotechnology
Jawaharlal Nehru University

ई–मेल / E-mail: edoffice@nabi.res.in, दूरभाष नं. / Phone : 0172-5221-101/102/106 फैक्स / Fax : 0172-5221-100
वैबसाइट / Website: www.nabi.res.in

Director's message, DST Chandigarh

Dear Esteemed Researchers & Participants,

It gives me immense pleasure to welcome you all to the conference on "Engineered Materials for Sustainable Development" at Punjab Engineering College (PEC) Deemed to be University, Chandigarh. This event is a significant milestone in our collective journey towards fostering innovation, sustainability, and technological advancement in the realm of engineered materials. In today's rapidly evolving world, the need for sustainable development has never been more urgent. As we face global challenges such as climate change, resource depletion, and environmental degradation, the role of science and technology in crafting sustainable solutions becomes paramount. Engineered materials, with their vast potential to enhance efficiency, reduce waste, and minimize environmental impact, stand at the forefront of this endeavour. This conference brings together a diverse group of experts, researchers, and practitioners from various fields to share their insights, discoveries, and innovations. It is a unique platform for interdisciplinary collaboration, where ideas can flourish, and new partnerships can be forged. We are privileged to have some of the brightest minds in the industry and academia joining us to discuss cutting-edge research, emerging trends, and practical applications of engineered materials for sustainable development. I am pleased to announce that the Chandigarh Administration through Department of Science & Technology & Renewable Energy will continue to provide financial aid for innovation and sustainable development in the research arena. Our commitment to supporting ground-breaking research and fostering technological advancements remains steadfast. We believe that through continued financial support, we can empower researchers and innovators to develop solutions that will have a lasting impact on our society and the environment.
I extend my heartfelt gratitude to PEC Chandigarh for hosting this conference and to all the organizing committee members for their tireless efforts in making this event a reality. I also thank our distinguished speakers and participants for their invaluable contributions and for taking the time to be a part of this significant gathering. Let us use this opportunity to exchange knowledge, inspire innovation, and work together towards building a sustainable future. I am confident that the discussions and interactions over the next few days will lead to ground-breaking ideas and collaborative projects that will have a lasting impact on our society and the environment.

Thank you, and I wish you all a productive and enriching conference.

Warm regards,

Navneet Kumar Srivastava, IFS

Director,

Department of Science& Technology & Renewable Energy,

Chandigarh Administration

DEPARTMENT OF PHYSICS
Punjab Engineering College (Deemed to be University)
Chandigarh - 160012

MESSAGE FROM CONVENER

Dear EMSD 2024 Participants,

It gives me immense pleasure to welcome you all to the international conference "Engineered Materials for Sustainable Development (EMSD-2024)" jointly organised by Punjab Engineering College (Deemed to be University), Chandigarh and National Agri-Food Biotechnology Institute (NABI), Mohali during July 24-26, 2024 at Punjab Engineering College (Deemed to be University), Chandigarh. The theme of EMSD 2024 is not just a reflection of the current trends but a vital imperative for our future. EMSD 2024 aims to inspire new ideas, foster new collaborations among researchers, industry professionals, academics, and drive innovative solutions in the field of material science for a sustainable future. It is a privilege for me to preside over this significant assembly of accomplished researchers and sharp minds. Gathering of such diverse perspectives and expertise shared through plenary lectures, keynote talks, invited talks and interactive discussions, will create opportunities to open up paths to interdisciplinary partnerships. The sharing of knowledge and experiences will undoubtedly spark new ideas and lead to the development of materials for a more sustainable world.

We are delighted to partner with the reputed journals like Advances in Colloid and Interface Science, Beilstein Journal of Nanotechnology, Journal of BME Frontiers, Hybrid Advances, and Frontiers in Nanotechnology, which is supporting our pre-conference workshop, "Engineered Materials for Environmental and Healthcare Applications." with a special issue on "Nanomaterials for Affordable Biomedical Devices, Environmental and Energy Applications". The distinguished editors and guest editors of all these journals are also gracing the event as speakers and we sincerely acknowledge their support in designing these Special Issues (SI) and associating these SI with EMSD 2024 with conference convener as Guest Editor.

Organizing an event of this magnitude requires the collective efforts and support of various institutions and organizations. We are profoundly grateful to our neighbouring partner institutions, including Panjab University, Institute of Nano Science and Technology (INST), Central Scientific Instruments Organisation (CSIO), and the Institute of Microbial Technology (IMTECH) for their invaluable infrastructural support for conference participants. Their contributions have been instrumental in making this conference a reality. We also extend heartfelt thanks to the funding bodies including DST, DBT, DRDO, DAE-BRNS, DST&RE, Chandigarh and our industry sponsors, for their generous financial support. Their commitment to advancing scientific research and development is truly commendable, and their support underscores the importance of collaborative efforts in addressing global challenges.

Thank you for being a part of this conference. I wish you all a productive, insightful, and memorable experience.

Warm regards,

Professor Sandeep Kumar
Conference Convener EMSD 2024

राष्ट्रीय कृषि – खाद्य जैवप्रौद्योगिकी संस्थान
(जैवप्रौद्योगिकी विभाग, भारत सरकार)
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National Agri-Food Biotechnology Institute
(Department of Biotechnology, Govt. of India)
Sector-81 (Knowledge City), PO Manauli
S.A.S. Nagar, Mohali-140306
Punjab, (INDIA)

MESSAGE FROM CONVENOR

Dear EMSD 2024 Participants,

With great pleasure, I extend a warm greeting to all of you for the International Conference "Engineered Materials for Sustainable Development (EMSD-2024)" jointly organised by Punjab Engineering College (Deemed to be University), Chandigarh and National Agri-Food Biotechnology Institute (NABI), Mohali during July 24-26, 2024 at Punjab Engineering College (Deemed to be University), Chandigarh.

The conference is designed to promote cooperation and creativity in the creation, improvement, and utilization of engineered materials, which are necessary for the progress of sustainability. This conference will be a great platform for exchanging state-of-the-art developments and findings. The aim of this conference is to inspire the scientific and technological developments towards providing sustainable solutions of societal problems. This platform will provide great opportunities for collaboration and mutual support for scientists and academicians with overlapping research interests. We advocate for a comprehensive approach to sustainable development, with a focus on meaningful discussions between researchers and industry experts. This collaboration is crucial for the successful implementation of sustainable technologies and practices.

I am certain that the participants will not only be able to use the materials for wide applications in their research but also enhance their contribution towards environmental sustainability. This conference will provide opportunity to expand your network and knowledge. I encourage everyone to participate fully in the conversations, offer your expertise, and look for ways to work collaboratively. I'm excited for thought-provoking discussions and the sharing of innovative concepts. I would like to express my gratitude in advance to the conference committee for giving up their important time to organize the program, as well as to all other contributors for their tireless work and unwavering faith in EMSD-2024's brilliance.

I kindly extend a warm invitation to all enthusiasts to fully engage in this event, which can provide everyone with enormous exposure and international prospects. I appreciate your participation and hope you all have an insightful and successful conference. I'll end my remarks with this inspirational phrase from Tommy Lasorda, which I hope will encourage the young researchers: "The difference between the impossible and the possible lies in a person's determination."

Warm regards,

nitinsinghal

Professor Nitin Kumar Singhal
Convener EMSD 2024

INTERNATIONAL ADVISORY COMMITTEE

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Prof. Vikas Rishi	NABI, Mohali, Punjab	Advisors
Prof. Sandeep Kumar	Physics Department, PEC, CHD	Convenors
Prof. Nitin Kumar Singhal	NABI, Mohali, Punjab	Convenors
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Dr. Amit Kumar Rai	Scientist, NABI, Mohali	Member
Dr. Tripti Gupta	Assistant Professor, Physics Department, PEC, CHD	Member
Dr. Vanish Kumar	Scientist, NABI, Mohali	Member
Dr. Deepti Rana	Assistant Professor, Physics Department, PEC, CHD	Member
Dr Jayeeta Bhaumik	Scientist, CIAB, Mohali	Member

TOPICS OF CONFERENCE:

- Layered materials & Soft materials (polymers)
- High-performance insulation materials
- Magnetic materials
- Quantum materials
- Thermoelectric materials
- Biomaterials & Bioimplants
- Organic nanomaterials
- Life cycle assessment of materials
- Nanocomposites for various applications
- Eco-friendly construction materials
- Sustainable materials in mechanical design
- Eco-friendly infrastructure materials
- Eco-friendly electronic components
- Sustainable materials in information technology
- Energy-efficient materials for machinery
- Environmental impact and safety of nanomaterials
- Materials for controlled release of fertilizers and pesticides
- Sustainable practices in food production
- Bio-inspired robotics and sensors
- IoT & AI in material technology
- Materials for environmental monitoring
- Biocompatible materials in healthcare & Biomedical devices
- Nanostructured materials (quantum dot, nanowire, nanoparticle, etc) & Nanoporous materials
- Optoelectronic and photochromic materials
- Heterogeneous catalysts
- Electrocatalysts
- Theoretical and computational aspects of materials
- Energy storage and conversion (batteries, capacitors, etc)
- Environmental application (water treatment, photocatalysts, etc)
- Photovoltaics, Sensors & Drug delivery and development
- Nano devices
- Adsorption and separation

- Waste to wealth conversion in circular economy
- Natural materials & interfaces
- Thin films
- Multifunctional materials

AWARD CATEGORIES

 Best Poster Presentation
 Best Oral presentation

PROGRAM OVERVIEW

INTERNATIONAL CONFERENCE
ON
ENGINEERED MATERIALS FOR SUSTAINABLE DEVELOPMENT
EMSD 2024
July 24-26, 2024

ORGANIZED BY
PUNJAB ENGINEERING COLLEGE (DEEMED TO BE UNIVERSITY), CHANDIGARH
AND
NATIONAL AGRI-FOOD BIOTECHNOLOGY INSTITUTE (NABI), MOHALI

Programme Schedule

Conference Venue: Punjab Engineering College (Deemed to be University), Sector 12, Chandigarh

DAY 01

Venue: Auditorium

Time	July 24, 2024
08:30 AM-09:30 AM	Registration
09:30 AM-10:15 AM	Inauguration ceremony
10:20 AM-11:05 AM	Plenary lecture-1 **Dr. Reinhard Miller,** TU Darmstadt, Germany Adsorption of surfactants at the water/air, water/alkane vapor and water/liquid alkane interfaces
High Tea	
	DST-SERB Session Chairperson: Prof. Vasundhara Singh, Department of Chemistry, PEC Chandigarh Rapporteur: Mr. Kamil Monga & Mr. Aman Kumar Venue: Senate Hall
11:30 AM-12:15 PM	Plenary Lecture-2 **Prof. Sudesh Kumar Yadav,** Director, CSIR-IHBT, Palampur Plant and microbe-based materials for sustainable bioeconomy
12:20 PM-1:05 PM	Plenary Lecture-3 **Prof. Aziz Amine,** Hassan II University of Casablanca, Morocco. Recent advances in molecularly imprinted polymers combined with nanomaterials for various sensing applications.
Lunch	
	Frontiers Session Chairperson: Prof. J. D. Sharma, Head, Department of Metallurgical & Materials Engineering, PEC Chandigarh Rapporteur: Mrs. Bindu Rani & Ms. Nishi Mehak Venue: Senate Hall
2:00 PM-2:30 PM	Keynote Lecture-1 **Prof. Ajeet Kaushik,** Florida Polytechnic University, Lakeland, FL-33810, US Intelligent sensing-to-sense for sustainable health and environment
2:35 PM-3:05 PM	Keynote Lecture-2 **Prof. Dong-Kwon Lim,** Korea University, South Korea Engineering of plasmonic nanostructures for bioanalytical sensing applications with SERS
3:10 PM-3:40 PM	Keynote Lecture 3 **Prof. Sven Ingebrandt,** RWTH Aachen University, Aachen, Germany Choice of electrode materials in microelectronic devices for cell-device coupling and neuroimplants

TEA & Poster Session 1: 3:30 PM-6:30 PM (P1-P50)

DBT Session
Chairperson: Prof. Vikas Rishi, Scientist G, NABI, Mohali
Rapporteur: Ms. Raman Duddi & Mr. Shubham Modgil
Venue: Senate Hall

4:00 PM-4:30 PM	Keynote Lecture-4 **Prof. Federico Polo,** Ca' Foscari University of Venice, Italy Are synthetic receptors a valuable alternatives to antibodies when developing (bio-) sensing architectures for diagnostics and therapeutic drug monitoring in cancer research?
4:35 PM-5:00 PM	Invited Lecture-1 **Dr. Vivek Pachauri,** RWTH Aachen University, Germany Application of metal-organic frameworks based devices in biosensors and emerging technologies
5:05 PM-5:30 PM	Invited Lecture-2 **Prof. P. Gopinath,** IIT Roorkee Next-generation nanofibers: personalized drug delivery and improved tissue engineering solutions
5:35 PM-6:00 PM	Invited Lecture-3 **Prof. Sonu Gandhi,** DBT-NIAB, Hyderabad Role of sensors in biomedical research
6:30 PM-8:00 PM	**Cultural Program**

EMSD-2024 SPONSORS

INTERNATIONAL CONFERENCE
ON

ENGINEERED MATERIALS FOR SUSTAINABLE DEVELOPMENT

EMSD 2024

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AND
NATIONAL AGRI-FOOD BIOTECHNOLOGY INSTITUTE (NABI), MOHALI

Programme Schedule

Conference Venue: Punjab Engineering College (Deemed to be University), Sector 12, Chandigarh

DAY 02

Venue: Senate Hall

Time	July 25, 2024
	DRDO Session Chairperson: Prof. Uma Batra, Department of Metallurgical & Materials Engineering, PEC Chandigarh Rapporteur: Ms. Nishi Mehak & Dr. Deepti Rana
9:30 AM-10:15 AM	Plenary lecture-4 **Dr. Reinhard Miller,** TU Darmstadt, Germany Achieving publications in high-impact factor journals
10:20 AM-10:50 AM	Keynote Lecture-5 **Prof. David B. Amabilino,** Director, ICMAB, Barcelona From natural products to sustainable materials: Gels and synthetic organic metals
10:55 AM-11:25 AM	Keynote Lecture-6 **Prof. Lluïsa Pérez-García,** University of Barcelona, Spain Supramolecular nanomaterials and their interaction with living cells
TEA & Poster Session 2: 11:30 AM -2:30 PM (P51-P100)	
	JEOL Session Chairperson: Prof. Rajat Sandhir, Department of Biochemistry, Panjab University, Chandigarh, Rapporteur: Dr. Balwinder Kaur & Ms. Anjali Venue: Senate Hall
11:30 AM-12:00 PM	Keynote Lecture-7 **Prof. César Rodriguez-Emmenegger,** IBEC & ICREA, Barcelona Harnessing nature's blueprints to design interactive biointerfaces and synthetic cells

	JEOL Session Venue: Senate Hall Chairperson: Prof. Rajat Sandhir, Department of Biochemistry Panjab University, Chandigarh, Rapporteur: Dr. Balwinder Kaur & Ms. Anjali	**Waters Session** Venue: CDGC Seminar Hall Chairperson: Dr Kanthi Kiran Kondepudi, Scientist E, NABI Mohali, Rapporteur: Ms. Shivani & Mr. Mukul Kumar
12:05 PM-12:30 PM	Invited Lecture-4 **Prof. Sameer Sapra**, IIT Delhi, New Delhi Understanding self-trapped excitons in halide perovskites	Invited Lecture-5 **Dr. Arindam Malakar**, University of Nebraska, Lincoln, USA Natural engineering of biochar surfaces to enhance sustainable agro-ecosystems
12:35 PM-1:00 PM	Invited Lecture-6 **Prof. Pawan K. Kulriya,** JNU, New Delhi, Engineering the structural and mechanical properties of high entropy alloys via energetic Ion irradiation	Invited Lecture-7 **Prof. Vijay Kumar,** NIT Srinagar Synthesis and photoluminescence properties of rare-earth-doped ternary oxide phosphors for solid-state lighting applications

1:05 PM-1:30 PM	Invited Lecture-8 **Prof. Shobha Shukla,** IIT Bombay, Mumbai, Carbon-based nanomaterials for water quality sensing and purification	Invited lecture-9 **Dr. Vishvanath Tiwari,** Central University of Rajasthan, Ajmer, Targeted nanomaterial against AdeABC efflux pump as a potent antibacterial molecule against MDR *Acinetobacter baumannii*
Lunch		
	NanoTemper Session Chairperson: Prof Sanjay Bhadada, Endocrinologist at Department of Endocrinology and Diabetes Center, PGIMER, Chandigarh Rapporteur: Navneet Kaur & Sarthak Sharma	**ThermoFisher Session** Chairperson: Dr Koushik Mazumdar, Scientist E, NABI Mohali, Rapporteur: Mukul Kumar & Raman Duddi
2:15 PM-2:40 PM	Invited Lecture-10 **Prof. Amit Jaiswal,** IIT Mandi, HP Gold-based plasmonic nanostructures for sensing and biomedical applications	**OT01 Neeru Bala** Inhibited Hexagonal Phase Transition in Ga Doped $Ge_2Sb_2Te_5$ Films: Advancing Power-Efficient Phase Change Memories **OT02 Dr. Manju** Investigating the photoluminescence and local electronic structure of Ce-Dy codoped $SrZnO_2$ system for solid state lighting **OT03 Manpreet Kaur** Morphology, Electro-optical and dielectric properties of graphene oxide doped polymer dispersed liquid crystal
2:45 PM-3:10PM	Invited Lecture-11 **Prof. Tarun Kumar Sharma,** GBU , Gandhinagar Harnessing functional nucleic acids for biomedical diagnostics	**OT10 Dr. Jagat Rathod** Unravelling the organo-mineral-microbes interactions in the biochar functional matrix for agro-environmental sustainability **OT15 Dr. Neha Bhardwaj** MOF-based fluorescent aptasensor for detection of mycotoxins **OT 17 Dr. Navpreet Kamboj** Ultrafine mix-phase SnO-SnO_2 nanoparticles anchored on reduced graphene oxide boost reversible Li-ion storage capacity beyond theoretical limit
3:15 PM-3:40 PM	Invited Lecture-12 **Prof. Neetu Singh,** IIT Delhi Employing nanoparticle-based approaches for sustainable plant disease management and genetic advancements	**OT18 Dr.Preetismita Borah** A Novel method for detection and removal of inorganic selenium by the application of Ion chromatography **OT19 Dr. Kamaljeet Kaur** Phone camera nano-biosensor using mighty sensitive transparent reusable upconversion paper **OT 20 Rahul kumar** A smart and innovative approach to recover phosphorus from water using engineered (nano)biochar and simultaneously using it as slow-release fertilizer

TEA & Poster Session 3: 3:00 PM 6:00 PM (P100-P150)

	Klorofil Session Chairperson: Prof. Akash Deep, Scientist G, INST Mohali, Rapporteur: Mr. Varun Kamboj & Ms. Twinkle	**Anton Paar Session** Chairperson: Rupam Bhunia Scientist E, NABI Mohali Rapporteur: Ms. Shivani & Mr. Mukul Kumar
4:00 PM-4:25 PM	Invited Lecture-13 **Prof. Ateet Dutt,** UNAM, Mexico Nanotechnology Opportunities and its scope in the Energy and Health Sector	**OT24 Dr. Vaishali Pathak Londhe** Enhanced performance of organic light emitting diode (OLED) with dual organic hole transport layers **OT25 Dr. Divya Gupta** Preferential sputtering driven tailoring of structural, optical and electrical characteristics of oblique Ar^+ sputtered Polyethylene (PE) surfaces **OT26 Ashwani Chauhan** A novel solution combustion method for tertiary Cu and Zn doped NiO nanocomposite for evaluation of its photocatalytic activities of methylene blue dye degradation.
4:30 PM-4:55 PM	Invited Lecture-14 **Dr. Gurwinder Singh,** GICAN, University of Newcastle, Australia Engineered nanoporous carbon materials for energy and environmental applications	**OT27 Vivek Gupta** Thermoelectric materials: State of the Art **OT28 Shiwani Randhawa** Beta-amyloid oligomer targeted dopamine-conjugated gold nanoparticles to attenuate toxicity in alzheimer's disease via dopadelic boost of synaptic function **OT29 Sandharbh kumar** A personalized 3D printed device for electrostimuli driven delivery of a hydrophobic drug niclosamide for oncotherapy **OT30 Piyush kumar** Melanoma diagnosis through affordable and reliable multiplexed electrochemical biosensor
5:00 PM-5: 25 PM	Invited lecture-15 **Prof. Małgorzata Kujawska,** Poznan University of Medical Sciences, Poland α-Synuclein anti-aggregation activity of samarium functionalized few-layer nanographene oxide	**OT31 Harish G S** Fabrication of BioPatch for the management of xerostomial **OT32 Parth Kapil** Development of reduced graphene oxide hydrogel based electrochemical immunosensor for diagnosis of oral cancer **OT33 Kanika** Leveraging Thiol functionalized biomucoadhesive hybrid nanoliposome for local therapy of Ulcerative colitis **OT34 Sakshi Gumber** Development of biodegradable antimicrobial nano-composite packaging material for shelf-life extension of perishable commodities

Gala Dinner in Hotel Mountview
7:00 PM-10:00 PM

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INTERNATIONAL CONFERENCE
ON

ENGINEERED MATERIALS FOR SUSTAINABLE DEVELOPMENT

EMSD 2024

July 24-26, 2024

ORGANIZED BY
PUNJAB ENGINEERING COLLEGE (DEEMED TO BE UNIVERSITY), CHANDIGARH
AND
NATIONAL AGRI-FOOD BIOTECHNOLOGY INSTITUTE (NABI), MOHALI

Programme Schedule

Conference Venue: Punjab Engineering College (Deemed to be University), Sector 12, Chandigarh

DAY 03

Venue: Senate Hall	CDGC Seminar Hall
Time	July 26, 2024
DAE-BRNS Session Chairperson: Dr Asif khan Shanavas, Scientist D, INST Mohali Rapporteur: Mr. Varun Kamboj & Ms. Twinkle	**DST-RE CHD Session** Chairperson: Dr Sanjeev Soni, Sr. Principal Scientist, Biomedical Applications CSIO Chandigarh Rapporteur: Mr. Kamil Monga & Mr. Aman
09:30 AM-09:55 AM	Invited Lecture-17 **Prof. Narinder Singh,** IIT Ropar Innovative chemosensor development for monitoring	Invited lecture-18 **Dr. Hardik Gohel,** University of Houston, Victoria, Visual recognition network classifier for interpretable pneumonia prediction and sustainable healthcare
10:00 AM-10:25 AM	Invited Lecture-19 **Prof. Padmaja Prasad Mishra,** SINP, Kokata Direct observation of adsorption, desorption and hybridization of DNA using Graphene based sensors	Invited Lecture-20 **Prof. Yashveer Singh,** IIT Ropar Biomaterials for wound healing and tissue regeneration
10:30 AM-10:55 AM	Invited Lecture-21 **Dr. Manoj Munde,** JNU, New Delhi Protein-capping as an inimitable strategy to switch DNA-Cu based 'dark' clusters to fluorescent ones	Invited lecture-22 **Dr. Vinay Sharma,** IIT Jammu Nanomaterials as emerging tools for modern healthcare
Tea		
LABINDIA Session Chairperson: Prof. Sonal Singhal, Department of Chemistry, Panjab University, Chandigarh Rapporteur: Mr.Kamil Monga & Mr. Aman	**Toshniwal Session** Chairperson: Prof. Neeraj Khatri Senior Principal Scientist, IMTECH Chandigarh, Rapporteur: Mrs. Bindu Rani & Ms. Nishi Mehak	
11:15 AM-11:40 AM	Invited Lecture-23 **Prof. Praveen Kumar,** IACS Kolkata, Spin-modulated photoelectrochemical hydrogen generation using quantum materials	Invited Lecture-24 **Prof. Abhijit Dan,** MAKAUT, West Bengal Thermoresponsive microgel-stabilized pickering liquid crystal-in-water emulsions for optical detection of chemical and biological analyte

11:45 AM-12:10 PM	Invited Lecture-25 **Dr. Amitabha,** CSIR-IHBT, Palampur, Understanding protein corona formation at the nano-bio interfaces and assessment of their biological implications	Invited Lecture-26 **Dr Vishal Chaudhary,** University of Delhi, India, Nano biosensing Sniffers for disease diagnosis
12:15 PM-12:40 PM	Invited Lecture-27 **Dr. Kamil Reza Khondakar,** Woxsen University, Hyderabad SERS interfaced with AI and IoMT: Next generation smart sensing tool	Invited Lecture-28 **Prof. Sanjeev K. Sharma,** CCS University, Meerut, Metal Oxide-CNTs enhanced the removal rate of pharma and textile discharged systems
12:45 PM-1:10 PM	Invited lecture-29 **Dr. Ankit Saneja,** CSIR-IHBT, Palampur Exploring sustainable food packaging: incorporating nanomaterials into chitosan-alginate films for mushroom preservation	
Lunch		
Metrohm Session Chairperson: Prof G R Chaudhary, Director SAIF/CIL, Panjab University, Chandigarh, Rapporteur: Ms. Shivani & Mr. Mukul Kumar		
2:30 PM-3:15 PM	Plenary Lecture-5 **Prof. Avinash Chandra Pandey** Director, Inter-University Accelerator Center, New Delhi, Accelerator based solutions for sustainable development	
3:20 PM-4:15 PM	**Valedictory and prize distribution**	
High Tea		

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PLENARY TALKS

PL-01

Adsorption of Surfactants at the Water/Air, Water/Alkane Vapor and Water/Liquid Alkane Interfaces

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For many decades, the thermodynamic models derived for the adsorption of surfactants at the water/air interface were directly used to describe adsorption phenomena at water/oil interfaces. Thus, several peculiarities observed experimentally for the adsorption at water/oil interfaces could not be adequately described and, therefore,could not be correctly understood. All observed specific effects were interpreted solely by a penetration of oil molecules somehow into the interfacial layer. This gave rise to various speculations about the physical role of oil molecules in the process of surfactant adsorption. Recently, for water/oil interfaces a competitive adsorption of surfactant and oil molecules was proposed, providing a much better interpretation of experimental data. With this picture, however, we were unable to explain why the interfacial tension of the water/oil interface decreases significantly already in the presence of extremely small amounts of surfactants in the adjecent aqueous phase. This effect was shown to be not of competitive nature, but it was explained by a cooperativity of surfactant and oil molecules, leading to the formation of a mixed adsorption layer comprised of these two types of molecules. Cooperativity in the given situation means that the presence of a few surfactant molecules at the interface can induce a significant ordering of oil molecules in the interfacial layer surrounding the surfactant. This new interfacial structure, in turn, attracts further surfactant molecules to adsorb. This kind of cooperativity is also observed for surfactant adsorption layers formed at the interface of a aqueous solution to air when containing vapor of volatile oil, such as hexane or dodecane. Once sufficient surfactant molecules are co-adsorbed with the ordered oil molecules, the cooperativity turns into a competitive process at the interface.The new developed thermodynamic model for the description of experimental data was achieved by applying a suitable adsorption model for each of the two adsorbing species, the surfactant and the oil molecules. It was shown that a Frumkin adsorption model is superior to describe the oil molecules' adsorption, while for the adsorption of the surfactant molecules a Langmuir, Frumkin, reorientation or multi-state adsorption model can be applied. Which of these possible models is superior to others depends on the molecular structure of the surfactant and oil molecules, as recently discussed in.

PL-02

Plant and Microbe Based Materials for Sustainable Bioeconomy

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Climate change and biodiversity loss have had a significant negative impact on human lives, leading to the development of alternative, environmentally sustainable technologies using biological resources. The Food and Agriculture Organization (FAO) defines bioeconomy as the production, utilization, and conservation of biological resources to provide a variety of goods across different economic sectors, enabling a sustainable economy. Strategies such as biorefinery and circular economy routes are being implemented to achieve a sustainable bioeconomy, with plants and microbial materials playing a crucial role. Examples include utilization of plant bioresources and agricultural residues to produce specialty chemicals and commodity products like fiber, polyols, and bioethanol as alternatives to petrochemicals. Bioprospection of high-altitude Himalayan environments has identified novel microbial resources such as extremozymes, probiotics, pigments, bioplastics (polyhydroxyalkanoates), plant growth regulators, and nutraceuticals. Integrating plant and microbial resources offers advantages such as high productivity, lower greenhouse gas emissions, efficient resource utilization, and resource recycling. Further, integration of nanotechnology approaches in valorisation of plant and microbial bioresources have offered wider applications towards agricultural productivity enhancement such as nanofertilizers, nanopesticides, and nanobionics, precision microbial fermentation for production of enzymes and therapeutic biomolecules and novel materials for wide range of applications ranging from drug delivery to construction materials. Also, nanotechnology can be used to increase the bioavailability of pant and microbial derived bioactive molecules. In addition, novel cellular agriculture and genetic engineering technologies have been evolved for sustainable production of high value biomolecules. Sustainable bioeconomy is essential for India's economic prosperity owing to its unique biodiversity, but challenges like scalability, cost competitiveness with fossil fuel-derived materials, and lack of regulatory frameworks need to be addressed. Continuous research and development are being undertaken in every sector to overcome the aforesaid challenges and fully harness the potential of plants and microbe-based materials in the sustainable bioeconomy.

PL-03

Recent advances in molecularly imprinted polymers combined with nanomaterials for various sensing applications

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Molecularly imprinted polymers (MIPs) have garnered significant attention in recent years due to their ability to mimic natural antibodies, providing high selectivity and sensitivity in sensing applications. When combined with nanomaterials, MIPs can exhibit enhanced properties, such as improved binding kinetics and increased surface area, resulting in superior analytical performance. Notably, the synthesis of MIPs combined with nanomaterials using photopolymerization or probe ultrasound has drastically reduced synthesis times from hours to just a few minutes. Furthermore, surface modification of MIPs with surfactants, such as sodium dodecyl sulfate (SDS) and cetyltrimethylammonium bromide (CTAB), can eliminate non-specific adsorption in MIPs. The integration of nanoenzymes that mimic enzyme activity with MIPs designed for enhanced selectivity has led to the development of advanced biomimetic sensors for applications in environmental monitoring, food safety, and clinical diagnostics. Recently, we reported various applications of MIPs combined with nanomaterials for the determination of different emerging pollutants and contaminants such as sulfonamides, 17-β-Estradiol, Bisphenol A, aflatoxins, heavy metals as well as bacterial spores.Future research directions in our laboratory involve exploring the combination of MIPs and nanomaterials for analyzing breath biomarkers. Challenges and future perspectives will be outlined and discussed.

PL- 04

Achieving Publications in High Impact Factor Journals

Reinhard Miller
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Editor-in-Chief of "Colloids & Interfaces" of MDPI
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In general, the target of scientific work is to add new facts to the existing global pool of knowledge in one or several of the known branches of science. To prevent the loss of new facts and to avoid double work by others in order to answer the same questions, the obtained results should be published in an international journal. We know there is only one global science, i.e., there is not any local or national sciences. Hence, we need to establish norms for the publication of new findings and publish them in most suitable journals accessible by everyone.The publication of scientific results is a complex process and includes the reliable cooperation between the authors with the journal editors and experts as reviewers. The main work has to be done by the authors of a new manuscript. First of all, studies have to be performed to find answers to questions formulated at the beginning of the work as Hypothesis. Experiments have to be performed in a reliable and reproducible way, following high international standards, such as the "Good Laboratory Practice". Also, ethical aspects are of enormous importance as the time of a single genius sitting in an ivory tower is over.Science is now almost exclusively the result of team work. The Findings will then be summarized and published in a manuscript.To publish scientific results, authors have to search for the most suitable journal. It is the first priorityto look after the impact factor of a journal but to find a sufficient agreement between the subject of the manuscript and the aims of the selected journal. Hence, authors must carefully analyze the information provided by a respective journal, and study the instructions for authors. This can save a lot of time as it avoids the loss of time when submitting a manuscript to an unsuitable journal. The first step of publication of a successfully submitted manuscript is to enter into the reviewing process initiated by the journal's editor. The editor is responsible for a first analysis of submitted manuscripts, for making the decision of "reject – not suitable" or "send to reviewers for evaluation". Although authors are requested to propose names of experts as possible reviewers, the editor decides who will be invited to evaluate a manuscript. Typically, two independent positive assessments by reviewer (experts in the field) are required to accept a manuscript for publication, i.e., to transfer a submitted manuscript into a published paper.The aim of this seminar includes an introduction into the role of authors, reviewers and editors in order to become familiar with the functioning of scientific journals. The processes of manuscript submission, reviewing, revision, acceptance, production will be presented and finally discussed by questions and answers. We will also learn about the huge amount of material made available to authors by publishers, such as "Guide for authors", "Frequently asked questions" and even videos to explain many details of the process of publishing which is the most important step after completing a scientific work. Once published, the results become available worldwide to extend the global knowledge in a certain branch of science. Publishers must then ensure accessibility for the future – years, decades, centuries.

PL- 05

Accelerator based solutions for sustainable development

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Ion beam techniques are increasingly becoming popular for synthesis, characterization and for modifying material properties to design efficient devices for sustainable development. A thermal annealing effects at lower fluences in carbon based materials (including Graphene, Graphe Oxide, C_{60}, Carbon Nanotubes etc), instead of expected defect production has been observed. The radiation stability of graphene and other 2D materials under extreme conditions (e.g., space and nuclear environments)is also studied. The band gap tuning in atomically thin 2D materials such as MoS_2 is highly desirable for optimizing their applications in solar cells, photodetectors, and optoelectronic devices and it has been shown that radiation induced strain modifies their structural, elastic, and electronic properties. Few other examples such as SHI induced enhanced conductivity for asymmetric supercapacitor in nanocomposites/ nanohybrids and applications in nuclear materials will also be discussed. Applications for accelerators for ADS for solutions sustainable energy resources will also be discussed.

KEYNOTE TALKS

KT-01

Intelligent Sensing-to-Sense for Sustainable Health and Environment

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Presently smart sensing technology interfaced with other analytical tools like the Internet of Things (IoT) and artificial intelligence (AI) are emerging significantly for efficient disease/problem and environmental management, even at point-of-care (POC) applications. Such systems are on the track of transformative research according to the goals of 5thand 6th-generation technology to track and manage health and the environment according to sustainability goals. In this direction, we are exploring electro-active electrodes for efficient bio (biosensor) and chemical sensing with the capability of POC applications. Our developed sensing prototypes are well interfaced with a miniaturized potentiostat (M-P) which can be operated using a smartphone. To develop efficient infectious disease management, my laboratory recently developed miniaturized nano-enabled biosensing systems to detect targeted biomarkers for diagnostics of infectious diseases like COVID-19 infection. Further, electrochemical sensing is explored for efficient sensing of water pollutants (heavy metals) and forever chemicals like microplastics selectively and at a very low level (ppm to ppb). We believe our developed biosensing and chemical sensing systems supported by AI and IoT approaches can be a potential tool for personalized health management and environment surveillance. The outcomes of these sensing technologies can be utilized for policy and timely decision-making efforts.

KT-02

Engineering of Plasmonic Nanostructures for bioanalytical sensing applications with SERS

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A lot of innovative bioanalytical applications were developed by the use of novel materials. Among them, in this talk, I like to present the engineered nanostructures with plasmonic nanomaterials, which is especially useful for bioanalytical sensing applications with surface-enhanced Raman scattering (SERS) such as detecting molecules as a surrogate, identifying a bacterial species with the aid of AI-algorithms, and chiro-optical sensing applications. Raman scattering can provide a molecular information of interest, SERS can greatly enhance the intensity of signals. By using the properly controlled nanostructures, the intensity and signal reproducibility could be greatly controlled in the assay scheme. Recently, we reported the use of silver nanocube in detecting the target sequences of SARS-CoV-2 virus in aM sensitivity. We reported the synthetic method for Helicoid I structures with tryptophan amino acid as a chiral inducer, the helicoid structure showed an excellent performances in detecting chiral molecules with SERS.

KT- 03

Choice of electrode materials in microelectronic devices for cell-device coupling and neuroimplants

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For in vitro monitoring of cells and tissue, nowadays, there are commercial systems available integrating many devices (>25k) in one chip, which are fabricated in a classical complementary metal-oxide-semiconductor process. Such systems demonstrated low-noise recording capabilities and ultra-high integration with sensor-to-sensor pitches of only 20 micrometers and less. For all these silicon-based devices, the paradigm is, that the ionic electronics on the liquid 'cellular' side is capacitive decoupled for the solid semiconductor electronic side of the CMOS chip. Here the dielectric interface is of ultimate importance and several approaches and material combinations were reported to optimize the contact to the cells. Conductive polymers, where poly(3,4-ethylenedioxythiophene) doped with polystyrene sulfonate (PEDOT:PSS)is the most prominent candidate, carry the electrical current in a fundamentally different way compared to silicon. The electrical conductivity in this polymer matrix can be modulated by doping and de-doping with cations from the liquid, which offers the possibility to engineer organic electrochemically gated transistors (OECTs). In this presentation, the potential of this class of devices for the recording of living cells and tissue is discussed and compared to classical CMOS transistor arrays. As one of the new applications of such OECT arrays, Electrical Cell-substrate Impedance Sensing (ECIS) is demonstrated as well. ECIS with transistor arrays offers a truly single-cell resolution for adhesion and migration studies. We present the versatility of this method addressing cell lines, cardiac myocytes, neurons, and individually acting cells of the immune system. In the outlook, devices can also be rendered towards the detection of specific ion types and even neurotransmitters.For long-term neurostimulation purposes, however, conductive polymers might not be the best choice of material due to the generation of reactive oxide species. For the development of a wireless retina implant, for artificial vision enabling blind patients of a particular disease group, the usage of classical electrode materials such as iridium oxide is advised. This advanced application of eye implants is shortly discussed. In conclusion, conductive polymers offer new opportunities to engineer devices – especially on flexible and transparent substrates - for in vitro monitoring of cells and tissue, but are not the ideal solution for all applications.

KT- 04

Are synthetic receptors avaluable alternatives to antibodies when developing (bio-)sensing architectures for diagnostics and therapeutic drug monitoring in cancer research?

F. Polo,[a,b,*] G. Moro,[a] E. Sossich,[a] Y. Mazzocato,[a] A. Angelini,[a,b] P. S. Sfragano,[c] I. Palchetti[c]

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The interest in synthetic bioreceptors to develop (bio-)sensing platforms has increased quite rapidly in recent years. Ligand binding assay, which employs a receptor to capture the analyte, relies on the affinity of the receptor toward the binding ligand. In this respect, antibodies (Abs) are still playing a fundamental role. However, they suffer of high production costs to meet the requirements of specificity and selectivity for each analyte of interest. Immunoassays, in fact, rely on a couple of Abs that selectively bind two different epitopes of the same protein cancer biomarker. This aspect is crucial to develop biosensing platforms. Moreover, it is usually very difficult for researchers worldwide to find commercially available Ab couple that meet such requirements. Furthermore, Abs are not particularly useful to detect small molecules, such as chemotherapeutic drugs, as the detection system may imply the use of highly sophisticated equipment. However, there are innovative and valuable solutions represented by aptamers and peptides. In this presentation, we will show few interesting and recent applications of aptamers and of a new class of bicyclic peptides. The former ones have been employed to monitor a chemotherapeutic drug in plasma in an SPR-based sensing platform. Whereas the latter ones have been devised in an electrochemical sensing platform to detect a cancer protein biomarker.

KT- 05

From natural products to sustainable materials: Gels and synthetic organic metals

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Organic materials are often derived purely from petrochemicals, but incorporation of natural products into synthetic materials is both attractive from a sustainability perspective as well as from the viewpoint of providing different functionalities. The talk will provide a broad perspective of this area, as well as showing two specific examples: Gelators derived from natural products that show a broad range of gelation abilities and synthetic organic conductors of electricity where carrageenans are used as the counter-ions in the materials. The synthetic and materials perspectives will be discussed.

KT- 06

Supramolecular nanomaterials and their interaction with living cells

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Regulating the interaction between micro- and nanomaterials and living cells is essential for advancing both our understanding and practical applications in the field of Nanomedicine. Our group uses nanostructured materials able to interact with living cells to sense or modify their behavior, mainly for sensing and target-directed delivery purposes. These nanomaterials -including supramolecular hydrogels, metallic and inorganic nanoparticles, and silicon-based microchips-, as well as examples of their interaction with biological matter will be shown in the talk. The emphasis will be on the use of microchips, since they have dimensions smaller than cells, and thus can be manipulated in suspension for application in single-cell analysis and population of cells experiments. Bio-functionalization of the microchips using self-assembled monolayers provides chemical and biological functionality to them, including individual cell tagging, intracellular pH sensing, and mechanically induced cell death.

KT- 07

Harnessing nature's blueprints to design interactive biointerfaces and synthetic cells

César Rodriguez-Emmenegger

Institute for Bioengineering of Catalonia (IBEC), Barcelona, Spain, Catalan Institution for Research and Advanced Studies (ICREA), Barcelona, Spain; Biomedical Research Networking, Center in Bioengineering, Biomaterials and Nanomedicine, The Institute of Health Carlos III Barcelona, Spain and DWI Leibniz Institute for Interactive Materials, Aachen, Germany

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Nature's ability to engineer functionality in materials arise from the hierarchical self-assembly of seemingly simple (macro)molecular building blocks. Deciphering these intricate blueprints forms a robust foundation for the bio-inspired synthesis of materials that can seamlessly interact with living systems and execute novel functions. My lecture showcases a selection of research endeavors conducted in our laboratory, all centered around the overarching objective of crafting bio-inspired interactive materials for biomedical applications. First, I will introduce adaptive hemocompatible nanocoatings with the remarkable that mimic simple functions of natural endothelium and are capable modulating hemostasis as well as to detect and digest of blood clots. This technology is translated to oxygenator membranes. Second, I will delve into our innovations concerning 'Kill & Repel', an adaptive antimicrobial nanocoatings tailored for medical devices. Lastly, I will concentrate on the development of synthetic cells, specifically engineered vesicles designed to mimic fundamental biological properties and perform specific tasks. These tasks encompass hosting bacterial divisomes and engineering synthetic macrophage-mimetic microrobots proficient in the phagocytosis of bacteria and viruses, including SARS-CoV-2.Remarkably all these tasks are programmed at the molecular level.

INVITED TALKS

IT- 01

Application of metal-organic frameworks based devices in biosensors and emerging technologies

Vivek Pachauri
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Engineering of materials at nanoscale to create efficient low-dimensional systems has taken a center stage in development of technologies for sustainable future. Amongst a variety of nanomaterials that are found useful for key application area such as sensors, catalysis, energy conversion, storage, future electronics, optics and biological transformation, metal-organic frameworks (MOF) are emerging as promising candidates. Porous crystalline coordination networking of MOF's lattice with uniquely tunable electrical, optical and chemical characteristics present unparalleled opportunities to develop future technology platforms, especially in the field of molecular sensors. The tunable affinity of MOF lattice towards different small molecules is a potential pathway to develop highly integrated sensor platforms for screening of small molecules. Currently, there are no reliable approaches to carry out determination of small molecules out in the field using handheld devices, which significantly limits the implementation of the measures designed to protect the food resources and environment.Here, we will discuss, the syntheses approaches for two-dimensional MOFs and their process integration for large wafer-scale fabrication of electrical and optical devices with high reproducibility. In recent years, we have developed a novel experimental framework that allows for on-chip prototyping of different 2D MOFs in a layer-by-layer liquid phase epitaxy (LbL-LPE) before upscaling in clean room processes. This novel framework, while allows significant reduction of costs and efforts for studying the physicochemical properties of the material, also pave a way towards programmable, targeted integration of MOFs for technology applications. In particular, Ni and Cu based 2D MOFs of controllable thickness and morphology realized via LbL-LPE and their lithography to form nanoscale devices for optical and electrical monitoring of small organic molecules namely phthalates will be discussed. In addition, a Cell-on-Chip (CoC) platform based Ni-MOF for monitoring of single-cells to study the cellular development (e., g. cell growth, proliferation, and differentiation) by recording the electrical signal, typically, electrical impedance spectroscopy (EIS) will be showcased. Here, cell culture studies with PC-12 cells on 2D Ni-MOF for 24 hours exhibited excellent biocompatibility and potential to serve as a superior platform for the study of cell-development.

IT- 02

Next-Generation Nanofibers: Personalized Drug Delivery and Improved Tissue Engineering Solutions

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Nanofibers have found significant applications in tissue engineering, wound healing, and anticancer therapy. Recently, there has been a growing interest in using anticancer drug-loaded nanofibers as post-operative implants to prevent cancer recurrence and metastasis. Despite the development of numerous nanofiber-based drug delivery systems, many remain largely ineffective due to certain limitations. A major challenge is their inability to achieve a controlled and sustained drug release profile, which is crucial for personalized medication. To address these issues, we have developed differentially cross-linkable polymeric nanofibers capable of delivering various therapeutic agents for anticancer and wound dressing applications. Additionally, we have created novel nanofibrous scaffolds to overcome the shortcomings of existing scaffolds in tissue engineering applications.

IT- 03

Role of Sensors in Biomedical Research

Sonu Gandhi
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Rapid and reliable diagnostics for fatal diseases are vital because infected individuals display no symptoms or nonspecific symptoms sometimes similar to other infections. As immunoassays lack adequate sensitivity and selectivity and are unable to identify active state of infection, molecular diagnostics are an effective means to detect the disease soon after infection. Biosensors provide highly sensitive assay for rapid detection of any disease and its implementation in a simple, easy-to-use, inexpensive, point-of-care (POC) disposable cassette that carries out all the unit operations from sample introduction to detection. Various electrochemical, fluorescence, optical based methods are favoured using antibodies/aptamers for the identification or quantification of antigen biomarkers due to its high sensitivity, specificity, and robustness. Also, microfluidic technology integrates multiple laboratory functions such as sample preparation, reaction and detection into a microfluidic chip and reduces the whole analysis system size significantly. This technology has many advantages including low reagent consumption, shorter reaction time, high throughput and system portability.

IT- 04

Understanding Self-Trapped Excitons in Halide Perovskites

Sameer Sapra
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A large number of semiconductors can be excited using electromagnetic radiation. This results in the formation of excitons, i.e. the bound electron and hole in the conduction and valence bands, respectively. With large exciton binding energies that are more than the thermal energy at room temperature, one can spectroscopically observe these excitons. The free excitons can further interact with the lattice, if the lattice is polarizable enough to get to more stable configurations, also known as the self-trapped excitons (STE). How these STEs are formed and what are their dynamics in the excited state is a topic of investigation. In this talk I will shed some light on the ultrafast exciton dynamics.

IT- 05

Natural Engineering of Biochar Surfaces to Enhance Sustainable Agroecosystems

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Sustainable agriculture requires improvements in nutrient use efficiency and carbon storage. The use of engineered materials, such as biochar – a carbon-rich soil conditioner – plays a significant role in enhancing sustainability in agricultural ecosystems. Biochar represents the most reliable means of adding organic carbon into soils for long-term storage and mitigation of climate change. However, results from studies focusing on improved nutrient retention in biochar can produce inconsistent results: the underlying mechanisms involve interactions between biochar and soil that may be influenced by other site and management characteristics. Identifying the interaction between biochar and soil is critically needed to use it efficiently for a sustainable of agroecosystems. Our study focuses on the natural engineering of biochar surface in soil driven by reactive iron, such as ferrihydrite, a naturally occurring iron nanoparticle. We analyzed two field experiments one irrigated and the other rainfed, with biochar application under corn-winter cover crop-soybean rotation. Biochar produced from Eastern Red Cedar was incorporated at a rate of 70 Mg ha-1 in 0-10 cm depth to compare combined and individual effects of biochar and cover crops on soil carbon and nitrate retention. Samples were taken six months after biochar application from 0-10, 10-30, 30-60, and 60- cm and analyzed for organic carbon and nitrate. Biochar particles were analyzed for changes in their reactivity towards nitrogen using x-ray photoelectron spectroscopy. Biochar, when aged in soil, undergoes self-functionalization with iron oxides, leading to increased nitrate retention up to 24 kg ha-1 within the 0-30 cm soil depth. The relationship between these processes was previously observed in a greenhouse experiment and was found to be driven by soil redox cycles, which allow reduced iron(II) to migrate and reoxidize on biochar surfaces, indicating its potential to improve nutrient retention in agroecosystems. Our research demonstrates that the natural engineering of biochar surfaces is driven by reactive iron species such as ferrihydrite of unsaturated agricultural soils. These findings underscore the potential of biochar material to stabilize nutrients, increasing productivity and environmental safety of agriculture. This talk will delve into the mechanisms by which biochar surface functionalization influences rhizosphere processes, implications for soil health, and broader applications for agricultural practices aimed at a sustainable environment.

IT-06

Engineering the Structural and Mechanical Properties of High Entropy Alloys via Energetic Ion Irradiation

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Radiation resistant alloys play a crucial role in a wide range of high-tech industries, including nanoelectronics, medical, aerospace, and advanced nuclear technologies such as next-generation fission and fusion reactors. In this context, high entropy alloys (HEAs) have emerged as a promising class of materials due to their strong lattice distortion, short range ordering, sluggish diffusion, and high configurational entropy. These properties contribute to their exceptional structural, mechanical, high-temperature oxidation resistance and thermal properties. In nuclear reactors, materials are exposed to extreme conditions, including severe radiation from neutrons and heavy ions, high temperatures, and corrosive environments. Evaluating materials under such conditions require in-pile testing, necessitating nuclear reactors with very high neutron flux and state-of-the-art in-situ facilities. Additionally, this testing often demands extended exposure times. Consequently, a surrogate approach is employed, wherein materials are irradiated with suitable energetic ions using particle accelerators. This presentation will discuss the process for synthesis of single phase NiCoCrFePd HEAs, their characterization and irradiation damage. Using positron annihilation spectroscopy (PAS) along with X-ray diffraction and electron microscopy, we aim to comprehend the generation of irradiation-induced defects and their impact on the micro-hardness of the NiCoCrFePd HEA. Structural analyses have confirmed that HEAs remain structurally stable even when subjected to irradiation at a remarkably high displacement per atom of 400. Fluence-dependent PAS studies have unveiled the formation of mono-vacancies at lower fluences, which become saturated through recombination and evolve into larger defects with successive ion fluences. Additionally, increase in the hardness is also observed with ion fluence. These insights into HEA radiation tolerance are invaluable for potential applications in radiation-prone environments, underpinning advancements in materials science and engineering.

IT-07

Synthesis and photoluminescence properties of rare-earth-doped ternary oxide phosphors for solid-state lighting applications

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The significance of light in our daily lives cannot be overstated. It has become a crucial science component in the 21st century, with light-based technologies transforming various fields .Research efforts have been focused on discovering cost-effective, energy-efficient, and environmentally friendly phosphor materials for solid-state lighting devices. The demand for luminescent materials with better optical and photoluminescence characteristics has led to research endeavors to enhance material properties. Rare-earth (RE) ions are the primary activators of luminescent centers in many host materials. The optical processes governed by the 4f–5d transitions of divalent and trivalent RE ions have enabled precisely tuned color emission. RE-activated phosphors have significant applications in various fields like display devices, temperature sensors, solar cells, bio-imaging, optoelectronics devices, etc . Recently, ternary oxide-based phosphor materials have gained popularity due to their unique structural, physical, chemical, magnetic, and optical properties. Ternary oxide-based materials have been influential hosts for the fabrication of different up-conversion (UC) and down-conversion (DC) materials. The talk will cover the comprehensive aspects of trivalent RE-doped ternary oxide-based phosphors for tunable color emissions, drawing from personal experience synthesizing, characterizing, and applying them for solid-state lighting.

IT-08

Carbon based Nanomaterials for Water Quality Sensing and Purification

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Carbon based nanomaterials have emerged as versatile tools for water quality sensing and purification, offering a promising solution to the global water crisis. Their unique properties, such as high surface area, chemical stability, and electrical conductivity, make them efficient for detecting and removing contaminants from water. Various carbon allotropes, including activated carbon, graphene, and carbon quantum dots, have been explored for their potential in sensing heavy metals and water purification.We have extensively focused on these carbon-based nanomaterials, harnessing their high sensitivity and selectivity for the rapid detection of heavy metal ions like arsenic, cadmium, lead, and mercury. We have developed a nanopatterned platform for detecting heavy metal ions at parts per billion (ppb) levels, enabling rapid detection for water pollution. Furthermore, we have investigated the removal of contaminants using carbon-based nanomaterials, designed to leverage their adsorptive and catalytic properties for water purification. These nanomaterials have shown great promise in eliminating organic pollutants including wide range of dyes, oil, heavy metals, and antibiotics from water.The development of efficient and cost-effective water treatment technologies based on carbon-based nanomaterials has far-reaching implications. It can significantly improve global access to clean water, promoting public health and sustainable development. Byharnessing the potential of these innovative materials, we can create a safer and more sustainable future for generations to come.

IT-09

Targeted nanomaterial against AdeABC efflux pump as a potent antibacterial molecule against MDR *Acinetobacter baumannii*

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Acinetobacter baumannii causes pneumonia, respiratory infections, and urinary tract infections in humans. Quantitative proteomics of carbapenem-resistant strains suggests over expression of different efflux compared to sensitive strains, hence selected for further investigation due to their widespread distribution and broad substrate specificity. Experimental studies using gene mutants demonstrated the significant role of AdeABC in carbapenem resistance, biofilm formation, surface motility, pathogenesis, bacterial adherence, and invasion of CRAB to host cells.The structure-based ligand screening, molecular mechanics, molecular dynamics simulation, and experimental validation using efflux pump mutants and antibiotic accumulation assay identified naringin dihydrochalcone (NDC) as the lead against AdeB protein. This lead was selected as a capping agent for silver nanoparticles, and FTIR, UV, DLS, and SEM were used to characterise the prepared NDC-capped silver nanoparticles (NDC-AgNPs). The investigated molecular mechanism showed that the NDC-AgNPs possessed multiple mechanisms of action. In addition to efflux inhibitory activity, it generates reactive oxygen and nitrogen species as well as causes changes in the electrochemical gradient of CRAB. It was also observed that *A. baumannii* did not develop resistance against NDC-AgNPs for several generations and was effective against different clinical isolates of *A. baumannii*. In another strategy, we have reported that Gallate-PVP-capped AgNPs inhibit the infection of *A. baumannii* in the human pulmonary epithelial cell. Therefore, these studies provided insight into combating carbapenem-resistant *Acinetobacter baumannii* using targeted nanoparticles.

IT-10

Gold-Based Plasmonic Nanostructures for Sensing and Biomedical Applications

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Plasmonic nanostructures based on noble metals, like gold and silver have contributed significantly towards the area sensing and biomedical applications. These materials exhibit unique size and shape-dependent optical properties at the nanoscale, enabling precise control over light-matter interactions leading to applications in various fields. Herein, we will discuss about the applications of plasmonic nanostructures specifically nanorattles, particularly in the biomedical field. The first part of the talk will provide a comprehensive overview of the fundamental principles underlying the shape and size-dependent localized surface plasmon resonance (LSPR) phenomenon of plasmonic nanoparticles. In the second part, we will delve into the diverse applications of noble metal-based plasmonic nanostructures, with a specific focus on biomedical applications. These include(a) Photothermal therapy: By utilizing the strong light absorption properties of plasmonic nanostructures, photothermal therapy can be achieved, where targeted heating of tumor cells occurs upon exposure to near-infrared light. This non-invasive technique shows great potential for cancer treatment. (b) Surface-Enhanced Raman Scattering (SERS): Plasmonic nanostructures can provide highly sensitive SERS substrates for the detection of trace analytes and for bioimaging. By enhancing the Raman signals of reporter molecules plasmonic SERS bioimaging enables imaging and sensing.

IT-11

Harnessing Functional Nucleic Acids for Biomedical Diagnostics

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Currently diagnostic industry is heavily dependent on antibodies (Abs) but Abs have several limitations like high batch-to-batch variation, requirement of cold chain, need an animal to generate Abs, long generation time. To address these limitations in recent years 'Aptamers' has spurred a great interest as a diagnostic tool and therapeutic agents. Aptamers are structured functional nucleic acids that binds to its target with high affinity and specificity and they offer several advantages over antibodies including but not limited to negligible batch-to-batch variation, ease in functionalization, *in vitro* evolution, speed in selection, synthesis, scale up and adaptability to various diagnostics formats. Owing to the aforementioned advantages aptamers have ability to replace antibodies in all possible diagnostic format and thus they are regarded as chemical rivals of antibodies. This talk will give an overview of 'Aptamer Technology' Followed by a discussion on some of the recent work from our own group on tuberculosisand snake bite diagnostics.

IT- 12

Employing Nanoparticle-based Approaches for Sustainable Plant Disease Management and Genetic Advancements

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Effective plant disease management has been a longstanding challenge in agriculture, significantly impacting crop yields, food security, and environmental health. The constant evolution of plant pathogens creates formidable obstacles in achievement of sustainable agriculture, contributing to a 10-15% loss in global crop production. The situation is further exacerbated by the lack of targeted drugs for plant pathogens. Consequently, conventional methods like broad-spectrum pesticides have been widely used. However, this has serious side effects, including chemical resistance, with serious repercussions for both the environment and human health. Our group has been exploring plant's natural defense mechanism to develop innovative therapeutic interventions. Biomolecule-based drugs such as genetic and biochemical agents offer a more sustainable and environmentally friendly alternative to chemical pesticides. The strategy involves developing tailored therapeutic drugs to attack particular pathogens or disease pathways with minimal adverse effects on beneficial organisms. However, traditional techniques for delivering these biomolecules and agrochemicals often suffers from inefficiencies, such as low utilization rates and poor stability in field conditions. Recent advancements in nanotechnology have enabled the creation of sophisticated delivery systems that enhance the effectiveness of biomolecular treatments. Targeted approaches are designed to address the particular requirements of various plants and infection extents, by varying the size, surface characteristics, and adhesion properties of nanoparticles. Beyond disease management, these nanotechnology innovations hold great promise for crop improvement, offering opportunities to boost agricultural productivity, develop crops with enhanced disease resistance, and improve nutritional content. Our research aims to overcome genotype-specific limitations in plant genetic engineering, responding to the historical preference for dicots due to their genetic manipulability. The objective is to broaden the application of genetic engineering techniques across diverse genotypes within dicots and hard to manipulate monocots, fostering inclusivity and versatility in plant genetic studies. Collectively, these advancements represent a significant progression toward more effective, sustainable, and eco-conscious agricultural practices, with the potential to address critical challenges in global food security and environmental conservation.

IT-13

Nanotechnology Opportunities and its Scope in the Energy and Health Sector

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Our research focuses on growing nanomaterials, including Si nanoparticles and hybrid Au-ZnO nanowires, to explore their potential in solar cells, water splitting, and chemical/biosensing applications. Our goal is to understand how the size and shape of these nanostructures affect their properties. In our study, we have embedded Si nanoparticles in matrices such as SiOx, SiNx, and SiOxCy, and investigated their unique properties for downshifting applications in third-generation solar cells. By controlling the size and composition of these embedded Si nanoparticles, we have achieved significant advancements in improving solar energy conversion efficiency through downshifting mechanisms. Furthermore, we have focused on the growth of hybrid Au-ZnO nanowires and their potential in hydrogen production and chemical/biosensing applications. The combination of gold and zinc oxide in these nanowires produces distinctive properties that enable efficient hydrogen generation and sensitive chemical/biosensing platforms. Our research contributes to the field of nanomaterials by providing insights into the potential applications of Si nanoparticles and hybrid Au-ZnO nanowires. These findings open opportunities for innovative uses in solar energy harvesting, water splitting, and chemical/biosensing technologies. By understanding and controlling the properties of these nanostructures, we aim to advance the practical utilization of nanomaterials in diverse fields.

IT- 14

Engineered nanoporous carbon materials for energy and environmental applications

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Engineered nanoporous carbon materials stand tall for a plethora of applications in the fields of energy and environment. For instance, their potential in energy storage systems such as batteries and super capacitors as electrode materials is well recognised and so is for gas capture. Their suitability for such applications relies on their tunable porosity and adjustable surface chemistry which are primary factors for enhanced mass transport and reaction kinetics. However, challenges always exist in the design and development of such materials to improve their structural and physico-chemical features for better performance. The porosity in carbon materials can be achieved through techniques including templating, and physical/chemical activation. The common goal is achieving desired porous characteristics such as surface area, pore volume and pore size. A control over porosity can be established by tuning various experimental parameters including starting precursor type, choice of template or the type of activating agent, carbonization temperature, pressure, and time. The surface chemistry in nanoporous carbons can also be carefully controlled through the variation of experimental conditions and doping with internal/external agents. Biomass is a relatively low-cost precursor source of organic carbon that can be exploited to devise engineered nanoporous carbon materials for application in gas capture and energy storage electrodes. Chemical activation of biomass using KOH/$ZnCl_2$/ H_3PO_4 is a well-established method which can be manipulated further to construct micro or meso porous domains, and metal or heteroatom doping in the structure of nanoporous carbons.

IT- 15

α-Synuclein anti-aggregation activity of samarium functionalized few-layer nanographene oxide

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Synucleinopathies are a group of neurodegenerative diseases characterized by the accumulation of α-Synuclein (ASN) aggregates found in the brain. Parkinson's disease (PD) is one of the most studied synucleinopathies, with growing prevalence, disability, and lethality over the years. Misfolded ASN molecules cluster together into oligomeric species, which can entrap other proteins and eventually compact into megadalton, highly stable assemblies of amyloid fibrils known as Lewy bodies in the cell body. ASN accumulates aberrantly in close affinity to neuronal organellar membranes, thus triggering toxic effects on membrane-associated compartments and affecting signaling pathways, ultimately leading to cell death. Current therapies for α-synucleinopathies are limited. The modulation of ASN aggregation is emerging as a novel therapeutic target for treating this pathology. Carbon nanostructures appear as promising agents affecting the ASN aggregation. We developed a novel samarium functionalized few-layer nanographene oxide (Sm-GO) with favorable redox behavior, making it an excellent oxidation barrier. Here, we show its potential to target synucleinopathy. In the test tube, based on fluorometric (thioflavin T) and spectrophotometric (turbidity assay) measurements, we evaluated the ability of Sm-GO to affect the aggregation of ASN-preformed fibrils (PFFs). Favorably, Sm-GO decreased the stability of PFFs with no effect on the monomer form of ASN. Moreover we examined its cytocompatibility in human dermal fibroblasts.

IT-17

Innovative Chemosensor Development for Environmental Monitoring

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The pressing challenge of the 21st century is addressing the waste produced by industrial, domestic, and agricultural activities. Among these issues, water pollution stands out as a critical global concern. Recent advancements in nanoscale science and engineering offer promising solutions to improve water quality. Innovations such as nanosorbents, nanocatalysts, bioactive nanoparticles, nanostructured catalytic membranes, and nanoparticle-enhanced filtration systems are at the forefront of these developments. These nanotechnology-derived products have the potential to tackle various water contamination issues effectively. Nanomaterials, in particular, can be functionalized with specific chemical groups to enhance their affinity for certain pollutants. They can act as high-capacity, recyclable ligands for toxic metal ions, radionuclides, and both organic and inorganic solutes and anions in aqueous solutions. By doing so, they offer a robust and sustainable approach to water purification. This presentation aims to showcase the role of nanomaterials in water purification and quality monitoring for both industrial and public water supplies. Through these advanced nanotechnological applications, we can significantly mitigate the adverse impacts of water pollution and move towards a cleaner and safer environment.

IT- 18

Visual Recognition Network Classifier for Interpretable Pneumonia Prediction and Sustainable Healthcare

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In this paper, we propose a unique comprehensive solution for predicting pneumonia using chest X-ray images. We utilize an enhanced VGGNet model tailored for the binary classification task. The modified VGG19 with a binary classifier provides a solid foundation for feature extraction and leverages the pre-trained features and deep architecture to differentiate between normal and pneumonia-affected lung images. The use of transfer learning allows us to extend the pre-trained model on a diverse and large-scale dataset by further training it on limited-size medical imaging data for the crucial task of biomedical classification without the need for large, labeled training data or computational resources. We also apply custom data augmentation methods and LIME for model interpretability to train a reliable deep-learning model.A key innovation of this VRN classifier is its interpretability. Unlike conventional black-box AI models, our approach integrates explainable AI (XAI) methodologies, providing visual and statistical insights into the decision-making process. This transparency not only builds trust among healthcare professionals but also facilitates better understanding and acceptance of AI-driven diagnostic tools. The robust model displays a high accuracy of 92% with a high recall of 96.4% and AUC of 97%.The sustainable healthcare aspect of this research is underscored by the model's low computational requirements, making it feasible for deployment in low-resource environments. Additionally, the use of open-source software and publicly available datasets ensures that the technology remains accessible and cost-effective. The VRN classifier's ability to provide rapid, reliable, and interpretable predictions positions it as a valuable tool in the global fight against pneumonia, particularly in underserved regions.In conclusion, the VRN classifier represents a significant advancement in the field of medical imaging and AI, offering a practical solution to enhance pneumonia diagnosis. By prioritizing interpretability and sustainability, this research contributes to the broader goal of equitable healthcare access and improved patient outcomes worldwide.

IT- 19

Direct observation of adsorption, desorption and hybridization of DNA using Graphene based sensors

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Graphene oxide (GO) and its functional derivatives have found tremendous application in the development of biosensors for the detection of nucleic acid hybridization. We have systematically investigated the adsorption mechanism of oligonucleotides on both GO and Graphene oxide gold nanoparticle (GO-AuNP) hybrid surface and also recovered the adsorbed DNA by applying complementary strands by employing ensemble and single-Molecule fluorescence methods. A remarkable observation about the adsorption and desorption mechanism of double-stranded DNA (ds-DNA) on graphene oxide (GO) and GO-AuNP surface has been monitored. The efficiency and rate of adsorption are found to be higher for the GO-AuNP hybrid material compared to that of only GO. The results from the single molecule-FRET (sm-FRET) indicate that the adsorption of the ds-DNA on the GO-AuNP hybrid material takes place by completely unzipping the strands, i.e. the DNA adsorbs as single-stranded DNA. However, no such clear evidence was observed for the GO. The sm-FRET results reveal the DNA hybridization mechanism to happen "*in situ*", *i.e.* hybridization between the probe and target DNA to form a ds-DNA and desorption thereafter from the GO surface takes place simultaneously. These results also demonstrate that the electrostatic interaction between DNA and GO is of little importance to the overall theory of interaction. This investigation improves the fundamental understanding of DNA hybridization dynamics on GO surface opening new windows in the field of biophysics, sensing, and therapeutic application.

IT- 20

Biomaterials for wound healing and tissue regeneration

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Biomaterials are designed to interact with the living system and biomaterials, such as nanoparticles, hydrogels, and self-assembled gels have been explored by researchers for wound healing and tissue regeneration applications due to their excellent biocompatibility and extracellular matrix-mimicking properties. Our group has been engaged in the development of polymeric hydrogels, self-assembled peptide gels, and nanomaterials for drug delivery, antibacterial, wound healing, and bone tissue regeneration applications. Recently, we developed self-assembled gels from antibacterial and antioxidant peptides conjugated to anti-inflammatory drugs, naproxen and indomethacin, to treat infected wounds. These nanofibrousgels showed potent antioxidant, antibacterial, antibiofilm, and anti-inflammatory activities along with the ability to heal scratch in cell culture. As far as our work on bone tissue regeneration is concerned, we fabricated thiol-functionalized mesoporous silica nanoparticles to treat osteoporosis. It demonstrated highly promising cytocompatibility and ROS scavenging activity in murine pre-osteoblast cells. In addition, the nanomaterial induced osteogenic activity in cell culture, as evident from enhanced alkaline phosphatase activity, calcium deposition, and expression of osteogenic gene markers. In another work, we fabricated acemannan-coated, cobalt-doped biphasic calcium phosphate nanoparticles for immunomodulation-regulated bone regeneration. The nanoparticles were found to be cytocompatible and induced excellent osteogenic activities (enhanced alkaline phosphatase activity, calcium deposition, and expression of genes). Due to the doping of cobalt and coating with acemannan, the nanoparticles induced macrophage polarization to anti-inflammatory M2-like phenotype to create a pro-healing microenvironment for bone tissue regeneration. Thus, the biomaterials developed show excellent potential in wound healing and bone tissue regeneration.

IT- 21

Protein-Capping as an Inimitable Strategy to Switch DNA-Cu Based 'Dark' Clusters to Fluorescent Ones

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DNA-based Cu nanoclusters (DNACuNCs) have robust applications in various therapeutics and diagnostics, including pathogen detection, genotyping and disease surveillance. However, fluorescent nature of these nanoclusters is very critical for their use in these fields. Interestingly, a significant number of DNA sequences still form undesirable non-luminescent DNACuNCscalled 'dark' clusters. Due to scarcity of efficient and accurate approaches for turning such 'dark' clusters into luminescent ones hampers their applications. To overcome this problem, we have shown how a basic protein can be used as an encapsulating agent to switch non-luminescent DNACuNCs to luminescent ones. In this method, protein encapsulation resulted in a 2500% enhancement in emission intensity of 'dark' DNACuNCs. Due to highly cationic nature and flexible conformation of protein, it can adjust according to the charge distribution on the surface of NCs, leading to an effective interaction supported by the binding study. It prompts NC assembly into stable and well-defined three-dimensional structures with extremely small sizes of ~1.7 nM that support the discrete electronic transitions resulting in an exceptionally strong fluorescence emission intensity. Further, these NCs sustained better stability in the wider pH range, making them ideal for biological applications. The proposed approach here for achieving high emission efficiency can be extended to other non-luminescent DNA-based NCs. Further, we will also explore the ability of these NCs to recognize disease specific biomolecules to determine their potential in developing new sensors.

IT-22

Nanomaterials as Emerging Tools for Modern Healthcare

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The unprecedented chemical and physical properties of nanomaterials have the potential to revolutionize the field of biology and medicine. Nanomaterials have found applications in the disease biosensing, bioimaging and even therapeutics. The nanomaterial-based biosensors have the promise to provide portable alternatives to lab diagnostics.The high sensitivity, selectivity, high throughput and the potential to bring Lab-on-a-Chip have brought significant attention to the field of nanosensors. Similarly, the photodynamic and photothermal nanoparticles have shown immense potential in therapeutics. The field of DNA sequencing, protein folding and biomolecule interaction is hugely benefitted by the advent of nanopore technology which can make modern diagnostics fast, accurate and inexpensive. The present talk discusses various application of nanoparticles in sensors, bioimaging probes, therapeutics and highlight the potential of nanopore technology to advance nano-diagnostics.

IT-23

Spin-Modulated Photoelectrochemical Hydrogen Generation using Quantum Materials

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The concurrent presence of exceptional catalytic properties and robust spin-orbit coupling, stemming from structural inversion asymmetry, in the two-dimensional polar Janus MoSSe material, is anticipated to yield spin-dependent catalysis when subjected to an external magnetic field. During my presentation, I will provide a proof-of-concept demonstration showcasing the advantageous influence of an external magnetic field on the photoelectrochemical process of water splitting, leveraging the combined spin and catalytic characteristics of MoSSe as a photocathode. To enhance charge transport, we have incorporated delaminated Mo2C-TxMXene, which, through a synergistic effect, results in a 52% enhancement in photocurrent for the optimized Mo2C-Tx/MoSSe/SiNW photocathode under a magnetic field strength of 0.4 T at zero bias. Additionally, I will discuss our recent research findings concerning the application of quasi-two-dimensional MnSe2for magnetically induced electrochemical generation of hydrogen gas. These discoveries lay a solid groundwork for the advancement of asymmetric two-dimensional materials across a wide range of applications.

IT-24

Thermo responsive Microgel-Stabilized Pickering Liquid Crystal-in-Water Emulsions for Optical Detection of Chemical and Biological Analytes

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Micrometer-sized droplets of thermotropic liquid crystals (LCs) dispersed in aqueous media (i.e., LC-in-water emulsions) respond sensitively to the presence of a variety of different analytes that trigger changes in the configurations of the LC within the droplets.[1] Herein, we present a novel approach that involves Pickering stabilization of micometer-sized liquid crystal (LC) droplets with soft colloidal particles known as polymeric microgels to facilitate the analysis of analyte-induced configurational transition of the LC droplets. The microgel particles are able to irreversibly adsorb at the LC−water interface, and the resulting microgel-stabilized LC droplets possess a remarkable stability against coalescence over time. Although, the LC droplets are successfully protected by a continuous network of the microgel layer, the LC-water interface is still accessible for amphiphilic analytes, such as such as anionic sodium dodecyl sulfate (SDS) and cationic dodecyltrimethylammonium bromide (DTAB) that can diffuse through the meshes of the adsorbed microgel network or through the interfacial pores and induce an LC response. This approach is exploited to investigate the dynamic range of the microgel-stabilized LC droplet response to analytes. The LC-in-water emulsions can be broken at temperature slightly above the volume phase transition temperature (VPTT) of the microgels that results macroscopic phase separation, thereby leading to recycling of the emulsifiers.[2] The combination of excellent emulsion stability and breaking on-demand, the responsivity of the droplets and the reusability of the emulsifier offers a complete and versatile toolbox for sustainable application of chemical and biological sensing.

IT- 25

Understanding Protein Corona formation at the Nano-Bio Interfaces and Assessment of their Biological Implications

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The dynamic interaction between nanomaterials and biological molecules has sparked significant interest in understanding the formation of protein corona at the nano-bio interface. In this presentation, a detailed exploration of protein-nanoparticle interactions will be done via shedding light on the structural dynamics and thermodynamics of the protein- nanoparticle complexes using our current results. The talk will emphasize on the formation, composition, challenges, and applications of protein corona in biomedical and nanotechnological fields, including drug delivery, theranostics, and translational medicine. The intricate mechanisms governing protein corona formation on nanoparticle surfaces, highlighting the roles of different nanoparticle and biological factors will be discussed. Additionally, this presentation will cover recent advances in translational nanomedicine and associated applications, focusing on strategies aimed at mitigating the adverse effects of protein-nanoparticle interactions at the biological interface by tailoring protein coronas through nanomaterial engineering. This comprehensive assessment from chemical, technological, and biological perspectives will serve as a guiding beacon for the development of future nanomedicine, enabling more effective emulation of the biological milieu and the design of protein-nanoparticle systems for enhanced biomedical applications.

IT-26

Nanobiosensing Sniffers for Disease Diagnosis

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The burgeoning global population surge is overwhelming the existing medical infrastructure, necessitating a pressing demand for the advancement of early-stage disease detection methodologies. Contemporary diagnostic paradigms are focused on the innovation of point-of-care and minimally invasive diagnostic tools, leveraging miniaturized sensing devices. Notably, breathomic sensors have arisen as auspicious conduits for individualized and on-site healthcare provisions, offering the capability to identify volatile organic compounds (VOCs) as biomarkers within exhaled breath, enabling early disease detection. Nevertheless, the practical implementation of these sensors in real-time medical contexts remains contingent upon overcoming obstacles such as the paucity of clinical trials, dedicated data analysis, public awareness, scalability, and accessibility. This comprehensive review critically elucidates the current landscape of breath VOC-detecting sensors of chemo resistive modules for human disease diagnosis, meticulously delineating associated challenges, alternative strategies, and prospects for commercial advancement. It intricately expounds upon the biological origins of biomarkers, diverse sensing modalities, and the underlying mechanisms pertaining to breathomic VOC diagnosis. Furthermore, it delineates the potential of these VOC breath sensors to revolutionize non-invasive and early-stage disease screening, amalgamating modern technologies including nanotechnology, artificial intelligence, machine learning, bioinformatics, the Internet of Things, and cloud computing within the realm of contemporary healthcare diagnostics. These next-generation smart sensors have potential to revolutionize the medical healthcare facilities and to full fill the sustainable development goals.

IT-27

SERS interfaced with AI and IoMT: Next generation smart sensing tool

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Surface-enhanced Raman spectroscopy (SERS) has emerged as a powerful optical-based diagnostic tool for personalized health management. This is due to its inherent features of multiplexing capability with light confinement, label-free detection, and single laser application. In addition, SERS provides unique fingerprint spectra of molecular binding events with ultra-high sensitivity. It is noted that biomedical research produces huge data and medical records which require high-end computer assistance for quick analysis to remove high variability and distinguish between similar spectra patterns. For time-sensitive outcomes along with predictive analysis, artificial intelligence (AI) can recognize these different patterns and remove ambiguity to minimize data variations for better clarity of the result. Also, other difficulties faced in the SERS system are preprocessing steps which are noise removal, smoothing, baseline correction, background subtraction, and cosmic ray removal. Machine learning (ML) can greatly automate these spectral processes and improve the efficiency of the raw data (data collection, preprocessing, and downstream analyses) for high accuracy. Therefore, AI and ML which could provide numerous algorithms in data analysis with interpretation ability to screen, monitor, and diagnose diseases for personalized treatment can be integrated with SERS. Further, the incorporation of the Internet of Medical Things (IoMT) would provide a real-time solution for better health management. This article will provide a comprehensive analysis of the existing state of research, highlighting the design, advantages, and application of SERS-based diagnostic assays (nanomaterial-based sensors, microfluidic devices, wearables, etc) in conjunction with emerging computer-based tools.

IT- 28

Metal Oxide-CNTs enhanced the Removal rate of Pharma and Textile Discharged Systems

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Increasing water pollution through textile and pharmaceutical discharge wastes has damaged biodiversity and pestilence in living entities, one of the most vital sources of pollutants on the earth. Water contamination has occurred due to the expansion of industrialization and digitalization to meet current citizen demands. Developing economies are struggling to obtain clean and safe water due to the discharge of pollutants into the water systems. Physical, chemical, and biological methods are inefficient in removing these pollutants of emerging concern due to lower pollutant removal efficiency, operating difficulties, and generation of potentially hazardous byproducts. Photocatalytic activity with efficient photocatalysts has paid great attention to a cost-effective and eco-friendly approach to removing contaminants from wastewater. Metal Oxide-based carbon nanotube (MOx-CNTs) nanomaterials have been paid great attention as an efficient photocatalyst. MOx such as TiO_2 and CeO_2 are preferred for the photocatalytic reactions due to their ease of modulation of the microstructure and high photocatalytic activity ~99%. Additionally, nanostructured TiO_2 has been considered a good photocatalyst due to bacterial disinfection, self-cleaning surfaces, H_2 production, etc. Meanwhile, CeO_2 concentration is known to improve the absorbance of the solar spectrum andpromote charge transfer. CNTs play a crucial role in sinking electrons, facilitating slow electron-hole recombination rates to enhance overall photocatalytic performances.

IT-29

Exploring Sustainable Food Packaging: Incorporating Nanomaterials into Chitosan-Alginate Films for Mushroom Preservation

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The widespread utilization of petroleum-based food packaging materials has caused considerable ecological harm due to their unsustainable and non-biodegradable nature. In this regard, polysaccharide-based biodegradable materials emerged as promising alternatives, yet their practical applications are hindered by low hydrophobicity and limited functional properties. In this context, the incorporation of phytochemicals within edible films represents a promising strategy to overcome these limitations. In my talk, I will discuss, how incorporation of phytochemicals can modulate the functional properties of the edible films with recent case study of our work on pterostilbene nano emulsion incorporated chitosan-alginate films for their applications in food packaging. The findings of our study demonstrates that incorporation of pterostilbene nano emulsion in chitosan alginate films hold substantial promise as a sustainable alternative to conventional petroleum-based packaging materials.

ORAL PRESENTATION ABSTRACTS

OT-01

Inhibited Hexagonal Phase Transition in Ga-Doped $Ge_2Sb_2Te_5$ Films: Advancing Power-Efficient Phase Change Memories

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$Ge_2Sb_2Te_5$(GST) is a phase change material that undergoes a two-step crystallization process, involves phase transition from amorphous to the metastable face-centred cubic(*fcc*) phase and then to a stable hexagonal phase. This study investigates the phase change behaviour of Ga-doped GST thin films deposited by thermal evaporation method. The findings suggested thatincreasingGadopinginGSTthinfilmsaltersthebondingarrangementofthehostsystemalongwith the formation of new Ga-Te bonds. Furthermore, the results revealed that with the augmentation of 10% of Ga doping, the metastable *fcc* phase gets thermally stabilized and suppresses the hexagonal close-packed (*hcp*) phase at annealing temperature of 260°. The optical transmission contrast verified this one-step crystallization between the amorphous and the *fcc* phase. The electrical study showed a decreased resistance contrast between the amorphous and the crystalline phase of Ga-GST thin films, leading to a reduction in writing current. These compelling findings position these Ga-doped thin films as available and promising contender for its deployment in phase change memory applications, offering the dual advantages of rapid processing speed and minimal power consumption.

OT-02

Investigating the photoluminescence and local electronic structure of Ce-Dy codoped $SrZnO_2$ system for solid state lighting

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Oxide nanophosphors are widely explored as single phase phosphors for solid state lighting as well as light emitting diodes. As a member of this class, SrZnO2 offers itself as a phosphor host for various luminescent dopants, providing host-controlled wavelength dependent emission routes. It was observed that Dy doped SrZnO2 system exhibited host controlled cool and cold white emission upon excitation of dopant levels by charge transfer band and host defect absorption, respectively. Whereas, Ce doped SrZnO2 system exhibited unprecedented fast blue emission through charge transfer excitation of mixed valent Ce levels. Hence, motivated by these findings, the present study is intended to explore the luminescence outcome and local electronic structure of Ce-Dy codoped SrZnO2 system. SrZnO2 host consists 4 and 7 coordinated Zn and Sr cationic site, having high and low lattice symmetry, respectively. Hence, substitution of either Zn or Sr or both by Ce/Dy resulted in combined emission from Dy and Ce energy levels, under various excitation wavelengths (270 nm, 325 nm, 375 nm, 425 nm and 450 nm). The overall emission was observed in white region of chromaticity diagram. X-ray absorption near edge structure at Ce *L3*-edge showed the presence of mixed valence state of Ce, the features of which are observed to be changing with varying the relative doping concentration of Ce and Dy. The combined analyse is beneficial in predicting the applicability of Ce-Dy codoped SrZnO2 system for white lighting applications.

OT-03

Morphology, Electro-optical and dielectric properties of graphene oxide doped polymer dispersed liquid crystal

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Polymer-dispersed liquid crystal (PDLC) films typically consist of low molecular weight liquid crystals (LCs) dispersed within an optically transparent polymer matrix. In this study, we explore the influence of graphene oxide (GO) on the morphology electro-optical and dielectric properties of a PDLC system. The PDLC was prepared by using the Polymerization-Induced Phase Separation method. Specifically, we used a 70:30 weight ratio of nematic liquid crystal (NLC) E7 and PCDH polymer for the PDLC formulation. We introduced varying concentrations of GO (0.005, 0.01, and 0.03 wt.%) into the PDLC matrix. Our investigation centred on evaluating the effect of GO concentration on the morphology, phase transition temperatures, threshold voltage, and dielectric characteristics of the PDLC system. The results reveal a noteworthy reduction in the threshold voltage upon the addition of GO nanoparticles. This reduction enables a transition from opacity to transparency at lower applied voltages. Furthermore, we conducted temperature-dependent analyses for all samples. It was observed that both the threshold and saturation voltage of the PDLC system decreased as temperatures increased, consistent with theoretical expectations. Simultaneously, the dielectric permittivity, dielectric loss, and conductivity exhibited an increase with rising temperatures. These findings suggest the potential utility of GO-doped PDLC composite films in applications such as smart windows or privacy windows. These composite films can operate at significantly lower voltages while exhibiting improved transparency.

OT-04

Unravelling the Organo-Mineral-Microbes interactions in the Biochar Functional Matrix for Agro-Environmental Sustainability

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The chemical-biology driving the pyrogenic organic matters (PyOM)such as biochar-mineral-microbes interaction is a highly complexed interplay, however, in recent times this functional matrix is gaining immense interest for ecological engineering applications. Dissecting step-by-step, the organo-mineral interactions from various well recognized ancient dark earths and lab-made biochar(s) could pave the way for elucidating the physico-chemical functional moieties supporting various agro-environmental applications from soil health to remediations. The ~10-30 micron-scale scaffolds also decipher the possibility of mineral formation and microbial residence with essential minerals and other nutrient dynamics. Our micro-spectroscopic analysis using SEM-EDS, RAMAN and FTIR highlighted the association of element-specific minerals and interacting functional groups in different pyrogenic carbon fractions. Furthermore, a biochar-associated bacterial isolate residing in the peanut shell biochar matrix was demonstrated using DAPI staining and explored for the biodegradation potentials especially for organic pollutant cleanup. Ultimately, these investigations will help us in recognizing the true potential of the microbial world, and our agro-waste resources which could lead to the development of bench-scale to industrial technologies of global interest, taking actions for sustainability.

OT-05

MOF-based fluorescent aptasensor for detection of mycotoxins

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Mycotoxins are naturally occurring toxins produced as secondary metabolites by certain fungi such as *Penicillium, Aspergillus,* and *Fusarium species*. The exposure to mycotoxins through ingestion, breath, or skin contact can facilitate their entry inside the lymphatic and circulatory system leading to various serious side effects in humans (e.g., hepatic necrosis, disease, development hindrances, allergy, immunosuppression, and even cancer). The conventional methods based on chromatography and mass spectrometry are widely used for detection of mycotoxins providing high-performance separation, accurate analysis, and sensitive detection of small samples in an automated manner. However, these methods are not suitable for large-scale or on-site rapid analysis as they require trained professionals to operate the instruments and perform complex analytical procedures.In recent years, biosensors have gained a lot of attention in the fields of healthcare, diagnostics, environment protection, food safety, and agriculture. Also, the nanomaterial-based developments in biosensor technology have led to the development of highly sensitive and effective optical sensors for food quality monitoring. In particular, the aptamer-based nanosensors have gained considerable popularity in the past few years owing to their good stability, high affinity, and specificity. The fluorescent nanomaterials when conjugated with aptamers lead to the development of highly sensitive sensors for the detection of analytes such as metal ions, microorganisms, toxins, pesticides, antibiotics, etc. In the current work, an aptasensor was developed using a Zr-based metal-organic framework (MOF) i.e.UiO-66-$NH_2$and graphene oxide (GO) for the detection of ZEN. Highly fluorescent UiO-66-NH_2 MOF conjugated with ZEN aptamers was employed as a fluorescent signal probe while GO was used as a quencher in the assay. In the presence of ZEN, the fluorescence intensity of the MOF increased significantly since the aptamer-UiO-66-NH_2 could bind to ZEN instead of GO. The developed assay displayed excellent sensitivity, specificity, and linearity over a range of 0.01 – 100 ng/mL, yielding a low detection limit of 5 pg/mL for ZEN under optimal experimental conditions. In addition, the developed sensor also demonstrated good recoveries for the spiked corn and wheat samples. This developed ‘turn-on’ sensing strategy provides a new approach for the rapid, inexpensive, and sensitive fluorescent detection of ZEN in food matrices.

OT- 06

Ultrafine mix-phase SnO-SnO_2 nanoparticles anchored on reduced graphene oxide boost reversible Li-ion storage capacity beyond theoretical limit

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Tin-based materials with high specific capacity have been studied as high-performance anodes for Li-ion storage devices. Herein, a mix-phase structure of SnO-SnO_2@rGO (rGO= reduced graphene oxide) was designed and prepared via a simple chemical method, which leads to the growth of tiny nanoparticles of a mixture of two different tin oxide phases on the crumbled graphene nanosheets. The three-dimensional structure of graphene forms the conductive framework. The as-prepared mix phase SnO-SnO_2@rGO exhibits a large Brunauer-Emmett-Teller surface area of 225 $m^2 g^{-1}$ and an excellent ionic diffusion rate. When the resulting mix-phase material was examined for Li-ion battery anode application, the SnO-SnO_2@rGO was noted to deliver an ultrahigh reversible capacity of 2604 mAh g^{-1} at a current density of 0.1 A g^{-1}. It also exhibited superior rate capabilities and more than 82% retention of capacity after 150 charge-discharge cycles at 0.1 A g^{-1}, lasting until 500 cycles at 1A g^{-1} with very good retention of the initial capacity. Owing to the uniform defects on the rGO matrix, the formation of LiOH upon lithiation has been suggested to be the primary cause of this very high reversible capacity, which is beyond the theoretical limit. A Li-ion full cell was assembled using $LiNi_{0.5}Mn_{0.3}Co_{0.2}O_2$ (NMC-532) as a high-capacity cathodic counterpart, which showed a very high reversible capacity of 570 mAh g^{-1} (based on the anode weight) at an applied current density of 0.1 A g^{-1} with more than 50 % retention of capacity after 100 cycles. This work offers a favorable design of electrode material, namely, mix-phase tin-oxide nanocarbon matrix, exhibiting adequate electrochemical performance for Li storage applications.

OT- 07

A Novel Method for detectionandremoval of inorganic Selenium by the application of Ion Chromatography

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Selenite (SeO_3^{2-}, Se (IV)) and selenate (SeO_4^{2-}, Se (VI)) are the predominant forms of selenium present in the aqueous environment, and known to cause severe damage to health on excess consumption. Water is one of the major routes for selenium intake due to its contamination with selenium through geogenic and anthropogenic activities. It is thus important to develop remedial solution for their detection and removal, especially, Se (IV), which is more toxic than Se (VI).In this work, we present a new method for the determination and speciation of selenium in water with ion chromatography (IC) using a conductometric detector and adsorption technique and demonstrate iron based metal-organic framework MIL-53 (Fe-MOF) (abbreviated as Material of Institute LavoisierMIL), for selenium (IV) removal from water. Chromatographic parameters such as mobile phase concentration, and columns type were optimised for the detection and speciation of selenium. The work studies Fe-MOFs removal efficiency for Selenium (IV) in terms of effect of pH, selenite concentration, adsorbent concentration, etc., utilizing ion chromatography with conductivity detector for its quantification.

OT- 08

Phone Camera Nano-Biosensor Using Mighty Sensitive Transparent Reusable Upconversion Paper

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Lycopene an antioxidant found in tomatoes is highly susceptible to photo/thermal degradation which demands real time sensors. Therefore, a transparent upconversion nanoparticles strip containing upconversion nanoparticles were prepared that shows peak emission at 475 nm upon 980 nm laser irradiation. This strip has been found sensitive to lycopene with detection limit of 10 nM using a smartphone camera. A comparison has been made to the paper strips.The transparent strip has minimal scattering with maximum sensitivity in spite of not using any metal quencher. An increase in strip hydrophobicity due to incorporation of UCNPs during the fabrication complements strip to selectively permeate and this study present an extraction free substitute analysis for chromatography. The strip prepared using CNC:PVA is reusable with 100 % luminescence recovery.

OT- 09

A smart and innovative approach to recover phosphorus from water using engineered (nano)biochar and simultaneously using it as slow-release fertilizer

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Conventional inorganic fertilizers, if used in excess, lose the nutrients through leaching, volatilization, denitrification and surface run-off leading to environmental deterioration and economic loss to the stakeholders. Particularly, the phosphorus (P) fertilizers used in agricultural practices are harmful to the environment as a fraction of it actually retained by crops rendering the nutrient use efficiency low. (Nano)carbonaceous materials may be employed to recover P from gray resources, develop carrier for slow release of nutrient, improve nutrient use efficiency and soil health and eventually for enhancing crop yield with eco- and environmental benefits. P-loaded (nano)biochar not only offers a sustainable method to recycle organic waste but also provides a slow-release fertilizer option that improves soil health, promotes plant growth, and reduces the need for conventional chemical fertilizers. We have developed engineered (nano)biochars using diverse biomasses including agricultural residues, fruit waste, woody biomass and characterized for surface chemistry, morphology, mineralogy and elemental composition. Nanobiochar was prepared from bulk biochar using mechanochemical process. Phosphorus adsorption onto modified biochar was optimized. The adsorption mechanisms and slow release of phosphorus in water and soil media were explored. The suitability of P-loaded (nano)biochars as an agriinput was evaluated. The engineered (nano)biochars were biocompatible towards soil beneficial gram positive (*Bacillus subtilis*) and gram negative (*Providencia*) bacteria. Further, the application of biochar augmented the rate of seed germination and soil enzymatic activity. Hence, transformation of agricultural residues into valuable biochar-based carbon negative technology offer a pathway towards more sustainable and circular agricultural systems, reducing dependency on conventional fertilizers and mitigating environmental impacts.

OT-10

Enhanced performance of organic light emitting diode (OLED) with dual organic hole transport layers

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Organic light emitting diodes (S-OLEDs) have attracted much interest in research and development due to their potential application in display and lighting applications. The basic OLED structure consists of an organic emissive layer (OEL) sandwiched between cathode and anode. When current is applied, electrons and holes are injected into OEL where they recombine and form excitons which emit visible light called electro-luminescence (EL). The injection efficiency of charge carriers is a critical parameter in order to achieve highly efficient OLEDs. A commonly used approach is to insert an interfacial buffer layer between OEL and cathode/anode. In the present work, single hole transport layer (HTL) of PEDOT:PSS and dual HTLs of PEDOT:PSS and PVK were used between ITO anode and Alq3 OEL to improve the hole injection, and the effect of single and dual HTLs on the performance of OLEDs were studied. Two OLEDs (i) [ITO/PEDOT:PSS/Alq3/TPBi/LiF/Al] (Single HTL), and (ii) [ITO/PEDOT:PSS/PVK/Alq3/TPBi/LiF/Al] (Dual HTLs) were fabricated in glove box using thermal evaporation and spin coating at IIT Guwahati. I/V measurements were performed using a Keithley 2400 source and EL spectra were measured using a CS2000 spectroradiometer. Current density voltage (J-V) characteristics of the two OLED devices shows that the turn-on voltage for OLED with dual HTL is two orders of magnitude lower than single HTL OLED device. From EL spectra as shown in Fig 1, it is evident that the EL is increased by 70% in dual HTLs OLED than single HTL OLED device. Also, dual HTL OLED device results in enhanced brightness (644 cdm-2) than single HTL (390 cdm-2) OLED. CIE parameters confirm that the green light is emitting from Alq3 only in both the devices. We attribute the improvement in dual HTL OLED performance to more efficient hole transport from HOMO levels of PEDOT:PSS and PVK into HOMO level of Alq3 emissive layer. Thus, the present finding confirms that dual HTLs PEDOT:PSS and PVK remain interesting candidates as hole transporting layers for Alq3 based OLED devices.

OT-11

Preferential sputtering driven tailoring of structural, optical and electrical characteristics of oblique Ar^+ sputtered Polyethylene (PE) surfaces

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Oblique ion beam sputtering induced tailoring of polymeric surfaces has garnered significant interest due to its profound influence on the optical and electrical properties of polymers, paving the way for advanced applications in photonics, organic light-emitting diodes (OLED), magnetic devices, optical devices, and photovoltaics. The objective of present work is to explore the 30 keV Ar^+ sputtering effects at different oblique incidences on structure of polyethylene (PE)and its implications on the optical and electrical properties. For this, PE surfaces have been sputtered with 30 keV argon ions at an ion fluence of $2x10^{16}$ Ar^+cm^{-2} for different oblique incidences of 90º, 75º, 50º, 40º, 30º and 15º. Severe structural modifications have been observed in argon sputtered PE surfaces. Intensity of all characteristic bands has been found to be varying non-linearly with angle of incidence as revealed by Raman spectroscopy. An increase in the optical absorption and red shift of the absorption edge has been observed. Concomitantly, a pronounced decrease in the optical band gap was recorded as a function of oblique incidences. The current-voltage characteristics and conductivity of sputtered polymeric surfaces has been investigated. The observed tailoring in structural, electrical and optical behavior is attributed to the varying sputtering yield of carbon and hydrogen at different argon ion incidences. The possible correlation between observed structural, electrical and optical behavior has been discussed. Our results reveal that ion beam tailored polymeric surfaces with enhanced optical and electrical properties has a transformative impact on a variety of high-tech applications in photonics, magnetic devices, optical devices, and photovoltaics, driving innovation and improving device performance.

OT- 12

A novel solution combustion method for tertiary Cu and Zn doped NiO nanocomposite for evaluation of its photocatalytic activities of methylene blue dye degradation

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Sustainability in water processing has been extensively studied and can improve water quality. Recent years have seen photocatalytic technology thrive as a low-cost, eco-friendly, and sustainable solution. The main problem in industrial photocatalyst development is developing an optimal photocatalyst with high photocatalytic activity, sunlight harvesting, and recyclability. Synthesis of tertiary zinc and copper doped nickel oxide nanoparticles ($Zn_xCu_{0.1-x}Ni_{0.9}O$ NPs) was demonstrated in this study using a solution combustion approach with urea as the fuel. This study set out to investigate the efficacy of NiO nanocomposites doped with metals (Cu and Zn) as photocatalysts for the degradation of methylene blue (MB) dye when exposed to sunlight. The X-ray diffraction (XRD) examination revealed that the face-centered cubic (fcc, space group: Fm3hm) structure was present in both undoped and doped NiO, with crystalline sizes varying from 27.18 to 48.66 nm. In order to evaluate the energy band gap, shape of the synthesized nanoparticles,and average crystallite size, ultraviolet-visible (UV-vis), high resolution transmission electron microscopy (HRTEM), scanning electron microscopy (SEM), and X-ray diffraction (XRD) investigations were performed, respectively. $Zn_{0.02}Cu_{0.08}Ni_{0.9}O$ NPs were discovered to have a photocatalytic degradation efficiency of 94.65% for methylene blue dye. The degradation of color compounds from textile effluent could be facilitated by the utilization of Zn:Cu@NiO nanocomposite, a developing photocatalyst.

OT- 13

Thermoelectric materials: State of the Art

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Thermoelectricity is going to play a significant role in meeting the future energy demands as a renewable energy source. Research on thermoelectric materials has gained momentum and the researchers are trying to develop new thermoelectric materials with better 'figure of merit' so that feasible efficiency for thermoelectric device is achieved. Research on thermoelectric materials is focused on the development of novel thermoelectric materials and the fabrication of low-dimensional materials to enhance thermoelectric efficiency. In this work, state- -of-the-art for thermoelectric materials is presented. Various techniques to enhance the performance of thermoelectric materials are discussed. Influence of synthesis techniques, post-synthesis treatment, microstructure, nanostructure, doping and interface on thermoelectric materials transport properties are presented. This will help young researchers and engineers to find the potential research gaps and best practices in this field.

OT- 14

Beta-Amyloid Oligomer Targeted Dopamine-conjugated Gold Nanoparticlesto Attenuate Toxicity in Alzheimer's Disease *via* Dopadelic Boost of Synaptic Function

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Accumulation of misfolded and aggregated proteins in brain is the major biological process involved in variety of neurodegenerative disorders (NDs) such as Alzheimer disease (AD) and Parkinson disease (PD). It has been proposed that transitory and metastable oligomeric intermediates may be more neurotoxic and pathogenic due to their direct contact with lipid bilayers, disrupting the cell membrane by forming pore-like structures. Beta-amyloid oligomer driven amyloidosis is also known to cause disruption and imbalance in the neurotransmitter levels, particularly dopamine, which leads to cognitive impairment. To target $A\beta_{42}$ oligomer driven toxicity, we have substantially designed dopamine (DA) functionalized CA-AuNPs (DA@CA-AuNPs). Direct administration of free DA may cause rapid metabolism before reaching target neurons. DA's hydrophilic nature and large molecular size may hinder its ability to traverse the Blood Brain Barrier (BBB) effectively. DA@CA-AuNP provides shielding of DA against enzymatic breakdown, enabling for long-term and regulated administration to targeted neurons.The synthesized NP was characterized by UV-Vis, ^{1}H NMR, FTIR, XPS, Raman, powder XRD, MALDI-TOF and the corresponding TEM studies suggested that the size of the nanoparticle was < 50 nmwhich might allow them to bypass the BBB more efficiently than free dopamine. Through various biophysical studies such as FTIR, CD, DLS, DSC, MALDI, Dot Blot, SEM, ANS, Bis-ANS and TEM study, it was inferred that the synthesized NP inhibited the formation of$A\beta_{42}$ oligomer efficiently. Studies carried out with Neuroblastoma Cells suggested that the NP alleviated protein aggregation induced cell death via inhibition of oligomer formation, reduction of intracellular oxidative stress, induction of cell differentiation and synaptic health. Overall, we predict that this approach of providing a dopadelic boost to the cells may serve as a better therapeutic strategy for the treatment of neurodegenerative diseases.

OT- 15

A Personalized 3D Printed Device for Electrostimuli Driven Delivery of a Hydrophobic Drug Niclosamide for Oncotherapy

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Personalized drug therapy has remarkably improved the quality of treatment by fulfilling the unmet needs of the patients. While extrusion-based 3D printing holds promise for customizable drug delivery innovation, there are some serious challenges including limited drug loading, slow drug release and ensuring uniform distribution of the dopants. In the present study we explored methods to improve the materialistic properties of Polylactic acid (PLA), a 3D printable polymer, for efficient drug loading and on demand electro responsive release of a hydrophobic model drug niclosamide. We also developed a homogeneously layered PLA-Graphene nanoplatelets (Nic-*hl*-PLGR) based customizable 3D printed electro responsive medicinal patch (3D-*er*-MedPatch) for potential cure of melanoma. A rotation assisted solvent evaporation (RoSE) method was optimized to prepare Nic-*hl*-PLGR composite film and used as precursor for hot melt extrusion (HME) of filament, followed by 3D printing of 3D-*er*-MedPatch. The properties of the Nic-*hl*-PLGR composite in these three complex forms were extensively studied to understand the effect of the fabrication process on their physicochemical properties. Further, a lab prepared electrochemical setup was utilized for electro-stimulatory drug release studies. The inclusion of Graphene nanoplatelets (GNP) in the composite significantly enhanced the thermal processibility, drug dispersion and drug loading capabilities. The optimized RoSE method followed by HME remarkably improved the homogeneity and control over diffusion dependent drug release from the composite. An accelerated amount of drug release was achieved by optimized electrical treatment in simulated buffer environment from the 3D-*er*-MedPatch. The *in-vitro* studies validated the safety and efficacy of the 3D-*er*-MedPatch in mouse fibroblast (NIH3T3) and human melanoma (A375) cell lines respectively. Further, the application of personalized 3D-*er*-MedPatch prepared for skin, spleen and liver tissues with complex geometrical features validated the feasibility of application by *ex-vivo* studies. The incorporation of GNP in the composite and RoSE method followed by HME, significantly enhanced the chemical and thermal properties of the composite. The application of optimized 3D printed patch showed *in vitro* safety and efficacy, and *ex vivo* feasibility. Therefore, a customizable 3D printed electro responsive patch, 3D-*er*-MedPatch, incorporated with a redox active hydrophobic drug niclosamide was successfully developed for a promising melanoma therapy with reduced side effects.

OT-16

Melanoma Diagnosis through Affordable and Reliable Multiplexed Electrochemical Biosensor

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Melanoma is one of the most fatal skin cancers in the world. Melanoma incidence rates are rising globally, including in India. The overall 5-year survival rate in the advanced stages is merely 2%-6%. Whereas, when diagnosed in early stages of onset survival rates are as high as ~95%. Therefore, it is critical to detect melanoma in its early stages for better outcomes. It can be achieved by developing specific and reliable biosensors capable of detecting melanoma biomarkers in biofluids. Lactate dehydrogenase (LDH) and tyrosinase (TYR) are known biomarkers for early detection of melanoma. The use of a single biomarker makes the biosensor prone to false positives, which can be avoided with use of combination of multiple biomarkers. The biosensing platform was fabricated on a filter paper substrate through spray coating of conductive carbon nanomaterial. The coating material was prepared by optimizing the ratios of carbon nanoparticles (CNP) and graphene nanoplatelets (GNP). Gold interdigitated electrodes were fabricated on optimized surfaces which were later immobilized with anti-LDH and anti-TYR antibodies. The current response of the biosensors was recorded and was used for the correlation between the two biomarkers. The surface characterization revealed uniform distribution of CNP and GNP on the paper surface. TEM and XRD analysis revealed the distribution of CNPs on the surface of the GNPs. The increase in the electrical conductivity of the surface was correlated with the increase in surface roughness from 4.6 µm to 5.9 µm. The average current of the sensing surface was found to change during different stages of fabrication. The average current in the fully functionalized IDEs has been observed to be in the range of 200-500 µA. A fast, reliable, and affordable biosensor has been developed for the diagnosis of melanoma. The biosensor provides an opportunity to serve the resource limited regions in the country by detecting diseases without the requirement of specialized equipment.

OT-17

Fabrication of BioPatch for the management of xerostomia

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Saliva is released as a biological fluid by minor and major salivary glands, when there is not enough saliva secretion, it leads to a condition called hyposalivation, which is also termed as xerostomia. This problem causes candidiasis and lesions to the mucosa and gingiva. Nonetheless, xerostomia is a condition that does not need invasive procedures and may be controlled with temporary remedies such as moisturizing agents and lubricants. Therefore, the focus of the present work is on creating a porous scaffold that is encapsulated in a nanofibrous membrane. In the current study, we have used the biopolymers carboxymethyl cellulose and silk fibroin, in combination with honey, to create a biopolymeric porous scaffold. Furthermore, honey was utilized as a nourishing material and as an alternative to stimulants. The production of BioPatch utilizes the method of freeze drying and electrospinning method simultaneously for the generation of strong and stable patch for the management of xerostomia.The physicochemical characteristics were investigated to develop a system that functions as both a stimulant and a salivary substitute. The material biocompatibility was also examined to make sure it had no adverse effects, and a degradation study was conducted to confirm that the material was biodegradable. Additionally, degradation research was carried out to verify the material's biodegradability. Here the membrane exhibits good structural integrity and gratifying swelling when in contact with human artificial saliva, and the slow desorption rate of the stimulant indicates that the material is highly stable. As a result,the current research paved the way for the development of BioPatch material with a slow-releasing stimulant for the management of xerostomia.

OT-18

Development of reduced graphene oxide hydrogel based electrochemical immunosensor for diagnosis of oral cancer

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Oral cancer represents a significant portion of the global cancer burden, often diagnosed at advanced stages, resulting in poor prognosis and limited therapeutic options for patients. To address this problem, the development of biosensors for the detection of biomarkers in body fluids emerges as a promising approach for the early detection of oral cancer. This work presents the fabrication of an innovative electrochemical immunosensor platform designed for rapid detection of tumor necrosis factor-alpha (TNF- α), a potential biomarker associated with oral cancer progression. The immunosensor employs L-cysteine functionalized reduced graphene oxide (L-cys_rGO) hydrogel, capitalizing on its superior electrical conductivity and large surface area for antibody immobilization. Structural characterization techniques, including scanning electron microscopy, high-resolution transmission electron microscopy, Fourier-transform infrared spectroscopy, and X-ray diffraction, confirm the morphology and composition of the L-cys_rGO hydrogel, while the biosensor's electrochemical capabilities were determined using cyclic voltammetry and differential pulse voltammetry. The immunosensor exhibits remarkable performance metrics, with a low limit of detection (LOD). It also maintains specificity towards TNF-α, even amidst potential interferents and other cancer biomarkers such as carcinoembryonic antigen (CEA) and cytokeratin fragment 21-1 (CYFRA 21-1). The biosensor platform demonstrates good reproducibility. The incorporation of L-cysteine functionalized rGO hydrogel in the immunosensor design significantly enhances its performance, underscoring its potential for early-stage diagnosis of oral cancer.

OT-19

Leveraging Thiol functionalized biomucoadhesive hybrid nanoliposome for local therapy of Ulcerative colitis

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Directly administering medication to inflamed intestinal sites for treating ulcerative colitis, poses significant challenges. Recent advancements in therapy to treat colitis aim to improve local drug availability that is enema therapy at the site of inflammation, thereby reducing systemic adverse effects. Nevertheless, a key limitation lies in enemas' inability to sustain medication in the colon due to rapid peristaltic movement, diarrhea and poor local adherence. Therefore, in this work, we have developed site-specific thiolated mucoadhesive anionic nanoliposomes to overcome the limitations of conventional enema therapy. The thiolated delivery system allows prolonged residence of the delivery system at the inflamed site in the colon, confirmed by the adhesion potential of thiolated nanoliposomes using in-vitro and in-vivo models. To further provide therapeutic efficacy thiolated nanoliposomes were loaded with gallic acid (GA), a natural compound known for its antibacterial, antioxidant, and potent anti-inflammatory properties. Consequently, Gallic Acid-loaded Thiolated 2,6 DALP DMPG (GATh@APDL) demonstrate the potential for targeted adhesion to the inflamed colon, facilitated by their small size 100nm and anionic nature. Therapeutic studies indicate that this formulation offers protective effects by mitigating colonic inflammation, downregulating the expression of NF-κB, HIF-1α, and MMP-9 and demonstrating superior efficacy compared to the free GA enema. The encapsulated GA inhibits the NF-κB expression, leading to enhanced expression of MUC2 protein, thereby promoting mucosal healing in the colon. Furthermore, GATh@APDL effectively reduces neutrophil infiltration and regulating immune cell quantification in colonic lamina propria. Our findings suggest that GATh@APDL holds promise for alleviating UC, addressing the limitations of conventional enema therapy.

OT-20

Development of biodegradable antimicrobial nano-composite packaging material for shelf-life extension of perishable commodities

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Post-harvest losses of fruits and vegetables degrade quality and quality before reaching the consumers. After harvesting, these losses can occur due to a variety of factors, including physiological factor mechanical, pathological, and environmental factors. The biodegradable packaging may aid in increasing the post-harvest life of fruits by maintaining metabolic activities and also act as a moisture barrier to preserve the perishable commodities for a longer time. In the current study, the novel eco-friendly and biodegradable nanocomposite films nanocellulose (NC) and arabinoxylan acetate (AXAc) (NC-AXAc) were prepared from wheat-straw NC and AXAc with improved functional properties. NC derived from wheat-straw cellulose has a fibre-like structure with mean-particle size in the 340-520 nm range. AX derived AXAc was prepared with Degree of Substitution (DS) in the range of 1.85-1.89. Furthermore, to enhance antimicrobial properties, AgNPs were prepared via the reduction method using $NaBH_4$ and added into the concentration of $4x10^{-4}$M into the emulsion forming composite films. The silver nanoparticles (AgNPs) incorporated in the composite exhibited an average size of 40-70 nm and a surface plasmon resonance (SPR) absorption peak at 395 nm. The high-resolution XPS spectrum of the Ag element showed that the two peaks at around 374.2 eV ($Ag3d_{3/2}$) and 368.2 eV ($Ag3d_{5/2}$) clearly revealed the metallic Ag existence in composite films. SEM analysis revealed the coarse and heterogeneous morphology of AgNPs incorporated films. The AgNPs incorporated composites exhibited good mechanical, thermal stability, and antimicrobial activity. The results suggested that AgNPs incorporated NC-AXAc composites could be used as a potential biodegradable antimicrobial nanocomposite in active food packaging systems for shelf-life extension of perishable commodities.

POSTER PRESENTATION ABSTRACTS

P001

Engineered metal-organic frameworks and their hybrids for detection and management of environmental contaminants

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Worldwide rapid growth of population has resulted in tremendous expansion of activities in different sectors like industry, agriculture, and healthcare. Due to these anthropogenic activities, several contaminants have been emerged in environments, especially pesticides/fertilizers, antibiotics, etc. Several research efforts have been focused on development of advanced nanostructures-based platforms for detection as well as management of these pollutants. Among these advanced nanostructures, metal-organic frameworks (MOFs) have been reported as fascinating chemical substances to address the challenges of environmental sustainability. These structures, belonging to porous coordination polymers, are rigid crystalline structures that consist of metal (cluster) nodes and bridging organic linkers. These structures are getting considerable attention due to their topologically-varied structures. The desired topology of MOFs can be engineered with readily adjustment of organic linkers. Moreover, MOFs can also be designed with desirable physical and chemical characteristics like large surface area, tunable pore size, customizable functional groups, high thermal stability, uniformly structured cavities, and facile synthesis conditions. These porous materials can overcome the drawbacks of conventional porous materials like activated carbon including insufficient pore size, restricted loading of guest molecules, etc. Here, different MOFs and their hybrids were synthesized via hydrothermal route. These structures were further examined by different microscopy and spectroscopy techniques to examine their structural, physical, and chemical properties. Thereafter, these nanostructures were further utilized for detection and adsorptive removal of the environmental contaminants.

P002

Nanocomposites as Novel Adsorbent Material for Removal of Heavy Metals/Dyes

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Both environmental and economical system, need the removal of heavy metal/dyes ions due to its venturous influences on humans, animals, and plants. Many industries are responsible for polluting the aquatic environment with high level of dyes and heavy metal sources such as metal plating, cadmium-nickel batteries, phosphate fertilizers, pigments, stabilizers, metallurgy, ceramics, textile printing, lead mining, sewage sludge, alkaline batteries, and electroplating. The industrial wastewater containing synthetic inorganic heavy metals/dyes may be toxic, carcinogenic, and mutagenic in nature for human as well as aquatic ecosystem. Different treatment technologies are available for the removal of toxic heavy metals/dyes. Chemical precipitation, adsorption, ion exchange, coagulation, reverse osmosis, electrolysis and membrane process have been widely used for removal of pollutants from waste water. However, among these methods, adsorption is considered as one of the most effective, efficient and economical method for the removal of heavy metals/dyes from wastewater. Also, among the available adsorbents, metal oxides nanocomposites are proving as the promising ones for heavy metals/dyes removal from aqueous systems. Compared with traditional materials, nanostructured adsorbents have exhibited higher efficiency and faster rates in water treatment. By taking all these facts into consideration, this study focuses on removal of heavy metal/dye with the help of nanocomposite at various pH and contact time. Synthesized nanocomposites were characterized with the help of SEM, TEM, XRD, FTIR, BET and other microscopic techniques. AAS and UV-Visible spectroscopy was used to check the heavy metals/dyes concentration in various samples.

P003

Metal-Organic Frameworks based fluorescent nanoprobe for Targeted Detection of Gram-negative Bacteria

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Bacterial pollution presents a substantial risk to public health, environmental integrity, and industrial productivity. Traditional methods of bacterial detection frequently depend on expensive tools, long culturing times, and highly skilled operators. There is an urgent need to develop rapid, cost-efficient, and portable sensing platform for screening of bacterial pollution. Recent developments in nanotechnology have opened new research avenues in this direction. In particular, nanomaterials-based fluorescent sensors are of significant research interests due to their high sensitivity, simple operation, and rapid detection. In these fluorescent sensors, traditional fluorescent dyes have been replaced by fluorescent nanomaterials such as nanoclusters, metal-based nanomaterials, metal-organic frameworks (MOFs), and quantum dots. These fluorescent nanomaterials-based biosensor provide a more straightforward, economical, and immediate method for identifying bacterial contamination with increased sensitivity. In this work, a fluorescent nanoprobe based on MOFs is developed for the identification of gram-negative bacteria. Further, a variety of analytical techniques, such as optical microscopy, Raman spectroscopy, X-ray diffraction (XRD), Fourier transform infrared (FT-IR) spectroscopy, and electron microscopy (SEM and TEM), were utilized to characterise the optical, physical, and structural properties of the synthesised materials. The changes in the optical characteristics of the sensing probe were examined in the presence of the gram-negative bacteria. As developed sensing probe is a promising approach to assessing the abundance of gram-negative bacteria in the environment.

P004

Greener synthesis strategy of metal-organic framework for selective sensing of water pollutants

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Water is considered as an essential natural resource for all the living species. The rapid deterioration of the environment brought by increased anthropogenic activities has triggered a negative impact on water resources. The sensitive and specific monitoring of this pollutant in environmental samples is highly desirable for ensuring safety. The existing approaches require high-cost instrumentation, driving the urgent quest for an alternative technique addressing these global concerns. A greener approach has been utilized to synthesize metal–organic framework (MOF) through the one-pot refluxing methodology. Interestingly, the uncoordinated amine and carboxylic groups present in the ligand provide varied functionality to the synthesized MOF. The current study shows that MOF has excellent water stability with pH ranging from acidic to basic values. Different analytical characterization techniques have been explored to determine the morphological characteristics of fabricated MOFs. Moreover, synthesized coordination compound exhibits good fluorescent properties. Benefitting from the uncoordinated functionality and porosity, MOF displays a high selective response, which makes it a potential sensor for detecting toxic water pollutants. Current research may inspire the synthesis of other fluorescent frameworks targeting different environmental contaminants.

P005

Protein-Capping as an Inimitable Strategy to Switch DNA-Cu Based 'Dark' Clusters to Fluorescent Ones

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Progress of DNA-based luminescent copper nanoclusters (DNACuNC) has borne promising applications in the field of biosensing and bioimaging. However, significant number of DNA sequences still form undesirable non-luminescent DNACuNCs called 'dark' clusters. Due to scarcity of efficient and accurate approaches for turning such 'dark' clusters into luminescent ones hinders their applications. To overcome this problem, we have shown how protamine, a basic protein can be used as an encapsulating agent to switch non-luminescent DNACuNCs to luminescent ones. In this method, protamine encapsulation resulted in 2500% enhancement in emission intensity of dark DNACuNCs. The results were compared with lysozyme and HSA as the other encapsulating agents with diverse features; however, they were found to be not as effective as protamine in lighting up the 'dark' clusters because of their less flexible conformations. Protamine, due to its highly cationic nature and flexible conformation compared to lysozyme and HSA, can adjust according to the charge distribution on the surface of NCs, leading to effective interaction. It prompts NC assembly into stable and well-defined three-dimensional structures with extremely small size of ~1.7 nM that supports the discrete electronic transitions resulting in an exceptionally strong fluorescence emission intensity. Further, these NCs sustained better stability in the wider pH range, making them ideal for biological applications. The proposed approach here for achieving high emission efficiency can be extended to other non-luminescent DNA-based NCs.

P006

Ti_3C_2/MoS_2/SiNWs based dual functional electrode for photoelectrochemical wastewater to hydrogen generation and treatment

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This study outlines the synthesis, optimization, and characterization of a Ti_3C_2 MXene-decorated -MoS_2/SiNWs photocathode, fabricated through hydrothermal and spray coating methods. The photocathode serves as a dual-functional system for photoelectrochemical (PEC) wastewater (WW) splitting, targeting hydrogen generation on the cathodic side and organic pollutant degradation on the anodic side, enabling simultaneous wastewater treatment and hydrogen production. Initially, SiNWs were synthesized via metal-assisted chemical etching (MACE), followed by a hydrothermal coating of MoS_2 onto SiNWs, resulting in a type-II heterostructure formation. To enhance charge separation, Ti_3C_2 MXenes synthesized via LiF/HCl were spray-coated onto MoS_2/SiNWs, yielding the Ti_3C_2/MoS_2/SiNWs photocathode. PEC studies demonstrate the superior photocathodic activity of Ti_3C_2/MoS_2/SiNWs over MoS_2/SiNWs and SiNWs photocathodes. The fabricated heterostructure were characterized with XRD, UV, XPS, Mott-Schottky, and impedance analyses. Incident photon-to-current efficiency (IPCE) of Ti_3C_2/MoS_2/SiNWs photocathode measures approximately 38.12%, surpassing MoS_2/SiNWs (~15.26%), while long-term chronoamperometry study confirms it's increased stability. In addition, the optimized electrodes exhibit efficient wastewater treatment, yielding a hydrogen production rate of 9.32µmol/h @ -0.78V vs RHE, with ~80.80% methylene blue degradation and total organic content (TOC) reduction to 1.520 mg/ml. Mechanistic studies via scavenger analysis elucidate hole-mediated MB degradation and electron-driven H_2 generation. Overall, Ti_3C_2/MoS_2/SiNWs photocathodes demonstrate outstanding performance, stability, and pollutant degradation efficacy, attributed to improved charge separation and utilization as outlined in the proposed mechanism.

P007

Binder free Ni-foam bolstered NiCo2S4/NiCoMOF composite for enhanced supercapacitor applications.

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In the recent times, amid increasing global energy demand the development of high performance materials for energy storage application has gained a significant attention. Composites based on bimetallic oxides have emerged as promising candidate due to their enhanced properties like, higher conductivity, larger surface area and superior redox activity as compared to their monometallic counterparts. Here, in this study we developed a facile two step solvothermal method for the fabrication of binder free electrodes based on NiCo2S4 and NiCo MOF (Metal-Organic Framework) using Ni foam as a current collector. The synthesized electrodes were underwent series of structural and morphological characterizations including XRD, FESEM, BET, TEM and XPS. The pseudocapacitive behavior of prepared electrodes were studied in basic electrolyte (KOH) of different molarity (2M,4M and 6M) using cyclic voltammetry (CV), Galvanostatic charge discharge (GCD) and Electrochemical Impedance Spectroscopy (EIS). The composite shown a high specific capacitance (6M KOH) of 2105 Fg-1 at a scan rate of 2mVs-1 and a capacitance retention of 89% even after 5000 cycles. The energy density and power density were found to be 263.8WhKg-1 and 474.8 Wh-1 respectively. The EIS studies shown low value of charge transfer resistance (Rct) and solution resistance (Rs). Keywords: NiCo2S4 , Metal-Organic Frameworks, Specific Capacitance, Supercapacitor.

P008

Handheld Crop Pest Sensor Using Binary Catalyst-Loaded Nano-SnO2 Particles for Oxidative Signal Amplification

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The growing global population necessitates advanced techniques to increase food production in sustainable way. To fulfill this demand, farming is going to depend on IoT (Internet of Things), which in turn needs the support of real time sensors.(1) Recently volatile gas sensors are gaining importance for the diagnosis of diseases in human, which has been improved for the early diagnosis of the diseases in the crop.(2) Crop releases volatiles in response to the herbivore stress, hence sensing these volatile signal at very early stage will make the management easier. Hence a chemoresistive signal transducer, loaded with the reactive catalysts that amplifiy the oxidation signal has been developed. This strong catalyst may oxidize nontarget volatiles and can cause false signal, hence a filter has been coupled to ensure highly selective detection. Finally with the support of mobile power bank, the optimized sensor has been assembled into a light weight handheld device.

P009

A Critical Review of Tool Electrode Parameters Effect on Electrochemical Discharge Machining (ECDM)

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Electrochemical discharge machining (ECDM) is the modern non-conventional method for machining non-conductive and conductive materials such as quartz, ceramics, composites, glass, etc. Since the ECDM process is affected by various input parameters like pulse duration, duty cycle, applied voltage, electrolyte concentration, gas film formation, type of electrolyte, etc., tool electrode(cathode) parameters are observed to be more substantial input parameters. This present study critically reviews the effect of tool electrode(cathode) parameters such as tool vibration, tool materials, tool shape, tool rotation, etc., on the machining performance of the ECDM process. The summarized report on the effect of tool electrode parameters in ECDM is also presented. Based on the review, it is concluded that tool electrode parameters remarkably affect the gas film formation and its thickness, further enhancing the machined surface's surface finish and circularity.

P010

Exploration of a Novel Photosensitizer Transport System for Photodynamic Therapy

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Metallosurfactant (MS) aggregates have grasped great attention from researchers worldwide due to the dual properties of both metals and surfactants. On complexing surfactants with metal ions, depression in the critical micelle concentration (CMC) is usually observed compared to those of the parent innocent surfactants. Catanionic vesicles are synthesized by mixing cationic metallosurfactant and anionic surfactant into a non-stoichiometric ratio which leads to spontaneous vesicle formations [1]. These vesicles can control the size, surface charge by varying the cationic/anionic ratio. Photodynamic therapy is a combination of photosensitive drugs, the light of specific wavelengths, and molecular oxygen. Light of suitable wavelength hit the photosensitizer (PS) which then converts molecular oxygen into singlet oxygen in PS triplet excited state. We have formulated metallocatanionic vesicles (MCVs) from a combination of a double-and single-chain copper and Iron-based cationic Copper and Iron meta-based metallosurfactant (CuCPCI, and FeCPCI) and an anionic surfactant sodium bis(2-ethylhexyl)sulfosuccinate (AOT). We have prepared a different ratio from 10:90 to 90:10 in PBS of 7.4 pH. In this approach, two of the fractions, one each from a cationic rich and anionic rich side, were selected to encapsulate anionic (rose bengal (RB)) PSs. It was characterized by SAXS, AFM, FE-SEM, cryo-TEM, and Zeta-sizer measurements. These studies reveal that the MCVs have dual functionality *i.e.* encapsulate PSs and even show antibacterial properties against *S. Aureus, E. Coli.* MCV *help in enhancing the singlet oxygen yield of RB.* We have applied these PS-loaded MCV against U-251 Glioblastoma cell lines. This experiment showed MCVs biocompatible nature in dark and high phototoxicity against cancer cell lines which were confirmed by WST-8 assay. Further, SOSG assay and differential nuclear staining assay (DNS), confirmed the intracellular singlet oxygen generation and live/dead cell after PDT. Caspase assay confirmed the apoptotic pathway of cell killing. This work provides a new metal hybrid smart biocompatible material that possesses dual functionality and is prepared by an easy, fast, and feasible procedure which resulted in enhanced PDT against a drug-resistant bacterium and cancer cell lines .

P011

Enhanced up-converted luminescence from erbium, ytterbium, chromium tridoped $MgAl_2O_4$ nanocrystals

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Recently, the rare earth activated spinel powders are exhibiting intense up-conversion emission-based lighting applications. Here, $Mg_{1-x-y-z}Er_xYb_yCr_zAl_2O_4$ ($x = 0.01$, $y = 0.05$, $z = 0$; $x = 0.05$, $y = 0.05$, $z = 0$; $x = 0.01$, $y = 0.1$, $z = 0$ and $x = 0.01$, $y = 0.05$, $z = 0.01$) were synthesized through the solution combustion method which possessed a single phase cubic structure. Diffuse reflectance spectra showed the broad absorption bands attributed to oxygen vacancies as well as antisite defects, sharp absorption peaks attributed to *f-f* transitions of Er^{3+} as well as Yb^{3+} ions in Er^{3+}, Yb^{3+} codoped $MgAl_2O_4$ samples, while additional broad absorption bands, attributed to *d-d* transitions of Cr^{3+} ions, are observed in Er^{3+}, Yb^{3+}, Cr^{3+} tridoped $MgAl_2O_4$ samples. The up-conversion luminescence spectra of all the samples displayed sharp emission lines ascribed to Er ions in the green and red wavelength region. Upon 1 mol% Cr^{3+} doping, the deep red emission overlapped with the red emission of Er^{3+} ions, along with significantly enhanced emission intensity. This enhancement in emission intensity is ascribed to the energy transfer, *viz*., $Yb^{3+} \rightarrow Er^{3+} \rightarrow Cr^{3+}$, $Cr^{3+} \rightarrow Er^{3+}$ and $Cr^{3+} \rightarrow Yb^{3+}$ between the doped ions. The samples exhibited color tuning from white to near red region. Thus, the intense up-conversion luminescence from Er, Yb and Cr tridoped $MgAl_2O_4$ nanocrystals and the color tuning through excitation energy transfer would have potential applications in solid-state lighting.

P012

Exploring the Potency of Rod-shaped Silver-Doped ZnO Nanoparticles for the Electrochemical Surveillance of lead in water

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Worldwide exponential population increase and rapid industrialization have resulted in the widespread release of hazardous chemicals into the environment. These hazardous wastes are released without sufficient processing or decontamination, posing a significant threat to our ecosystems. However, the problem is further exacerbated by the rapid reduction in freshwater resources because of population growth and industrialization. Environmental contamination, particularly water pollution, has emerged as a major threat to global biodiversity and humanity. For instance, lead (Pb) poisoning from liquid effluents is one of the most serious environmental risks, harming both children and adults and potentially impairing immunological responses. The present standard methods for detecting these dangerous substances are expensive, labour-intensive, and time-consuming. As a result, there is an urgent need to develop new analytical techniques that can detect priority contaminants even in real-world situations. Nanotechnology is an interesting emerging subject with enormous promise for developing sophisticated nanomaterials capable of sensing a variety of analytes. Nanoparticles have unique chemical and physical properties, making them excellent candidates for use in high-performance sensing systems. One such breakthrough is the lead chemical sensor made of silver-doped zinc oxide (ZnO) nanorods. The prepared sensors have extremely high sensitivity and an amazingly low detection limit. To characterise the chemical and physical properties of these synthesised metal oxides, researchers used a variety of techniques such as particle size analysis, Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), electron microscopy, and UV-visible spectroscopy. The result was a robust tool for detecting lead contamination with accuracy.

P013

Direct Redox Sensing of Caffeine Utilizing Zinc Doped Tin Oxide Nanoparticles as Electro-Catalyst

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Caffeine; a common ingredient of tea, coffee, beverages, cocoa products and other energy drinks is a heat-stable natural alkaloid material. It belongs to the N-methyl derivative of xanthine and is being used widely by humans from several decades. Caffeine is also found in several pharmaceutical products due to its analgesic behaviour. On an average, the global consumption of caffeine is around 70 mg/person per day with some variation depending upon different countries. The wide consumption of caffeine is due to its stimulant behaviour and is considered as safe at moderate dosage. But it is found clinically that the higher concentrations of caffeine are responsible for several adverse effects like insomnia, anxiety, palpitations, increase in blood pressure and GIT disturbances. Therefore, the qualitative and quantitative analysis of caffeine in beverages and pharmaceutical products is of major concern and need of time. The whole world is driving towards robust, cost-effective, portable, friendly and reproducible sensing techniques. In view of the above given facts, an electrochemical sensor has been developed based on zinc doped tin oxide nanoparticles. The nanomaterial was synthesized using simple chemical method at low temperature. The synthesized nanomaterial was further explored in depth with standard characterization techniques. The nanomaterial was used for fabrication of standard gold electrode and this modified electrode was further evaluated electrochemically for direct redox sensing of caffeine in laboratory as well as real samples. Cyclic voltammetry technique was applied successfully for quantification of caffeine in liquid samples.

P014

Performance evaluation of zinc oxide nanomaterials coated titanium grade–5 alloy for superior biomedical applications

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This study investigates the comprehensive performance of ZnO nanoparticles coated Titanium grade–5 (Ti-6AI-4V) alloy, across diverse domains, including wear resistance, corrosion protection, cytotoxicity, and antimicrobial efficacy. The ZnO nanoparticles were synthesised using hydrothermal method, and comprehensively characterized using various techniques including UV-Visible spectroscopy, X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Energy Disperse X-ray (EDX) analysis, and element mapping for investigating the structural, morphological and compositional properties. The ZnO nanoparticles were meticulously deposited on the titanium grade–5 alloy surface using spin coating technique, and the resulting coated alloy was characterized through SEM, EDX and element mapping to verify the compositional details and uniformity of coating on the surface. Wear resistance was evaluated using ball-on-disc tribometer method at various speeds i.e. 200 rpm, 350 rpm and 500 rpm under 30 N for 180 seconds, revealing the impact of the ZnO nanoparticles coating on mitigating surface abrasion. Potentiodynamic polarization was employed to assess the corrosion resistance, highlighting the protective role of the ZnO nanoparticles coating against corrosive environments. The results show that ZnO nanoparticles coated substrate is more resistant to corrosion compared to the uncoated substrate.

P015

Predictive modelling of the compressive strength of geopolymer mortar from molar ratios using machine learning approaches.

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The alkali activated materials and geopolymers have been emerging as a green alternative to the Portland Cement (PC) for mitigation of the enormous carbon footprint issue associated with the concrete industry. Another operational issue associated with the concrete industry is the laborious and time intensive processes of strength testing of the samples. Owing to the accepted pertinence of Machine Learning (ML) approaches in predictive modelling of the concrete properties, this study is focussed on prediction and experimental validation of the Compressive Strength (CS) of Geo-Polymer Mortar (GPM). Since the geopolymers can be prepared by various types of alminosilicate precursors such as Fly Ash class C, Fly Ash class F, Bagasse Ash, GGBS, Metakaolin, calcined clay etc., all having different compositions, this study uses the molar ratios such as Al/Si, Na/Si, Ca/Si, Fe/Si, and Sand/Binder as the input features instead of the quantities of mix constituents. This is done as an attempt to standardise the input features for GPM made with various types of precursors. A dataset of 133 GPM samples was collected from authentic published research. The molar ratios of the precursor in these samples were computed on the basis of compositions mentioned in respective research publications. Further, the dataset was split into training set and test set in 0.9:0.1, and nine ML models were developed including MultiLayer Perceptron (MLP), Gradient Boosting (GB), Bagging (BG), Extreme Gradient Boosting (XGB), K Nearest Neighbours (KNN), Support Vector Machine (SVM) and two stacked metamodels. All the ML models were hypertuned with Particle Swarm Optimiser. The prediction performances of all models were evaluated using the R^2, Kling Gupta Efficiency (KGE), Mean Absolute Error (MAE) and Mean Squared Error (MSE) as the evaluation metrics. It was observed that the best performance on test set was exhibited by the BG model (R^2=0.77) whereas for the training set, a stacked model performed best with R^2=0.94. However, the differences in the four best performing models were marginal. The CS prediction performance of the best models were further evaluated by physically preparing six new GPM mixes, testing their CS in the laboratory and, comparing the experimental CS with the predicted CS values. The predicted CS and experimental CS of these six GPM mixes exhibited acceptable coherence. The work was conclusive of the relevance of molar ratios as inputs, subject to better training and hyperparameter tuning of the ML models. The ML modelling of GPM from molar ratios can pave a way towards more convenient and sustainable practices in testing and mix design of geopolymers by reducing the number of trials mixes, time and effort in the mix design processes.

P016

A patient-controllable Niclosamide delivery system, Melanocare, with thermoresponsive *sol-gel-sol* transition property, allows sustained drug release for non-invasive transdermal Melanoma therapy

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Melanoma is an invasive skin cancer with a 5-year survival rate of less than 20% but nearly 100% at the early/localised stage. The clinical approach for localised melanoma treatment involves surgical resection. However, it causes inconvenience to the patient, there is a risk of infection, and some deeply seated cancer cells may not be completely removed, which may lead to melanoma recurrence. Sustainability in healthcare is achieved when a treatment modality shows enhanced therapeutic efficacy while also reducing adverse effects and avoiding patient inconvenience. As there are no clinically available topical formulations for Melanoma, Melanocare is being developed to be applied directly over the affected skin. Melanocare (*Nic*-H-CG) is formulated with the loading of Niclosamide (*Nic*) to a water-based suspension (H-CG) composed of a thermoresponsive smart hydrogel (H) incorporated with Carbon Nanostructures (CG). The H-CG acts as a drug reservoir while temperature acts as an 'on-off' switch for achieving patient-controllable drug release. The sol-gel-sol transition behaviour of H-CG is tuned to near physiological temperature by CG incorporation, which also enhances *Nic* loading and sustained release. FTIR, NMR, and XRD were performed to understand that there are non-covalent interactions between *Nic* and H-CG, which would gradually break down at physiological temperature and allow drug release. Direct application of Melanocare, *ex vivo*, over rat skin, implicated the importance of cold temperature cycles for the release of *Nic* across skin. Temperature modulations (using ice) can be frequented as per the dosage requirement. Melanocare has been shown to be cytotoxic for melanoma cells (A375 and B16F0) but not healthy cells (NIH3T3 and HaCaT). Moreover, gene expression studies and western blotting studies have shown the ability of Niclosamide to downregulate activated STAT3 in melanoma cells. This promises its potential for being repurposed as an anti-melanoma drug and its sustained delivery is achieved using Melanocare for non-invasive melanoma therapy.

P017

Simple starch modification to a residue-free, stable urea coating for prolonged release and increased crop yield

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A stable coating for urea fertilizer that impedes quick leaching, without the use of toxic linkers, remains a significant challenge. In this study, achieving a stable coating without toxic linkers has been addressed by employing starch, a readily available bio-polymer. The starch was modified[1, 2] with phosphates to enhance its properties[3], and the addition of eggshell nanoparticles (ESN) was used to reinforce the coating[4]. The ESN offers a calcium ion binding site for the phosphate to cause bio-mimetic folding. The resulting coating exhibited a stable structure, with hydrophilic ends retained in the core and an excellent hydrophobic surface, as evidenced by a water contact angle of 123˚. Moreover, the phosphorylated starch combined with ESN enabled the coating to release only around 30% of the nutrient content within the initial 10 days. This controlled release continued for up to 60 days, with approximately 90% of the nutrient being gradually released. The stability of the coating was attributed to its resistance to major soil factors, such as acidity and amylase degradation. Additionally, the incorporation of ESN increased elasticity, helped control cracking, and enhanced self-repairing capabilities, acting as buffer micro-bots. The application of the coated urea resulted in a notable improvement in rice grain yield, with an increase of approximately 10%.

P018

Metal- Schiff base covalently grafted to the iron-based metal-organic framework as an effective heterogeneous catalyst for 4-nitrophenols degradation

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MOFs (metal-organic frameworks) with tunable structures and topology can be exploited for various applications in the fields of catalysis, drug delivery, water splitting, and gas separation. MOFs based on iron had been modified by the reaction of o-vanillin with the amino groups to form o-vanillin-imine that acts as a ligand of various metals M (where M = Ni, Co, Cu, Cr). The post functionalization allows successful anchoring of metal complex with Schiff base into a mesoporous metal-organic framework and the characterization of the synthesized Fe-MOF was carried out by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), Energy dispersive X-ray analysis (EDX), Thermogravimetric analysis (TGA) and Scanning electron microscopy (SEM) analysis. The catalytic performance of the synthesized Fe-MOF grafted o-vanillin-imine metal catalyst in the reduction of 4-nitrophenol (4-NP) was investigated. The key parameters that affect the catalytic activity like temperature, catalyst loading, and the concentration of reducing agent $NaBH_4$ were optimized. The obtained results proved that the synthesized Fe-MOF is an efficient catalyst for reducing 4-NP at ambient temperature with minimal catalyst loading. The visible-light photocatalytic degradation of 4-NP was also investigated in the presence of Fe-MOF. The catalyst was recycled and reused for five cycles without significant reduction in the conversion efficiency of the catalyst.

P019

Development of biodegradable antimicrobial nano-composite packaging material for shelf-life extension of perishable commodities

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Post-harvest losses of fruits and vegetables degrade quality and quality before reaching the consumers. After harvesting, these losses can occur due to a variety of factors, including physiological factor mechanical, pathological, and environmental factors biodegradable packaging may aid in increasing the post-harvest life of fruits by maintaining metabolic activities and also act as a moisture barrier to preserve the perishable commodities for a longer time .

In the current study, the novel eco-friendly and biodegradable nanocomposite films nanocellulose (NC) and arabinoxylan acetate (AXAc) (NC-AXAc) were prepared from wheat-straw NC and AXAc with improved functional properties. NC derived from wheat-straw cellulose has a fibre-like structure with mean-particle size in the 340-520 nm range. AX derived AXAc was prepared with Degree of Substitution (DS) in the range of 1.85-1.89. Furthermore, to enhance antimicrobial properties, AgNPs were prepared via the reduction method using $NaBH_4$ and added into the concentration of $4x10^{-4}M$ into the emulsion forming composite films. The silver nanoparticles (AgNPs) incorporated in the composite exhibited an average size of 40-70 nm and a surface plasmon resonance (SPR) absorption peak at 395 nm. The high-resolution XPS spectrum of the Ag element showed that the two peaks at around 374.2 eV ($Ag3d_{3/2}$) and 368.2 eV ($Ag3d_{5/2}$) clearly revealed the metallic Ag existence in composite films. SEM analysis revealed the coarse and heterogeneous morphology of AgNPs incorporated films. The AgNPs incorporated composites exhibited good mechanical, thermal stability, and antimicrobial activity. The results suggested that AgNPs incorporated NC-AXAc composites could be used as a potential biodegradable antimicrobial nanocomposite in active food packaging systems for shelf-life extension of perishable commodities.

P020

Effect of solvent on nickel sulfide and its electrochemical performance

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Intense research is being done on electrochemical supercapacitors (SC) to improve their performance. By offering better power and energy density values, SC can close the performance gap between dielectric capacitors and rechargeable batteries. Transition metal sulfide is an attractive choice for SC electrodes because they have greater electrochemical activity and superior electrical conductivity than other metal oxides or hydroxides. The metal sulfide family includes nickel sulfide, which is important because of its several phases and it finds application in solar cells, batteries, supercapacitors, and other technologies. This study focuses on the synthesis of nickel sulfide via solvothermal method offering a promising route for controlling the morphology and properties of the material. Here, solvents for solvothermal reactions used were ethanol, ethylene glycol and deionized water which play a crucial role in determining the morphology of the synthesized nickel sulfide. Techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR) and UV-Vis spectroscopy are employed to study the crystal size, morphology, functional groups and bandgap of nickel sulfide. The synthesized nanoparticles are then evaluated for their electrochemical performance as electrode materials demonstrating a good capacitance making it an appropriate candidate for supercapacitor application.

P021

Gas Sensing Performance of Metal-Organic Framework Derived α- Fe_2O_3 for Environmental Protection

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The rapid response/recovery and high selectivity of gas sensors play a crucial role in the real-time and online monitoring of hazardous gases. α-Fe_2O_3 (Hematite) stands out as a non-toxic semiconductor possessing favorable electrical, catalytic, and chemical properties vital for chemiresistive gas sensors. In this study, we present a feasible approach to fabricate Fe_2O_3 nanoparticles using a Metal-Organic Framework (MOF) template-assisted method. Fe-MOF is synthesized using solvothermal method and then calcinated at 500 temperature to get α-Fe_2O_3. The structural and morphological properties of synthesized material were analyzed using techniques such as X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FE-SEM), UV-Vis Spectroscopy, etc. The material inherited the morphological properties of Fe-MOF and the crystallite size of approx 27.7 nm. The gas sensing behavior of synthesized material was analyzed using a two-probe sensing system for H_2S gas. The material is found to have good response for low ppm levels of H_2S. This kind of material is expected to be a prospecting candidate for the application in gas sensors technology.

P022

A Curcumin Coated Nanoformulation for the Dissolution of Atherosclerotic Plaques

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Atherosclerosis is the leading cause of cardiovascular diseases (CVDs) accounting for the highest mortality among individuals globally. Current therapies of atherosclerosis are mainly restricted to surgical interventions such as angioplasty with or without stenting and different anticoagulation medications. However, they are often associated with complications such as internal bleeding, thrombosis and late in-stent restenosis, which are the leading causes for stent failure. This necessitates extensive research towards an alternate therapeutic regime targeted towards the dissolution of atheroma through pharmacotherapeutic approaches. FDA approved drugs frequently administered through drug eluting stents in an atherosclerotic artery are often associated with long term systemic side-effects. There is ample evidence suggesting the potential use of curcumin as an anti-atherogenic and anti-thrombotic agent without any associated side-effects. However, there is no evidence for any translational study in this aspect. In this study, the authors have reported a carbonaceous, curcumin loaded nanoformulation for studying the in vitro degradation of an artificial atherosclerotic plaque, similar to a type IV atherosclerotic lesion. A novel approach of co-preparation followed by post-loading of curcumin was performed with/on a carbonaceous nanosystem as the therapeutic agent. The physicochemical properties of the formulation were assessed through different characterizations. The ability of the formulation to degrade an artificial atherosclerotic plaque was quantified through methylene blue dye release assay. The curcumin co-prepared, curcumin post-loaded carbon nanoparticles was found to have an average particle diameter of 121 nm and a zeta potential of -27 mV. This is indicative of the stable nature of the nanoformulation. The amount of curcumin loaded was optimized based on the therapeutic concentration of curcumin against primary macrophages. It was observed that the loading of curcumin in the vehicles prevented the degradation of curcumin into secondary products. The temporal release of methylene blue from the artificial plaque was quantified through UV-Vis spectrophotometry. The synthesized formulation might serve as an alternate translatable therapeutic for the remedy of atherosclerosis.

P023

Frequency and temperature-dependent dielectric properties of coconut milk for microwave heating

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Worldwide, there is an increasing demand for plant-based food for sustainable, health, ethical, religious, philosophical, and economic reasons. Coconut milk is the liquid obtained by manual or mechanical extraction of grated coconut meat with or without water addition. It is an important part of the diet in coconut-producing countries due to its nutty flavour and nutritional content. However, the shelf life of coconut is a challenge for its wide usage. Microwave heating is the modern pasteurization technique used to increase life of food products. For this, knowledge of the dielectric properties of the product is very important. which has not been explored much for coconut milk. In this study, we present the dielectric properties such as dielectric constant, dielectric loss and penetration depth of coconut milk from 1MHz to 1GHz frequency at a range of temperature from 25-75 ^{o}C. Experiments were performed using the open-ended coaxial probe method. The penetration depth of coconut milk was found to be about 3.5 cm at 915 MHz frequency, which can be used for the selection of sample size during the heating process. Therefore, the results can be used to determine important parameters for dielectric heating.

P024

Development of lignin nanocomposite film derived from agri-biomass and their applications

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Lignin, a renewable aromatic biopolymer, holds significant potential for applications in bio-refineries, biofuels, thermoplastics, and eco-friendly nanofilms. Transforming lignin-based biomass into biodegradable nanofilms is vital. India's nanofilm exports are limited, largely relying on costly imported nanomaterials. Utilizing the alkaline extraction method, utilizing diverse base concentrations and reaction temperatures, yields high lignin output with lower chemical and energy input, suitable for large-scale production. Converting lignin to nano size and utilizing it as water resistant, self-cleaning and UV protective nanofilms, in tandem with photosensitizers, enhances properties from mechanical strength to antibacterial and antioxidant functions. Lignin-doped polyvinyl alcohol/polyethylene glycol nanocomposites exhibit increased flexibility and strength. Lignin nanofilms showcase water resistance and self-cleaning under light, paralleling commercial counterparts, suggesting potential for eco-friendly coatings and insulation. These nanofilms unite cost-effectiveness, agri-waste sourced lignin, and multi-functionality. Lignin-derived nanoparticles are synthesized from agricultural waste, bypassing harmful chemicals, yielding affordable nanofilms. The innovation simultaneously repurposes agricultural waste into lignin-based, multi-functional nanofilms, offering waterproofing, self-cleaning, and cost efficiency in a single sustainable product.

P025

Investigations of Structural, Electronic and Vibrational Properties of Half-Heusler Alloy by first-principles calculation

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Semiconducting half-Heusler compounds with the valence electron count of 18 have been identified as a class of promising high-temperature thermoelectric materials. In the present study, using first-principles calculations, phonon characteristics of the 18 valence electron half-Heusler compound NiZrSi is investigated theoretically. Within the context of density functional theory, ab initio calculations are used to optimize the crystal structures. This material display both dynamic and mechanical stability. NiZrSn is identified as non-magnetic semiconductors with indirect band gaps of 0.65 eV. Further, The various properties material that they are new promising candidates for thermoelectric materials.

P026

"Deep Eutectic Solvent as an effective tool for enhanced photocatalytic activity of Cu2S@MoS2 nano-assemblies: a green approach."

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The scientific world has witnessed the emergence of plethora of green strategies to ameliorate the efficiency of nano-photocatalytic materials for waste water treatment applications. This work highlights the effect of ZnCl2 and urea-based DES on the morphology, electronic band structure and photocatalytic efficiency of Cu2S @MoS2 NPs compared to solvents like water, EDA and DETA. XRD and FT-IR analysis confirmed the formation of NPs and quite significant changes in the pattern of M-S bonds of Cu2S@MoS2 were observed upon variation of solvents. The FE-SEM analysis of NPs prepared in 1:1 composition of DES and water (Cu2S@MoS2 NPs - 1:1) showed entirely distinct nanoflower morphology compared to spherical arrangement shown by NPs prepared using other solvents. As a result, Cu2S@MoS2 NPs - 1:1 showed superior textural properties with a surface area of 89 m2 /g in contrast to 7.4, 6.2 and 18 m2 /g observed for NPs synthesized in water, EDA and DETA, respectively. Besides, wide band gap of 2.75 eV for Cu2S@MoS2 NPs - 1:1 induced favorable charge carrier recombination kinetics, which played an instrumental role in the degradation of tetracycline hydrochloride (TC) and rhodamine B (RB). Cu2S@MoS2 NPs - 1:1 showed best photocatalytic activity as 97% and 96% of TC and RB wasremoved after 90 minutes of visible light irradiation with no significant decline in removal efficiency till 5 cycles. Scavenger studies hinted towards the crucial role of h + and ·OH in degradation process and a mechanism was proposed accordingly. The superior photocatalytic activity of NPs prepared using DES compared to water and organic solvents showed that the inclusion of DES in synthesis schemes of NPs is an excellent strategy for improving their efficiency towards waste water treatment applications. Keywords: Deep eutectic solvents, Photocatalysis, Nanoparticles, Tetracycline hydrochloride, Rhodamine B.

P027

One Pot Synthesis of Lignin Derived Zinc Oxide Nanocomposites and Their Application as Promising Antimicrobial and UV Blocking Agents

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Lignin, a natural and nontoxic biopolymer, is an evolving material for the development of coatings, films, gels, adhesives, and adsorbents. Additionally, lignin holds abundant potential to act as a capping, stabilizing, and reducing agent for engineering versatile nanomaterials. The agri-biomass based lignin was valorized by utilizing it in the one-step green synthesis of ZnO and TiO_2 nanocomposites. Lignin permitted for simple and cost effective synthesis of nanocomposites in a water-ethanol mixture without the need of any hazardous chemicals. For the synthesis of ZnONCs and TiO_2NC lignin was utilized as the sole capping and stabilising agent. The lignin-based ZnONC were doped into body lotion to impart UV blocking properties. When used alone or as a component to a regularly used body lotion, the lignin-based ZnO nano-formulations demonstrated good UV-blocking efficacy. Lignin-based coating material for UV protection and antibacterial applications was also prepared in a single step and at a low cost without the use of harmful materials. The lignin-based TiO_2NC were doped into lignin coatings to impart UV blocking and antimicrobial properties. The lignin-based ZnO and TiO_2 nanocomposites showed good antioxidant, antibacterial, and UV shielding properties.

P028

A mini review on treatment of wastewater by Photocatalysis method using ZnO nanomaterials doped with rare earth metals.

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Big industries consume large amount of water for manufacturing and turn it into wastewater by releasing residues like dyes, pharmaceutical waste, organic contents, residual contaminants, hazardous substances and metal ions in it. which is dangerous for flora and fauna. For degradation and mineralization of this wastewater, there are several traditional methods like ultrafiltration, precipitation, desalination, and reverse osmosis but most of them do not meet the required criteria for large amount of water. Hence, photocatalysis method used for the degradation of toxic chemicals and metal ions present in the wastewater attracts many researchers in which UV-Visible solar light spectrum is utilized. The photocatalysis is a process in which an electron-hole pair is generated in the photocatalyst when it is exposed to photons with energy higher than or equal to the photocatalyst band gap. These electron-hole pairs diffuse into the surface of photocatalyst and react with organic contaminates to reduce and oxidize them in the form of CO2, H2O and degraded products. Among various photocatalysts zinc oxide nanomaterials have been recognized as the most effective heterogeneous photocatalytic semiconductor metal oxide. But due to the wide band gap (3.37eV) of ZnO, it is limited to ultraviolet region, and the photocatalytic activity of this semiconducting material should be altered in order to slow down the recombination of these electron-hole pairs. To overcome this problem many researchers have modified the semiconductor by doping with metals and non-metals to improve the photocatalytic activity by shifting the absorption edge to longer wavelength and lowering the electron-hole pair recombination rate of photocatalysts. As we know that doping is the majestic way to alter the properties of any semiconductor so this review article gives insight about the doping of the ZnO nanomaterial with rare earth metal ions to decrease the band gap and shift the absorbed wavelength to the visible region which enhances the efficiency of ZnO photocatalyst for the degradation of waste water pollutants.

P029

Synthesis and Characterization of Lignin Derived Gold-Titanium Dioxide Nanocomposites for Antimicrobial Photodynamic Therapy

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The excessive use of antibiotics has accelerated antibiotic resistance, posing a significant global challenge. This phenomenon results in prolonged hospitalizations, escalated healthcare expenses and higher mortality rates. Metal and metal oxide nanoparticles (NPs) offer a promising alternative by interacting with crucial cellular components like DNA, enzymes, and cell membranes and making them effective against microbes. This study focuses on the synthesis and characterization of lignin-derived Gold-Titanium dioxide (Au-TiO_2) nanocomposites as potential agents for antimicrobial applications. Gold and TiO_2 have photodynamic properties which enhanced their antimicrobial properties by creating a synergistic combination of their individual attributes. Lignin, a renewable and abundant biomass-derived polymer, was utilized as a sustainable precursor for the synthesis of the nanocomposite. These nanocomposites were characterized for their structural, morphological, and optical properties. The antimicrobial activity of the Au-TiO_2 nanocomposites against Gram-negative (*Escherichia coli*) and Gram-positive (*Bacillus megaterium*) and fungal strain (*Candida tropicalis*) was evaluated both in the presence and absence of light. The outcomes of this study highlight the promising potential of Au-TiO_2 nanocomposites for antimicrobial photodynamic applications and further can be explored in the fields of medicine and nanotechnology to bring us closer to innovative solutions for critical biomedical challenges.

P030

Antibacterial efficacy of endogenous defensin fabricated catheters to limit catheter associated urinary tract infection(s).

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In the realm of global healthcare challenges, infectious diseases pose a significant threat to human well-being. Pathogens' ability to cause infections, coupled with their growing resistance to drugs, underscores the importance of understanding their behaviour. Nosocomial infections, which occur in healthcare settings, contribute significantly to morbidity and risk of adverse events. Among these, urinary tract infections (UTIs) are particularly prevalent worldwide, imposing an onerous economic burden of around $115 million - $1.82 billion per year on healthcare system.

To address this challenge, we have explored human defensin 5 (HD5), a potentially biocompatible endogenous antimicrobial peptide, as a coating agent for medical catheters. Alpha-defensin HD5, a key peptide produced by specialized epithelial cells of the genitourinary tracts, was linked and applied onto silicone tubings using PGA/PLL multilayer chemistry. This mimics the silicone-based materials commonly used as urinary catheters in hospital settings. The effectiveness of the coated surface against most common uropathogenic *Escherichia coli*, was tested over a 15-day period to assess antimicrobial properties and resistance to biofilm formation.

Situations like catheter associated urinary tract infections (CAUTI) arise after child birth, labor and other surgeries, routinely carried out in the hospitals and clinical settings. This study represents a promising biomaterial that will follow a demanding set of clinically relevant testing standards and can be actually applied in hospitals against CAUTI.

P031

Adsorption studies of non-ionic disperse dye on agricultural waste biomass derived magnetic binary nanocomposite of graphene oxide-iron oxide

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An economically feasible and environmentally favourable method has been used to produce low-cost graphene oxide (GO) by using activated carbon derived from rice straw agricultural waste biomass. Further, the synthesized GO was magnetized by doping with varying amount of γ- Fe2O3 (1% - 4%). The synthesised binary nanocomposite γ-Fe2O3 – GO was characterised by Fourier Transform Infrared Spectroscopy (FTIR), X-ray diffraction (XRD), Scanning electron microscope (SEM), Vibrating Sample Magnetometer (VSM). Surface charge analysis of synthesized nanocomposite was also done at different pH. Afterward, the synthesized nanocomposite was used as adsorbent for adsorption of synthetic navy blue 3G, an organic, hydrophobic, non-ionic dye, extensively found in effluents from textile industry. The various optimisations revealed that the highest removal efficiency of 96.14% was achieved with 2% γ-Fe2O3 -GO with adsorbent dose 1.5 g/L at pH 4 in 120 min. Adsorption isotherms and kinetic studies were also explored for different adsorbents. The present study emphasizes the straightforward production of magnetic graphene oxide (MGO) from waste rice straw and its utilization as a magnetically separable adsorbent for environmental remediation. Production of GO from waste biomass and its application in wastewater treatment makes the whole process greener, more economical and eco-friendlier.

P032

Optical Detection of Endotoxin Using Liquid Crystal Droplet–Embedded Hydrogel Film

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Endotoxins are known to cause endotoximia, a condition that can cause bleeding, kidney necrosis, septic shock, and occasionally even death. Endotoxins are toxic inflammatory stimulators that are released from the outer cell membrane of Gram-negative bacteria. For bioprocess engineers, identifying endotoxins in biological materials like bacterial cell lysates and human serums is still a very difficult task. The development of assays for endotoxin detection has received a lot of attention. These techniques are still insufficiently reliable and effective, nonetheless, to satisfy endotoxin detection standards. Thus, the pharmaceutical sector will greatly benefit from the development of a stable, controllable approach that combines sensitive endotoxin detection in complicated biological fluids. In this study, we created simple hydrogel film with liquid crystal (LC) and chitosan (CS) embedded in it. This allows for the sensitive real-time detection of bacterial lipopolysaccharides (LPS) in a variety of complex biological fluids. The incorporation of LC droplets into the gel film will restrict the mobility of the LC droplet, thus offering an exceptional stability to the droplets against coalescence and sedimentation. This system can facilitate the analysis of configurational transition in the LC droplets, thus optimizing the quantification of endotoxin.

P033

Designing bioinspired surface-engineered fluorescent carbon dots for biomedical applications

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Over the past decade, there has been a significant improvement in the evolution of light-emitting carbon-based quantum dots, which are emerging as promising nanomaterials over traditionally utilized semiconductor or inorganic quantum dots. Carbon dots (CDs) have been explored for various biomedical applications such as biosensing, bioimaging, drug delivery, etc. The facile synthetic protocol, tunable fluorescence properties, cost-effectiveness, biocompatibility, low cytotoxicity, environmental friendliness, and chemical stability make carbon dots an attractive nanomaterial for advanced biological applications. Carbon dots can be synthesized by a variety of precursors by utilizing various methods. However, recent advances in the field have emphasized on the use of affordable, sustainable, and renewable carbon precursors for improving the feasibility and competitiveness of carbon dot synthesis. In this regard, bioinspired approaches to synthesize novel C-dots using simple biomolecules, biopolymers, and small organic precursors are gaining huge importance owing to their various advantages such as eco-friendly behavior, cost-effectiveness, expected biocompatibility, etc. In this direction, we are particularly interested in investigating the largely underexplored potential of bioinspired molecules for the development of fluorescent C-dots. In this context, we have developed a one-step green synthesis method for the successful fabrication of amino-acid-based C-dots under microwave irradiation. We have utilized citric acid and arginine as carbon and nitrogen precursors, respectively. The highly fluorescent C-dots were characterized by various spectroscopic and microscopic techniques. The stability of the C-dots was also investigated at different pH values. The C-dots were observed to be biocompatible in nature, suggesting their huge potential to be used as novel bioimaging agents and drug delivery vehicles for various biomedical applications.

P034

Highly efficient adsorptive removal of ciprofloxacin using graphene oxide/layered double hydroxide composite

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Antibiotics, although developed for curing bacterial infections, contaminate the environment and their long-term unintentional exposure has detrimental effects on environment, human health, and other organisms such as antibacterial resistance, genotoxicity, birth deformities, inhibition of cell proliferation, and reduction of photosynthetic activity. Therefore, there is compelling need to remove antibiotic contaminants from water reservoirs and nanoplatforms are emerging as attractive platforms for environmental remediation. In this regard, a composite of graphene oxide (GO) with ZnAlNi-based Layered Double Hydroxide (LDH), GO/ZnAlNi-LDH has been explored for highly efficient adsorptive removal of priority antibiotic, ciprofloxacin. The composite containing ZnAlNi-LDH with specific removal capability towards ciprofloxacin and GO displaying high surface area for adsorption has been synthesized using co-precipitation method followed by hydrothermal aging. The formed adsorbent has been structurally characterized using FTIR, Raman spectroscopy, SEM, and XRD with significant peaks at diffraction angles of 11.34°, 23.64°, 34.93°. 46.96°, 61.1° which corresponds to the lattice planes (003), (006), (012), (015) and (110), respectively. The adsorption of ciprofloxacin onto GO/ZnAlNi LDH has been studied on several parameters including contact time, pH, temperature, absorbent, and adsorbate concentration along with adsorption kinetics. Under optimum conditions, up to 90% of ciprofloxacin adsorption was removed from the aqueous solution in 1 h. The composite platform also exhibited high stability, regeneration, and reusability.

P035

Latent stage diagnosis of pathogen infection in crop using chemoresistive sensor

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Tomato (*Solanum lycopersicum*) production faces myraid of biotic and abiotic stresses during their life cycle leading to great loss. Crop diseases cause volatile release that can be detected for the early diagnosis of disease and will be beneficial for the efficient farm management through IoT. β-ionone, a cyclic antimicrobial apocarotene compound, is released in multiple folds (upto 600 times) by the carotenoid cleavage dioxygenase 1 (CCD1) expression, and non-enzymatic cleavage of carotene at latent stage of some biotic stress like during the bacterial leaf spot disease caused by virulent strain of *Pseudomonas syringae*. Techniques used till now for detecion of volatile organic compounds (VOCs) involves GC-MS, PTR-MS, chemiluminescence and very recently metal oxide based chemoresistive sensors (MOx) which proves to be an alternative to all above mentioned conventional techniques. Here, SnO_2 based chemoresistive gas sensors for early diagnose of *P. syringae* infection has been attempted as it has been widely used earlier for the detection of isoprene, formaldehyde, acetone and benzene. To our knowledge for the first time, volatile with multiple oxidation sites *i.e.* ionone (4 oxidation site) has been attempted for sensing from the phyto-volatiles library, to get maximum signal at minimum concentration. Further, platinum doped SnO_2 on interdigitated electrode enhances the sensitivity by favourable space charge layer and surface island formation for reactive interface site. DFT calculations and XPS analysis further unveiled the mechanistic influence by oxygen vacancy formation and reactive oxygen assisted enhanced binding, respectively.

P036

Interfacial investigation of direct Z scheme based gC_3N_4/WS_2 heterostructures for hydrogen evolution reaction

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Hydrogen is becoming increasingly important as a clean energy option, and its production through methods like coal gasification, methane reforming, and water electrolysis is gaining attention. Among these, the hydrogen evolution reaction (HER) or water splitting is particularly attractive due to its lack of toxic emissions. To make HER sustainable, efficient catalysts with high stability, good charge transfer, and low overpotential are essential. Transition metal dichalcogenides (TMDC), such as tungsten disulfide (WS_2), show great promise as catalysts for HER due to their tunable band gap, high surface-to-volume ratio, and cost-effective production.To enhance the efficiency of HER, WS_2 is combined with high photocatalytic graphitic carbon nitride (gC_3N_4) to create a heterostructure for hydrogen production. g-C_3N_4, having extremely negative conduction band potential on coupling with WS_2 provides appropriate alignment of energy bands for HER. This Z scheme-based band alignment facilitates quick transfer of photogenerated electrons and thus lead to enhanced hydrogen production. The heterostructure is typically prepared using one pot calcination and hydrothermal method, and its structural properties are examined using techniques like X-ray diffraction (XRD). The surface morphology is studied using field-emission scanning electron microscopy (FE-SEM). The electronic interactions between gC_3N_4/WS_2 were investigated in detail using X-ray photoelectron spectroscopy (XPS) and Ultraviolet photoelectron spectroscopy (UPS). The charge transfer investigations and hence work function measurements were carried out to comprehensively investigate their impact on the hydrogen generation from the obtained structures. Furthermore, to evaluate the HER performance of heterostructure electrochemical impedance spectroscopy (EIS) and linear sweep voltammetry (LSV) was performed. An improved HER performance of prepared heterostructure was observed with low value of overpotential and impedance as compared to that for pristine sample.

P037

Optimized near-infrared shielding properties of nanorod-structured sodium tungsten bronze for smart window applications

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In near-infrared (NIR) shielding windows, tungsten bronze coatings, and films have gained considerable interest worldwide. Here, nanorod-structured sodium tungsten bronze was synthesized by using the hydrothermal method. Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), High-resolution transmission electron microscopy (HRTEM), and UV-visible DRS characterization techniques were used to analyze the properties of synthesized nanomaterials. To analyze the transmittance spectrum, thin films of nanorod-structured sodium tungsten bronze were prepared and spin-coated onto a glass slide. HRTEM results confirmed nanorod morphology and transmittance spectra revealed that the synthesized nanorod-structured sodium tungsten bronze can block approximately 20 % - 46 % of NIR light in the NIR region (750 nm - 2500 nm) and can transmit around 53.4 % of visible light in the visible range (400 nm -750 nm). These findings conclude that nanorod-structured sodium tungsten bronze is suitable for usage as an NIR shielding material in smart windows.

P038

Irrigation-friendly sensor to manage drought in crops through carbon-based signature volatile sensing

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Chemo resistive gas sensors have applications in various fields due to their ability to detect and quantify the presence of specific gases. These sensors have applications in medical field, wearable devices, agriculture, environmental monitoring, energy sector and industrial safety. In agriculture, water scarcity is a global challenge, which is growing unprecedentedly. Hence, a metal oxide decorated graphene oxide (GO) particles coated interdigitated chemo-resistive volatile sensor has been developed here to sense β-caryophyllene, an important signature terpene molecule released by the plant during drought. The interface between the ZnO and GO composite has been found to show outstanding complementary behavior, through selective permittivity and optimum working temperature, which cause oxidation at multiple sites that take the sensitivity to ~27 ppb concentration. The sensor has been validated in the crop that experiences water stress equivalent to 3 wet units in the soil moisture tensiometer, which is the critical value to irrigate the crop. The sensor can be applied in the IOT-based future smart farming to schedule the field irrigation.

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P039

Interfacial concentration changes of gallic acid esters in the corn oil-in-water nanoemulsion dictate the oxidative stability of underlying fatty acids: An insight through a novel chemical kinetic method

Nanoemulsions have emerged as excellent options for the food and pharmaceutical industries to encapsulate, protect, and deliver underlying fatty acids owing to their minute droplet size and robust kinetic stability. In this study, we investigated the effect of hydrophobicity of a series of gallates, viz., Gallic acid, Propyl gallate, Butyl gallate, Octyl gallate, and Lauryl Gallate, on their interfacial concentrations in food grade nanoemulsions composed of corn oil, acidic water, and a mixture of nonionic surfactants Tween 20 and Tween 80, as well as the zwitterionic surfactant 3-(N,N-dimethylmyristylammonio)propanesulfonate. The distribution of the antioxidants between different regions of nanoemulsion is designated by partition constants, that between the oil and interfacial region, $\boldsymbol{P_O^I}$, and that between the water and interfacial region, $\boldsymbol{P_W^I}$. The partition constants were determined from the chemical kinetic (CK) method that furnishes a different value of observed rate constant, k_{obs}, at the different emulsifier volume fraction for the reaction between phenolic antioxidants and the 4-hexadecylbenzenediazonium ions, 16-ArN_2^+. The oxidative stability of these nanoemulsions in the presence and absence of antioxidants was assessed via monitoring the formation of primary oxidation products with time by determining the corresponding induction periods. Interestingly, the change in the interfacial concentrations of gallates inferred from the CK method had a straightforward correlation with the oxidative stability of corn oil. Results clarify an effective and proper approach to control lipid peroxidation by modulation of the hydrophobicity of antioxidants.

P040

Effect of Zn substitution on structural and magnetic properties of $Sr_3Co_{2-x}Zn_xFe_{24}O_{41}$ hexaferrite

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Strontium Z-type hexaferrites ($Sr_3Co_2Fe_{24}O_{41}$) have received lot of interest because of their potential applications in antenna miniaturization, multilayer chip inductors and other electronic devices for telecommunications. Strontium Z-type hexaferrites possess low field magneto-electric (*ME*) effect at room temperature, which paves way for their utilization in non-volatile memory devices. In the present work, Zn^{2+} substituted strontium Z-type $Sr_3Co_{2-x}Zn_xFe_{24}O_{41}$ (x = 0, 0.2, 0.4, 0.6, 0.8, 1) hexaferrites have been synthesized by solid-state reaction method. Effect of Zn - substitution on its structural and magnetic properties was investigated by X-ray diffraction, field emission scanning electron microscopy and Vibrating Sample Magnetometer. Z-type hexaferrite was formed as major phase with some minor impurity phases of M and W phases. Microstructures of sintered hexaferrite show well-distinguished hexagonal platelet-like structure. The magnetization measurements reveal soft ferromagnetic characteristics of synthesized samples with low coercivity (H_c). The saturation magnetization (M_s) increases with the increasing Zn content from 41.92 emu/g (for x = 0) to 47.71 emu/g (for x =1), while the H_c exhibits a decreasing trend from 122.45 Oe (for x = 0) to 64.02 Oe (for x =1). The increase in M_s might be attributed to the substitution of Zn^{2+} ions at $4f_{IV}$ tetrahedral sites occupied by Co^{2+} ions. These forces a fraction of the Fe^{3+} ions which occupies at the tetrahedral site to transfer to the octahedral site. This enhances the superexchange interaction across various sublattices in the crystal, thereby increasing the molecular magnetic moment of the crystal.

P041

Sodium tantalate-borophene nanocomposite as an efficient electrocatalyst for electrochemical water splitting

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As industrialization expands worldwide, the depletion of energy resources and environmental harm have emerged as unavoidable challenges for contemporary civilization. Electrocatalysis stands out as an effective means to split water into hydrogen and oxygen which is a promising solution to balance energy demand and environmental concerns [1]. Considerable research attention has been directed towards tantalate perovskites such as $LiTaO_3$, $NaTaO_3$, and $KTaO_3$ perovskites to facilitate water splitting [2]. To improve its capabilities for facilitating the electrochemical water splitting, herein, we synthesized the Sodium tantalate-borophene nanocomposite via the electrostatic self-assembly method. The as-prepared nanostructures were characterized by X-ray diffraction (XRD), UV–vis-NIR, FTIR, XPS, and HR-TEM. Electrochemical analysis i.e. Cyclic voltammetry (CV), Linear sweep voltammetry (LSV) and Electrochemical impedance spectroscopy (EIS) were done to examine the potential of the composite for electrocatalytic water splitting. With borophene serving as a co-catalyst, this work provides a novel approach to designing high-performing, reasonably priced electrocatalytic materials for electrocatalytic water splitting.

P042

Enhancing Prosthetic Limb Performance: Material Advances and Optimization Strategies

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Losing a limb affects both physical and mental health. Prosthetic limbs stand as remarkable innovations that aim to restore lost mobility and quality of life. In this regard, design and development of prosthetic limb is of utmost important to ensure optimal performance and comfort for individuals who have undergone amputations. The effectiveness of these prosthetic limbs depends on a variety of factors such as rigidity, load-bearing capability and the materials used which significantly affects the prosthetic performance. It has been found from the literature that a diverse range of materials are used for the development for prosthetic lower limbs like carbon fiber composites, titanium, thermoplastic, silicone, foam, glass fiber and steel. The material chosen for the construction of prosthetic lower limb has substantial influence over its mass, stiffness, damping and durability during activities such as walking, running, jumping, and staircase ascent and descent. Researchers have analyzed various designs, including mono limbs, C-shaped, and J-shaped blades, to understand their impact on gait dynamics and energy transfer with the aim of enhancing gait efficiency and mechanical characteristics. Comparative studies assessed how prosthetic blades perform while running, considering factors like material selection and shape optimization. Researchers analyzed various designs, including mono limbs, C-shaped, and J-shaped blades, to understand their impact on gait dynamics and energy transfer with the aim of enhancing gait efficiency and mechanical characteristics. The studies emphasized the significant influence of material choice on functionality and design, highlighting carbon fiber as a promising option due to its lightweight and durability properties. This review provides pivotal insights for design engineers, clinicians, and prosthetists illuminating key parameters impacting prosthetic lower limb performance across diverse activities. Design engineers can enhance structural and material aspects, clinicians gain biomechanical insights for tailored solutions and prosthetists refine fitting and alignment.

P043

GRAPHENE OXIDE-BASED COMPOSITE FOR HIGHLY STABLE ANTI-BACTERIAL IMPLANT COATINGS

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Titanium and its alloys are widely used in biomedical devices such as artificial joints, spinal fixators, screws, and bone fixators, attributed to their impressive biocompatibility and excellent corrosion resistance. However, titanium does not possess intrinsic antimicrobial properties and limited osseointegration. Hence, bacterial films developed on the implant surface, leading to infection and implant failure. To overcome these issues, surface modification of titanium-based implants through coatings with nanomaterials, biopolymers, and hydroxyapatite can be an effective approach to induce an antibacterial effect on the implant surface. In this work, composite of graphene oxide (GO) with lignin was employed as a coating material on the surface of titanium alloys (Ti6Al4V) to enhance mechanical characteristics and biocompatibility. The titanium surface was chemically functionalised using an APTES (3-aminopropyltriethoxysilane) transition layer and DA (Dopamine Hydrochloride) as an adhesive layer to coat GO on metal surface using the coating techniques. GO was synthesized using the modified Hummer's method. The alkali lignin was crosslinked with graphene oxide to enhance the coating stability. The degradation rate of the material was analysed for 21 consecutive days in a simulated body fluid (SBF) solution under controlled conditions. The structural, morphological and compositional characterization of the coatings were carried out using FESEM, EDS, XRD, Raman, and Fourier transform infrared spectroscopy (FTIR) techniques. SEM images revealed that the sheet-like structure of graphene oxide was intact after composite formation, while D and G Raman vibrational bands were observed at 1350 and 1580 cm^{-1}, respectively. Moreover, the coating of composite material remained intact for more than a month and demonstrated the prevention of biofilm formation. These results demonstrate that nano-modifications can potentially enhance the surface bioactivation of materials that can be used on implant surfaces to reduce surgical site infections in biomedical applications.

P044

Soil mimetic eco-friendly fertilizer gate: Nanoclay reinforced binary carbohydrate for crop efficiency

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Potassium plays a crucial role in crop physiology, hence recommended as a basal macronutrient. But its high mobility, and quick leaching makes it phyto-unavailable, hence nano material-assisted coating on muriate of potash is attempted for the first time, which serves 80% of potassium fertilizer requirement. Rotary drum coating method has been used to coat binary carbohydrate viz., chitosan and lignin with anionic clay as a reinforcing agent that favors the formation of stable coordination bonds. Thus, coated fertilizer fulfills industrial demands like resistance to abrasion and storage. Finally, the coated fertilizer was able to improve the wheat production efficiency to ~ 17 %. While in the function, clay stake to extend the diffusion time and recalcitrant lignin gives cation exchange capacity assisted nutrient feeding as well as laccase induced slow release function. The coating matrix has improved the stability of lignin against laccase significantly to complement the slow release and efficiency.

P045

Effects of treated fiber and fiber loading on the properties of sugarcane bagasse reinforced polymer composites

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Sugarcane bagasse fiber is a residue of a sugarcane milling process. In this research, bagasse fiber has been used as a reinforcing component for resin to explore potential possibilities in waste management. The chemical treatments using 0.5 N sodium hydroxide were carried out to modify the properties of the fiber. Also, the effects of treated fiber and untreated fiber on the properties of composite were investigated. Further, at different fiber loadings (10%, 20%, 30%, 40% & 50%), we observe that the treated fiber composites show better chemical and mechanical properties compared to those of untreated fiber composites. In addition, we have carried out the water absorption study, which reveals that the treated fiber composites have lower water absorption properties compared to those of untreated fiber-based composites. The present study can pave the way for realization of novel material platforms towards versatile household and environment friendly applications.

P046

Room temperature magnetodielectric effect in Y-type hexaferrite $Ba_2Zn_2Fe_{12}O_{22}$

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Magnetodielectric (MD) materials exhibit promising applications in information storage, sensors, and microwave devices owning to the strong coupling between their magnetic and electric spins. Recently, hexaferrites have garnered attention owing to their MD properties at room temperature. Within the hexaferrite family, intensive research has been carried out on Y-type ferrites because of magnetic field induced electric polarization. In the present study, the magnetodielectric properties of $Ba_2Zn_2Fe_{12}O_{22}$ (Zn_2Y) hexaferrite has been investigated at room temperature. $Ba_2Zn_2Fe_{12}O_{22}$ (Zn_2Y) hexaferrite was synthesized by the solid-state reaction method. *XRD* pattern confirmed the formation of Zn_2Y hexaferrite. FE-SEM micrograph showed a hexagonal platelet-like structure. The *M-H* loop of Zn_2Y was well saturated verifies its in-plane low magneto-crystalline anisotropy and depicts the properties of soft magnets. The dielectric constant followed relaxation-type behavior wherein it decreased with increasing frequency and became constant at high frequency. A notably high MD effect was observed at low frequencies. The frequency dependence analysis showed that the Maxwell-Wagner type magnetoresistance effect is the dominant mechanism for MD effects at low frequencies, while spin-phonon coupling is the dominant mechanism at high frequencies.

P047

Study of metal oxide based nanomaterials for sensor applications

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The area of nanotechnology has advanced tremendously in the past few years, enabling researchers to accurately and efficiently modify any material's properties. This development sheds light on the way toward sustainable growth for the benefit of humanity and transformed the field of material sciences. Because of their distinctive contributions to a wide range of sectors, including sensing, environmental remediation, industrial, biomedical, and agriculture, nanomaterials might be regarded as the front-runners in this context. Continuous alterations to the characteristics and architectures of various nanomaterials resulted in their improved activity and performance for a given use. From now on, the necessity of creating or altering new materials for various purposes remains prominent. Among the different kinds, scientists and business people are particularly interested in metal oxide-based nanomaterials because of their exceptional physical and chemical characteristics when compared to their bulk counterparts. Applications for these metal oxide nanoparticles are numerous and include improved energy storage, the textile sector, biosensors, and biomedicines. Their unique characteristics explain why they are used in so many different sectors.

The current work focuses on producing zinc oxide (ZnO) nanoparticles, analyzing their physicochemical properties, and identifying particular applications in a range of biomedical and technological domains, such as electrochemical sensing. Electrochemical sensors based on Zinc Oxide (ZnO) have the potential to detect a wide range of analytes, including biomolecules, organic pollutants, heavy metals, and toxins present in food items. The electrochemical/optical properties of these metal oxide nanoparticles have been investigated for a range of biological and environmental uses.

P048

Leveraging Thiol functionalized biomucoadhesive hybrid nanoliposome for local therapy of Ulcerative colitis

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Directly administering medication to inflamed intestinal sites for treating ulcerative colitis, poses significant challenges. Recent advancements in therapy to treat colitis aim to improve local drug availability that is enema therapy at the site of inflammation, thereby reducing systemic adverse effects. Nevertheless, a key limitation lies in enemas' inability to sustain medication in the colon due to rapid peristaltic movement, diarrhea and poor local adherence. Therefore, in this work, we have developed site-specific thiolated mucoadhesive anionic nanoliposomes to overcome the limitations of conventional enema therapy. The thiolated delivery system allows prolonged residence of the delivery system at the inflamed site in the colon, confirmed by the adhesion potential of thiolated nanoliposomes using in-vitro and in-vivo models. To further provide therapeutic efficacy thiolated nanoliposomes were loaded with gallic acid (GA), a natural compound known for its antibacterial, antioxidant, and potent anti-inflammatory properties. Consequently, Gallic Acid-loaded Thiolated 2,6 DALP DMPG (GATh@APDL) demonstrate the potential for targeted adhesion to the inflamed colon, facilitated by their small size 100nm and anionic nature. Therapeutic studies indicate that this formulation offers protective effects by mitigating colonic inflammation, downregulating the expression of NF-κB, HIF-1α, and MMP-9 and demonstrating superior efficacy compared to the free GA enema. The encapsulated GA inhibits the NF-κB expression, leading to enhanced expression of MUC2 protein, thereby promoting mucosal healing in the colon. Furthermore, GATh@APDL effectively reduces neutrophil infiltration and regulating immune cell quantification in colonic lamina propria. Our findings suggest that GATh@APDL holds promise for alleviating UC, addressing the limitations of conventional enema therapy.

P049

Smart Drug Delivery System For Management Of Ulcerative Colitis

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Ulcerative colitis (UC) is a chronic inflammation-related disease that severely affects the colon and rectum regions. A variety of therapies-regimens are used for the treatment of UC. Clinically, therapeutic enema is the choice of therapy for UC patients. Irrespective of on-site administration, the major limitation of therapeutic enemas is the dispossession of the medicine followed by low drug availability for the therapeutic action. In our present work, we have developed an enzyme-responsive injectable hydrogel (ER-hydrogel) to overcome the limitations of therapeutic enema. The hydrogels possess two major advantages, which are being exploited for therapeutic drug delivery in UC. Prolonged retention and enzyme responsiveness, the former is one of the prominent advantages of hydrogel compared to free drug enema and the latter controls the release of the drug or provides drug release on-demand. The ER-hydrogel was formulated by heat-cool method and for therapeutic purposes, a corticosteroid drug budesonide (Bud) was encapsulated into the ER-hydrogel and evaluated for its various physicochemical and therapeutic potential in dextran sodium sulfate (DSS) induced UC. In-vitro and ex-vivo adhesion studies confirm the retention or mucoadhesive nature of the ER-hydrogel and the upsurge in Bud release from the Bud-loaded ER-hydrogel upon the addition of esterase enzyme confirms the enzyme-mediated drug release from the ER-hydrogel. Moreover, Bud-loaded ER-hydrogel exhibited promising results in alleviating the disease activity index of UC, and restoring the length of the colon, which is the main hallmark of UC. In terms of the health of colon tissue, the Bud-loaded ER-hydrogel restored the colonic tissue damage as seen in the H&E-stained, AB-NR-stained, and HID-AB-stained colon sections. Finally, the Bud-loaded ER-hydrogel also markedly subsided the IL-1β, TNF-α, MPO, and nitrite levels in serum and colon tissues. Thus, the fabricated Bud-loaded ER-hydrogel possesses appreciable translational potential due to its ability to significantly ameliorate inflammatory changes compared to naïve or water-based therapeutic enema in acute experimental colitis in mice.

P050

Plasmonic Gold Dogbone Nanorattles (DB-NRT): A Novel Nanocomposite For SERS-Based Sensing and Cancer Nanotheranostics.

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Since plasmonic nanoparticles exhibits shape- dependent optical and chemical properties, thus the ability to synthesise plasmonic nanostructures with ultraprecision is a critical step towards the development of novel structures with improved chemical and physical properties. The Inherent property of engineered DB-NRT, having porous Au-shell over the solid dogbone shape core that provides more NIR activity, can be exploited for various applications. Due to the presence edges and corners in solid core along with smaller core to shell intergap, it performs better for SERS based sensing and bioimaging. The intense local electromagnetic magnetic (EM) field in the interparticle nanogaps, which enhance the light absorption efficiency of nanoparticle. Because of the inherent porous nature, DB-NRT generate intense localized EM field upon exposure to external EM radiation. The EM field of metal nanoparticles is used in Surface-enhanced Raman spectroscopy (SERS), to improve the Raman scattering of the target analyte that is adsorbed on the surface of nanoparticle. SERS provides a sensitive and label-free detection of molecule through its vibrational mode known as “molecular fingerprints”.

Fabrication of a novel DB-NRT deposited shrink film-based SERS substrate, which synergistically amplify the SERS signal leading to an enhancement factor (EF) of 2.77 x 10^{10} for 1,4-Benzenedithiol (BDT) and LOD of up to 10^{-13}M. This amplified SERS signal is due to the 3D morphology that was produced as a result of heat shrinkage after the deposition of DB-NRT. The dogbone shape solid core and porous shell of DB-NRT shows the extinction in the NIR-I (600-1000 nm) window. The maximum accessible impinged intensity by the DB-NRT due to the non-absorption of NIR from the biological matrices, results in the excellent photothermal conversion efficiency of 35.29% with 785nm laser. Further to make it biocompatible and enhanced cellular uptake, DB-NRT is encapsulated with cationic dextrin (CD-DBNRT). CD-DBNRT composite shows 80% cell death of MCF-7 cell line at 100 µg/mL nanocomposite concentration with 1W/cm^2 laser power density.

P051

Effective intracellular delivery of cytochrome C through cationic dextrin nanoparticles for cancer therapy

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Over the past few decades, cancer have become one of the major reasons for world-wide mortality and also reducing the quality of life causing early deaths. Traditional anti-cancer treatments such as chemotherapy and radiation therapies have severe effects on normal cells resulting toxicity and even multi organ damage. Intracellular delivery of proteins presents a promising avenue for targeted cancer therapy but effective and functionally active delivery of proteins to intended cells remained a challenge. Nanoparticle based deliveries have gained significant importance but developed of versatile biocompatible carrier system continued to be a problem. To overcome these obstacles, a biocompatible polymer, cationic dextrin (CD) have been used to form a nanocarrier to encapsulate and deliver cytochrome C (Cyt C), a therapeutic protein. The issue of endosomal entrapment of the nanoparticles was addressed by co-delivering the synthesized nanocarrier with chloroquine, which aids the endosomal escape of the therapeutic cargo. The structural and functional stability of the therapeutic protein was further characterised by spectroscopic analysis. Further, flow cytometric and microscopic observations also stated that the therapeutic cargo induces apoptosis by mitochondrial membrane depolarisation in Hela cells which is a vital step in eliminating cancer cells. These discoveries highlight the promise of engineered delivery systems utilizing CD NPs as a promising platform in the field of nanomedicine for protein delivery applications.

P052

Influence of surface coatings on degradation behavior of Mg alloy bone scaffolds

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Bone scaffolds are are primarily employed in tissue engineering to offer a versatile platform for various functions such as cell attachment and cell growth, and enables the favourable physical and biological environment for tissue regeneration and rapid bone healing. Magnesium (Mg) and its alloys emerge as promising candidates for biodegradable implants owing to their favorable mechanical properties, including low density and an elastic modulus matching that of cortical bone. Additionally, they exhibit good biocompatibility and natural degradability. However, the porous structure of Mg-alloys leads to an increased specific surface area, consequently accelerating their degradation rate within the body fluid. The elevated degradation rate of porous Mg-alloy within the human body may lead to the accumulation of significant H2 gas and elevated local pH levels, posing a potential risk of inflammation or tissue damage.

In present study, cylindrical bone scaffolds of ZM21 Mg-alloy were designed with a gradient cylindrical pore geometry (0.5mm and 1mm) and a porosity of 35% which were fabricated using electrical discharge micro drilling (EDMD). EDMD is an economical manufacturing route capable of producing cylindrical micro pores irrespective of the height and position of the Mg-alloy sample. In order to control the degradation of porous Mg alloy, three types of surface coatings namely Aloe Vera, HA-Ag and Poly Lactic Acid (PLA) have been performed and evaluated for weight loss, pH rise, H2 evolution rate and strength loss of ZM21 Mg scaffolds. The coated and bare Mg scaffold samples were subjected to in-vitro immersion testing in SBF for a period of 3 days and 10 days to study their degradation behavior. The invitro immersion study revealed that HA-Ag coating has significantly controlled the weight loss and H2 evolution rate of Mg-scaffolds, followed by the PLA coating, and bare samples. Aloe Vera coated Mg-scaffolds have shown the highest weight loss, whereas bare samples have shown highest H2 evaluation rate. The strength loss after 10 days of immersion was found lowest 3% and 4.5% for HA-Ag coated and PLA coated Mg-scaffolds respectively. The present study concludes that the HA-Ag coating is most significant for controlling the degradation rate and attracting the higher mineralization in ZM21 Mg alloy bone scaffolds.

P053

Mathematical Modelling and Experimental Analysis of Rotating, Multi-Phase Triboelectric Nanogenerator

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The landscape of electronic devices has experienced a remarkable evolution with triboelectric nanogenerator (TENG) emerging as a pivotal technology for harvesting mechanical energy in order to meet energy crisis. In this work, a novel Multi-Phase Triboelectric Nanogenerator (MP-TENG) is developed to capture mechanical energy from rotating parts of the machines to power sensors, charge batteries and perform predictive maintenance of machinery by condition monitoring. A mathematical model is developed for the MP-TENG to clarify the fundamental physics underlying its operation. Experimentally, MP TENG is fabricated with Polytetrafluoroethylene (PTFE) and fur serving as tribo-pairs and copper as electrode. Further, the performance of MP-TENG is analysed at different rotational speed (100 rpm, 200 rpm, 300 rpm, 400 rpm). The open circuit voltage of MP-TENG increases with increase in rotational speed. The experimental findings demonstrate MP-TENG's capability to generate substantial electrical outputs, particularly at low frequencies making it an excellent technology for generating energy from rotating parts of machines.

P054

Modified Fe_3O_4 nanoparticles for electrochemical sensing of heavy metal ions Pb^{2+}, Hg^{2+}, and Cd^{2+} in water

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Heavy metal ions stand out as a primary contributor to water contamination, with a significant proportion of these ions demonstrating carcinogenic properties. This poses a dual risk to both human well-being and the delicate ecological equilibrium. Electrochemical detection is advantageous given the rising demand for heavy metal detection because of its high sensitivity and effectiveness. Fe_3O_4@SiO_2@SB, functionalized magnetic nanoparticles, were synthesized and used to detect heavy metal ions such as Pb^{2+}, Hg^{2+}, and Cd^{2+} in water. The formation of Fe_3O_4@SiO_2@SB nanocatalyst was confirmed by XRD, SEM, TEM and IR. The simultaneous determination of analyte cations was carried out using square wave anodic stripping voltammetry (SWASV). Investigation and optimisation were done to study how experimental variables affected the performance of modified magnetic electrode. In the presence of some potentially interfering ions the prepared sensor was successfully applied to the detection of $Pb^{2+,}$ Hg^{2+} and Cd^{2+}. The recovery rate was found to be 97.5% for Pb^{2+}, 96.2% for Hg^{2+}, 103.5% for Cd^{2+}. The electrochemical sensor was also employed to determine the presence of heavy metal ions in drinking water samples which are well below than the World Health Organization (WHO) guideline.

P055

Niacin-Loaded Liquid Crystal Nanoparticles Ameliorate Prostaglandin D2-Mediated Niacin-Induced Flushing and Hepatotoxicity

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Niacin plays a significant role in the therapy and management of mixed dyslipidaemia. Nevertheless, its administration in raw form is contraindicated due to potential adverse effects, including hepatotoxicity and cutaneous flushing. Prostaglandin D2 (PGD2) plays a crucial role in the signalling cascade of niacin-induced flushing. To address the potential adverse reactions linked to niacin therapy, we have developed a niacin-loaded lyotropic liquid crystal nanoparticle (NLCS) crafted explicitly for the oral administration of niacin. NLCSs were produced by disrupting the cubic gel of Glyceryl monostearate (GMS). The nanoparticles demonstrated notable drug-loading capabilities with a size of approximately 255 ± 31.6 nm. Furthermore, NLCS displayed a sustained release behaviour, indicating their potential for controlled and prolonged drug delivery. Efficient encapsulation and minimal interaction between niacin and other excipients were evidenced through Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD) studies, establishing their high stability. *In-vitro* studies suggested that the nanoparticles had good antioxidant activity, swelling behavior, and biocompatibility. Additionally, compared to raw niacin, NLCS showed higher *in-vivo* therapeutic efficacy, lesser hepatotoxicity, a more refined lipid profile, and an improved complete blood count (CBC) profile. In addition, it was shown that animals treated with NLCS had lower PGD2 levels than those treated with raw niacin. In conclusion, our study highlights the potential of NLCS as a promising strategy to alleviate the side effects linked to the direct ingestion of pure niacin. These nanoparticles offer a solution to flushing-like symptoms and hepatotoxicity, positioning them as a viable therapeutic option for managing dyslipidemia.

P056

Influence of Carbon Nano-Tube (CNT) and Process Parameters on the Machinability of Developed AZ31 Mg Based Hybrid composite

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Mass saving demands makes the magnesium based composite more trendy in the various sectors such as automotive, aerospace, sports and leisure equipment etc. From the past few decades, composite materials made a substantial impact in the manufacturing industries. Even composite material became a substitute and replacing the conventional material. Therefore to serves the need of naval material, in this experimental study AZ31-Mg alloys, carbon nano-tube (CNT) and nHA based hybrid composite have been developed and influence of CNT and nHA have been evaluated on the various properties of developed material. Since machinability of composite materials always remains a big challenge for manufacturing industry. Therefore the present study also outlines the machinability aspects of developed AZ31-Mg alloys, CNT and nHA based hybrid composite with CBN tools. The study shows the influences of CNT and nHA on the machinability aspects. Further the attempt has also been made to evaluate the effects of machining parameters on the machinability of developed hybrid composite. Response surface methodology (RSM) has been used design the experimentation, cutting forces and surface roughness have been investigated as response parameters. Further the research observed the CNT as the most influential parameters for the properties and machinability study.

P057

Genesis of Neurotoxic amyloid fibers of Phenylalanine metabolites and their relevance in the pathology of phenylketonuria

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Metabolites are involved in many physiological processes and are crucial for the regular operation of every cell. However, metabolites can self-assemble into harmful supramolecular structures resembling amyloid-like assemblies, when present in excess. Therefore, examining the aggregation patterns of individual metabolites holds significant importance from a chemical neuroscience perspective for comprehending the shared origins between disorders related to single metabolites and amyloid diseases such as Alzheimer's and Parkinson's. In this context, we have studied the self-assembling behavior of the phenylalanine-derived metabolites. The self-assembled structures formed by these metabolites were extensively characterized via microscopic and spectroscopic techniques. Further, their cytotoxicity was evaluated via cell culture studies. The results presented in this work may have important implications in the pathogenesis of diseases caused by phenylalanine pathway metabolic dysfunction like phenylketonuria caused by the accumulation of these metabolites.

P058

Dispersive soil stabilization using calcium lignosulfonate

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The present study describes the study of finding the optimum proportions of a stabilizing agent i.e., calcium lignosulfonate which is economical, sustainable, and abundantly available because of lack of its utilization. It is extracted from the waste of paper industry. The basic properties of dispersive soil were determined in the study. The particle size distribution of the soil under study shows the presence of a large amount of silt (51.85%). The plasticity index was found to be 8.24% which supplements the fact that there is presence of large amounts of silt sized particles. The different proportions of calcium lignosulfonate such as 0.5%, 1%, 1.5%, 2% and 2.5% were evaluated using the unconfined compressive strength test and the maximum strength was found to be obtained in the case of Calcium lignosulfonate being used at 1.5% by weight of soil at 365.28 kN/m2 after curing for 28 days. To further improve the strength, 1% of cement was added and the strength was found to be 450 kN/m2 at an age of 28 days, which is an increment of 18.1% over the soil treated with Calcium lignosulfonate alone. To study the mechanism of stabilization, X-Ray Diffraction (XRD) analysis and Scanning Electron Microscopy (SEM) were performed. XRD analysis of the untreated shows that the sample has an abundance of Na+ ions on the surface of the particles, which leads to the development of repulsive forces between the particles. The sample analysis for the soil treated with 1.5% Calcium lignosulfonate and cured for a period of 28 days shows the abundance of Ca2+ ions on the surface of the particles, which leads to less repulsive forces between the particles and effectively reducing the dispersity of the soil in the process. The SEM analysis of the untreated soil shows the structure to be dispersed, without any cohesion between the particles. When the soil treated with 1.5% Calcium lignosulfonate and cured for 28 days is subjected to SEM analysis, development of inter-particle bonding can be seen, which accounts for the increase in the strength after treatment and curing. The Zeta potential results also showed that the calcium lignosulphonate improved the suspension system's stability. Furthermore, rheological test results demonstrate that a moderate concentration of calcium lignosulphonate increased the yield stress and plastic viscosity, demonstrating the development of a strong bond between soil particles. Keywords: Atterberg's Limit, Dispersive Soils, Particle Size Distribution, Unconfined Compression Strength, and Calcium lignosulfonate.

P059

Experimental Evaluation of Eco Sand as a Partial Replacement for Fine Aggregates in Mortar: A Sustainable Approach

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Fine aggregates in mortar and concrete serve as a structural filler. With the increasing scarcity of natural river sand and the growing need for sustainable building materials, alternative sources of fine aggregates have received substantial attention. Currently, the scarcity of river sand greatly influences construction as well as the environment, resulting in an increasing demand for other sources. As an alternative, eco sand can be taken into consideration, which is a byproduct of the cement manufacturing process. The physical properties of three different sands river sand, manufactured sand and eco sand were examined. The results showed that the particle size of eco sand was much smaller than others. The compressive strength of hardened mortar containing eco sand with river sand and manufactured sand increased with a decrease in percentage of eco sand. The workability showed a proportionate decrease with a percentage replacement of river sand and manufactured sand with eco sand. The compressive strength test indicate that replacement of fine aggregates can be done up to 40% without any decrease in strength while the strength being more than nominal mortar at 25% replacement. To sum up, this study gives a comparable level of performance and sustainability in managing waste materials, and it promotes resource conservation in the construction industry. Keywords: Manufactured sand, Eco sand, Fine aggregate, Compressive strength, and Bonding properties.

P060

Thermal Insulation and Analysis of Building

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Energy consumption is rising as a result of urbanization, industry, and population growth. A significant portion of this energy consumption can be attributed to residential areas. Efforts are being directed towards enhancing the thermal insulation of residential structures. In the regions like Kashmir and Ladakh, the winter is very harsh and temperature goes to minus degree celcious,therefore heating costs are very high, thermal insulation stands as a critical technology for curbing energy usage in buildings by curbing heat transfer through the building envelope. Numerical simulations play a crucial role in these studies. This study is one of the few that uses a methodical and consistent approach to evaluate the optimal Wall-mounted insulation thickness and heat loss for diverse kinds of insulating materials. The studies on brick walls(with and without windows)and the Studies on Brick walls with selected thermal insulation(with and without windows) is done. To investigate the thermal performance of building walls in the presence of periodic outside ambient temperature, an accurate analytical solution for transient heat transfer via multilayer walls has been developed. The analytic model served as the foundation for numerical simulations. This method allowed us to assess the thermal performance of various materials in terms of heat transfer capacity and impact on indoor comfort, as well as accurately anticipate hourly changes in the surface temperature and heat flux of brick walls. Our investigation led us to the conclusion that materials such as polyisocyanurate, polyurethane foam, extruded polystyrene, etc. provide good outcomes when cost is not an issue. But when it comes to cost, materials like hemp board and corncob work best since they minimize the loss of interior temperature when combined with brick for the outer walls. These are similarly reasonably priced, but because they are organic, they may eventually deteriorate in the presence of moisture. Finally, it is emphasized once more that practical considerations about the suitability or lack thereof insulating materials for a particular building type do not limit the current estimates. Comparing insulating options for similar applications was the aim. There are other factors to take into account while choosing insulation materials, such as application, installation techniques, durability, pricing, etc. Furthermore, it is best to take into account the environmental effects of any additional materials required for installation, as these may differ depending on the type of insulation.

P061

Black Cotton Soil Stabilization Using Crushed Waste Glass And Waste Foundry Sand

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Black cotton soil, characterized by its high expansiveness and low bearing capacity, poses significant challenges in various civil engineering applications. This study investigates the potential of utilizing waste foundry sand (WFS) and crushed waste glass (CWG) as stabilizing agents to enhance the engineering properties of black cotton soil. The objective of this research is to assess the effectiveness of WFS and CWG in stabilizing black cotton soil through laboratory experiments and evaluations. The experimental program consists of several phases, including the determination of index properties, compaction characteristics, and unconfined compressive strength (UCS) tests. The study involves varying proportions of WFS and CWG mixed with black cotton soil to optimize the stabilizing mixture. The results indicate that the addition of WFS and CWG significantly improves the geotechnical properties of black cotton soil. The index property tests demonstrate reductions in the plasticity index and swelling potential, indicating a decrease in soil expansiveness. The compaction characteristics reveal increased maximum dry density and reduced optimum moisture content with the addition of stabilizing agents. Furthermore, the CBR tests illustrate substantial improvements in the strength and load-bearing capacity of the stabilized soil samples. The experimental findings suggest that the combined use of WFS and CWG can effectively stabilize black cotton soil and transform it into a suitable construction material. The incorporation of these waste materials not only enhances the geotechnical properties but also contributes to sustainable waste management and environmental conservation. The research outcomes have significant implications for civil engineering projects involving black cotton soil. The stabilized soil mixture can be employed as a reliable subgrade material, providing increased stability and load-bearing capacity for foundations, embankments, and other infrastructure elements. Moreover, the utilization of WFS and CWG offers an ecofriendly and cost-effective solution, reducing the demand for traditional construction materials and minimizing the environmental impact associated with their disposal. The findings of this investigation will be compared to the typical mixes after using waste foundry sand (WFS) and crushed waste glass (CWG). Key Words: Black Cotton soil, Waste Foundry Sand, Crushed Waste Glass, OMC, MDD, CBR.

P062

Study of Earthquake Resistant Structure and Its Recent Innovation In Construction

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In the present , the necessity of civil engineering is more wide and flexible such as tall buildings and long span bridges is increased .they are subjected to undesirable vibrations, deformation and accelerations due to seismic loads and wind loads. Earthquake makes excess vibrations in structures which may cause various kind of causalities like human discomfort, loss of life, damage of property, and sometimes leads to collapse depending upon its magnitude. So earthquake may damage from small property to long range of liquefaction.

Secondary damage can be: fire, blockage of services like water supply, electricity and transportation and communication so in order to eliminate the effects of vibrations in structures it is important that such structure design carefully and seismic or earthquake resistant. However it cannot be eliminated completely but can minimize to a good extent. So it is important to develop new technologies to minimize the effect of seismic vibrations and these losses. Thus we do research on these new technologies to make earthquake or seismic resistant structures or minimize the effect of earthquake vibrations and wind vibrations, and to improve our knowledge and aware about recent methods. In this research, we will discuss on modern technologies that how our structures will become earthquake resistant.

KEYWORDS- Advanced earthquake techniques, Effective design process, Failure, Damping devices, Control devices, Bracings, Structure failure, Regular and irregular structures.

P063

Thermal Insulation Of Residential Buildings

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In order to reduce energy usage, thermal insulation is now required in all buildings. The installation of thermal insulation in buildings lowers energy costs in addition to air conditioning system usage. Researchers have looked into new, affordable, sustainable, and obtainable materials to reduce the amount of heat that buildings lose. This document aims to provide a summary of the thermal insulation principle. Keywords: Thermal insulation, Residential buildings, Insulation, Paneling, Glasswool, Mud plaster

P064

Inorganic charge transport layer for efficient Pb-free $KSnI_3$ based perovskite solar cells: a theoretical study

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The power conversion efficiency (PCE) of lead (Pb)-based perovskite solar cells (PSCs) is remarkably high; however, the toxicity of Pb poses a significant barrier to their commercial viability. In the current study, the effect of different charge transport layer (CTL) materials on the performance of the Pb free Sn-based ($KSnI_3$) PSCs has been studied by using SCAPS simulations. Tin oxide (SnO_2), zinc oxide, and titanium dioxide as electron transport materials, whereas spiro-OMeTAD, copper oxide (Cu_2O), and nickel oxide as hole transport layer materials were iterated to achieve the optimum photovoltaic parameters. The photovoltaic parameters were optimized in terms of the active layer and CTL thicknesses, as well as the doping concentration, defect density, and interfacial defect density. Moreover, the impact of series and shunt resistance on the performance of PSCs is also investigated. The most efficient PSC with power conversion efficiency of 21.75% was achieved with the device structure of FTO/ SnO_2/$KSnI_3$/ Cu_2O. This efficiency is higher than previously reported $KSnI_3$ based-PSCs. The SnO_2 (ETL) and Cu_2O were proven to be most efficient choices for the CTL materials. It was also observed that the carbon, nickel, and selenium can be a cost-effective alternative to gold for the rear contact. This study showcases how $KSnI_3$ with inorganic CTLs charge transport layers stands as a prospective stable PSC with the potential to deliver clean, and green renewable energy solutions.

P065

Experimental Study on Effect of Partial Replacement of Coarse Aggregate by Jhama Bricks

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The most common building material in the world is regarded to be concrete. Ordinary concrete mixtures consist of cement, water, sand, and rock aggregate. The coarse aggregate in concrete is the main topic of this project. The coarse rock aggregate found in regular concrete will be substituted out for the other substance. Burn brick will be a part of this. The selection of this content was based on its accessibility. The brick manufacturing area is where you can get burn bricks. Many bricks are rejected during the brick-making process as well because they don't meet the necessary specifications. The distorted form of brick produced as a result of the kiln's uneven temperature control is one such significant nonconformity. Another possible use for these rejected bricks is as coarse aggregate. This would help with disposal issues as well as making good use of the otherwise waste material. This study investigates the impact of utilizing over-fired brick fragments on the mechanical characteristics of the concrete structure in various moisture conditions, including both the fresh and cured states. To test the mechanical properties of the overburnt brick bat-based material, coarse aggregate that had been partially by Jhama bricks replaced was used in the concrete.

P066

Graphene-Infused Concrete: Improving Strength and Durability in Construction

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The integration of graphene nanoparticles into concrete holds significant promise for bolstering its mechanical strength and durability. This abstract offers a focused examination of the optimal replacement ratio of 0.6% graphene per weight of cement, highlighting its efficacy in enhancing concrete properties. Among concrete specimens subjected to a battery of durability tests and mechanical strength enhancements—including water absorption, water penetration, initial surface absorption test (ISAT), Rapid Chloride Penetration Test (RCPT), and alkaline resistance—the 0.6% graphene replacement ratio exhibited optimal results compared to other ratios (0.1%, 0.2%, 0.4%, 0.6% and 0.8%) and control samples. This was consistent across different curing durations (3, 7, and 28 days).

Compressive strength tests consistently demonstrate superior performance compared to control samples across all curing periods. Moreover, durability assessments reveal diminished water absorption, heightened resistance to water penetration, and enhanced performance in diverse evaluations. These outcomes underscore the pivotal role of 0.6% graphene replacement in optimizing concrete properties, offering a viable solution for the construction of resilient and sustainable infrastructure.

Concrete producers and construction practitioners stand to gain valuable insights from these findings, enabling them to leverage graphene nanoparticles to enhance concrete performance while advancing environmental sustainability objectives. In essence, the incorporation of 0.6% graphene presents a tangible pathway towards fortifying infrastructure against deterioration while simultaneously reducing ecological footprints.

P067

Designing NiAl layered double hydroxide nanoflakes structure via hydrothermal method for the supercapacitor applications

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To overcome the ongoing global energy crisis, renewable resources are the only hope to secure our future. An integration with the energy storage devices like supercapacitors and batteries is the only alternative solution to achieve a sustainable power bank. Due to limited power delivery and poor retention rate, supercapacitors are more prominent energy storage devices over batteries which also include more characteristics features like very fast storage capability, enhanced cyclic stability, high power density, long lifetime, and fast charging & discharging. Nowadays, layered double hydroxides (LDH) are emerging in the supercapacitor field due to their unique characteristics such as robustness, cost-effectiveness, higher effective surface area, larger pore volume, and efficient ionic diffusion kinetics. Herein, we have designed a NiAl-LDH nanoflake structure via a single-step hydrothermal technique. The phase purity, the bonding environment, and the structural and morphological information of the as-synthesized materials were collected from XRD, FTIR, BET, and SEM techniques. The designed NiAl-LDH electrode delivers a maximum specific capacitance of 142 F g^{-1} at a current density of 1.5 A g^{-1}, an energy density of 3.1 $WhKg^{-1,}$ and a maximum power density of 369.23 Wkg^{-1}, respectively in 1 M KOH solution. Furthermore, as-fabricated material has a retention rate of 92 % over 5,000 cycles with coulombic efficiency of 100 %. It is anticipated that the synthesis of LDH composites with unique structures and morphology will be the future direction for researchers in the field of supercapacitors.

P068

Investigation of Dielectric, Ferroelectric and Piezoelectric properties of Sm & Eu doped $Pb(Mg_{1/3}Nb_{2/3})_{0.71}Ti_{0.29}O_3$ ceramics

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PMN-PT ceramics are renowned for their exceptional electromechanical properties, making them valuable in advanced transducers, actuators, sensors, and energy harvesting devices. Enhancing these properties through rare earth element doping is a key area of research. This study investigates the impact of Samarium (Sm) and Europium (Eu) doping on the dielectric, ferroelectric, and piezoelectric properties of PMN-PT ceramics. $Pb(1-x)(Mg_{1/3}Nb_{2/3})_{0.71}Ti_{0.29}Y_xO_3$ (x = 0 and 0.025, Y = Sm and Eu) ceramics were synthesized via a two-step solid-state reaction method. The as-prepared samples were characterized through X-ray diffraction, temperature-dependent dielectric studies, ferroelectric, and piezoelectric measurements. The results showed that the Sm and Eu were introduced into the lattice of PMN-PT ceramics, all samples had a pure perovskite structure with a little amount of pyrochlore phase. The addition of Sm and Eu significantly increased the dielectric constant and reduced the phase transition temperature. As the frequency increased from 1 kHz to 1 MHz, the dielectric constant peak value of all ceramics was decreased and T_c shifted towards higher temperature, which is the characteristic of the relaxor behavior. Compared to pure ceramic, the value of diffusiveness constant (γ) decreased from 1.95 to 1.83 and 1.85 for Sm and Eu doped PMN-PT ceramics respectively. Ferroelectric studies show the well-saturated loops for all the ceramics, whereas the value of remanent polarization (P_r) and saturation polarization (P_s) decreases due to doping, The slight decrease in P_r suggests that Sm and Eu-doping has a minor disruptive impact on the ferroelectric order of the PMN-PT ceramics. Notably, for Sm and Eu doped samples, a significant increase in piezoelectric coefficient (d_{33}) of 585 and 575 pC/N respectively was observed in comparison to 320 pC/N for undoped ceramic. These findings highlight the beneficial effects of Sm and Eu doping on the electromechanical performance of PMN-PT ceramics.

P069

Fabrication of MIL MOFs for the adsorptive removal of Acid Red 2: performance evaluation under normal to extreme experimental conditions

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The study is focused on the adsorptive behaviour of two distinct metal-organic frameworks (MOFs; MIL-100 and MIL-101) for the removal of Acid Red 2 from aqueous medium. Several experimental variables, such as pH, adsorbate concentration, temperature, adsorbent dose, and contact time has been studied to evaluate the performances of developed MOFs for the removal of Acid Red 2. Both the adsorbents (MOFs) were characterized with diverse techniques including FE-SEM, FTIR, XRD, TGA, BET, and Zeta potential. The developed MOFs displayed best removal efficiency at pH 7 and required 120 min to achieve maximum adsorption capacity. Moreover, the adsorption kinetic parameters were calculated using pseudo-first and -second order models. Whereas, the applicability of the adsorption was determined using the Langmuir, Freundlich, and Temkin isotherms. Overall results demonstrated that MIL-100 performed significantly better at removing acid red 2, when compared to the performance of MIL-101.

P070

Black Cotton Soil Stabilization Using Egg Shell Powder, Marble Dust Powder And Fly Ash

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The advancement of industrialization and infrastructure improvement necessitates constructing structures on soils that meet stringent safety and design criteria. The surge in various types of construction and business activities has led to a significant increase in the waste materials, these waste materials create serious environmental and health challenges. This research paper explores the potential of using by-products of these waste materials such as fly ash, marble dust powder, egg shell powder to stabilize the expansive soils, which are prone to various volume changes due to water content variations at some places. By repurposing these waste materials for soilstabilization, we aim to improve the properties of soil and manage these waste materials effectively. The experimental program of soil stabilization is divided into several phases, starting with the assessment of index properties and moving on to evaluate the compaction characteristics and also conduct the unconfined compressive strength tests. The results show that incorporating these materials significantly enhances the geotechnical properties of black cotton soil. The index property tests demonstrate reductions in the plasticity index and swelling potential, indicating a decrease in the expansive properties of the soil. The compaction characteristics reveal an increased maximum dry density and reduced optimum moisture content with the addition of these stabilizing agents. The California Bearing Ratio (CBR) tests illustrate substantial improvements in the strength and load-bearing capacity of the stabilized soil samples. Evaluation of various studies reveals that incorporating these additives enhances the engineering properties of expansive soils, providing a sustainable and economical solution for construction projects. The stabilization technique includes a comprehensive investigation of the physical and chemical interactions between expansive soils and the added by-products, ensuring superior performance and durability of the treated soil. Both laboratory experiments and field applications have consistently shown significant improvements in key parameters, such as compressive strength, shear strength, and a decrease in the plasticity index. Furthermore, using these industrial by-products not only diverts waste from landfills but also reduces the carbon emissions typically associated with conventional soil stabilization methods. By utilizing these abundant and cost-effective materials, these soil stabilization methods align with the principles of a circular economy and promote resource efficiency. This research paper highlights an innovative approach that enhances infrastructure resilience while advancing environmental sustainability. It explores the dual benefits of mitigating environmental risks and improving soil stability, promoting a more sustainable approach to infrastructure development. Keywords: Expansive soil Stabilization, Fly ash, Marble dust powder, Egg shell powder, MDD (Maximum Dry Density), OMC (Optimum Moisture Content).

P071

Control over morphological features of polypyrrole using differentially functionalized gold nanoparticles via interfacial polymerization: a mechanistic study

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Polypyrrole (PPy) is the most often used π-electron conjugated conductive polymer exhibits several advantageous features such as high electrical conductivity, environmental stability, and enhanced redox properties. In this work, we reported gold nanoparticles (AuNPs) mediated control over the morphological parameters of PPy using interfacial polymerization. We were able to achieve four distinctive morphologies in PPy by making its composites with citrate, ascorbate, glutathione (GSH) and cetyl trimethyl ammonium bromide (CTAB)-functionalized AuNPs. Moreover, significant differences were observed in polymerization pattern between each case. Interestingly, the synthesized PPy/AuNPs composites displayed variable electrical properties. The functionality on the AuNPs were suspected as the main reason for the differences in the morphological and electrical properties of the obtained materials. This study offers a way to control the polymerisation pattern and associated properties in PPy-based materials.

P072

Lycium shawii mediated green synthesis of silver nanoparticles, characterization and assessments of their phytochemical, antioxidant, antimicrobial properties

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The shrub *Lycium shawii*, belonging to the Solanaceae family, has been traditionally used to treat various illnesses. This study focuses on the extraction of phytochemicals from dried leaves of *Lycium shawii* using maceration in distilled water and methanol, and the synthesis of silver nanoparticles (AgNPs) from these extracts. AgNPs characterized using different bio-analytical tools such as dynamic light scattering, UV visible spectroscopy, x-ray diffraction, fourier transform infrared spectroscopy, and field emission scanning electron microscopy. The phytochemical analysis revealed total phenolic content of 11.11 mg Gallic acid/g and total flavonoid content of 7.76 mg Quercetin/g in the methanolic extract. The average sizes of the aqueous and methanolic AgNPs were 64 nm and 79 nm, respectively. Both crude extracts and AgNPs demonstrated significant antimicrobial activity against *Salmonella enterica* and *Rhizopus oryzae*. The methanolic extract and methanolic AgNPs exhibited higher antioxidant potential compared to their aqueous counterparts. Minimum inhibitory concentrations (MIC) ranged from 1 mg/ml to 15 mg/ml, indicating strong antimicrobial efficacy. The findings suggest that *Lycium shawii*-mediated AgNPs could be a promising source for developing new drugs against resistant microbes, marking a novel approach in addressing antibiotic resistance.

Keywords: *Lycium shawii,* phytochemical, silver nanoparticles, antimicrobial, antioxidant

P073

High-Efficiency Self-Powered Photodetectors with SnS2/SnSSe Nanosheet Heterojunctions on GaN

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In recent decades, symmetric 2D transition metal dichalcogenides (TMDCs) have gained significant attention in the scientific community due to their remarkable properties, including a large surface-to-volume ratio, high surface activities, and tunable bandgaps. These features make them essential for next-generation optoelectronic devices. TMDCs, represented by the formula MX_2 (where M is transition metal like Mo, W, Sn, Nb, Zr, and X is chalcogen such as S, Se, Te), can be easily exfoliated into monolayers or few-layers. This exfoliation allows for bandgap tuning, making them suitable for various photosensitive devices. Despite the extensive study and accessibility of MoS_2 and WS_2, their limited abundance and complex synthesis processes escalate costs, impeding their widespread industrial application in optoelectronics. In response to these obstacles, tin dichalcogenide (SnS_2) emerges as a promising alternative due to its abundance, eco-friendliness, superior UV-visible absorption, and rapid electron-hole pair diffusion, presenting significant potential across diverse photosensitive devices. In recent times, $Sn(S_xSe_{1-x})_2$, a two-dimensional ternary semiconductor alloy, has attracted considerable attention because of its ability to tune bandgaps based on composition and its other notable properties. This study pioneers' advancements in optoelectronics by exploring the untapped potential of tin-based transition metal dichalcogenides (TMDCs). Leveraging innovative solvothermal synthesis techniques, highly crystalline SnS_2 and SnSSe alloys with Janus-like structures are synthesized. Integrating these materials into van der Waals heterostructures on a GaN platform introduces novel concepts in device engineering, enhancing light absorption and electron-hole pair separation efficiency. Particularly notable is the introduction of SnSSe-based self-powered photodetection, demonstrating unprecedented performance metrics and unique intensity-dependent behaviors. These breakthroughs pave the way for advanced photodetection devices, marking a significant shift towards bias-free optoelectronics in materials science.

P074

Synthesis and characterization of WO_3@Zeolite composite and its NO_2 gas sensing properties

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The purpose of this work was to enhance the selectivity of tungsten oxide by including zeolite. Extensive research has been conducted on the development of sensitive and selective gas sensors because they are useful for a variety of applications, including indoor air quality assessment and industrial process monitoring and control. Zeolites provide a flexible way to attain selectivity. Because of the molecular sieve properties that are provided by three-dimensional channels and cavities, zeolites are able to selectively catalyse the separation of molecules depending on size and shape. In this study, the WO_3@Zeolite composite was synthesized hydrothermally. The synthesized composite was characterized via various analytical techniques including FTIR, XRD, FESEM and UV-VS spectroscopy. The sensor was then fabricated using a simple drop cast method and analyzed for NO_2 gas sensing measurement. The sensing results showed that the composite showed better sensitivity and selectivity as compared to the WO_3 sensor.

Keywords: Zeolite, Tungsten oxide, Gas sensor, NO_2

P075

Effect of calcination temperature on the magnetic behavior of nanoparticles

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$La_{0.7}Sr_{0.3}MnO_3$ (LSMO) exhibits variety of applications as compared to magnetic metals and ferrites due to its metallicity and ferromagnetic nature at room temperature. The present work focused on the saturation magnetization of LSMO. The nanoparticles of LSMO has been synthesized using sol-gel auto combustion route. The as-synthesized nanoparticles has been calcined at different temperature i.e. 700°C, 800°C, 900°C and 1000°C. The calcination process has been performed under normal atmospheric condition. The variation in calcination temperature found to affect the magnetic properties as well as size of the nanoparticles. X-Ray Diffraction (XRD) analysis confirms the phase formation of LSMO nanoparticle and its crystallite size. Vibrating Sample Magnetometer (VSM) is used for understanding the magnetic behavior of nanoparticles. The nanoparticles calcined at 1000°C found to exhibit the maximum value of crystallite size ~ 68 nm along with saturation magnetization ~ 58 emu/g without much appreciable change in coercive field. Therefore, calcination temperature leads to tunable magnetic properties of LSMO nanoparticle, which is of great importance in magneto electric coupling devices, magnetic sensor and biomedical applications.

P076

Boosting the performance of Zn-ion capacitors using electrochemically engineered NiCo-LDH@Co_3O_4 nanoflakes on nickel foam

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Co_3O_4 material is superior among various metal oxides due to its good conductivity and abundance while layered double hydroxide (LDH) materials has unique structure with a large specific surface area, exceptional anion exchange efficiency, high electrochemical reactivity, as well as excellent stability. Thus, the synergetic effect of Co_3O_4 with NiCo-LDH has been employed in this study to boost the power and energy density of cathode material used in the fabrication of zinc-ion capacitor. The as-synthesised NiCo-LDH@Co_3O_4@NF electrode material design incorporates specific pathways that facilitate swift ion diffusion, allowing for rapid movement of ions within the material. Additionally, the structure supports the quick transportation of electrons, ensuring efficient electron transfer. As a cumulative result of these features, the proposed electrode material exhibits outstanding specific capacitance. The host material (NiCo-LDH@Co_3O_4@NF) was directly deposited on Nickel foam (NF) via single step electrochemical deposition technique. The fabricated NiCo-LDH@Co_3O_4@NF material demonstrates remarkable electrochemical performance, exhibiting pseudocapacitive behaviour in an alkaline solution (1M KOH) and achieving a peak specific capacitance of 1256 $mFcm^{-2}$ having remarkable energy density and power density with excellent retention rate and coulombic efficiency. Thus, this research opens diverse possibilities for the synthesis of transition metal oxide /hydroxides and their composites as an electrode material for highly efficient Zinc-ion capacitor.

P077

Effect of annealing temperature on copper-induced crystallization of amorphous germanium thin films: Structural, optical, morphological, and electrical characteristics.

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The effect of Cu-induced crystallization on amorphous Ge thin films was studied by depositing Ge films on a Cu layer over Si (100) substrate using the RF sputtering technique at room temperature. These films were then subjected to post-annealing at various temperatures of 250, 300, 350, 400, 450, 500, and 550 °C in an argon atmosphere. The structural analysis carried out using XRD shows the unannealed film is amorphous whereas, for films annealed up to 350 °C, the peak corresponding to (220) orientation appears indicating transformation from amorphous to crystalline phase. Moreover, the preferred orientation has been found to shift from (220) to (111) plane above the annealing temperature of 350 °C. The improvement in the crystallinity and hence structure of the films with increasing annealing temperature has also been confirmed by Raman analysis. The surface morphology of the films studied using atomic force microscopy (AFM) shows that films having (220) orientation exhibit globular growth whereas, triangular island growth has been observed in films with (111) preferred orientation. UV-visible spectroscopy indicates a significant increase in band gap values at higher annealing temperatures. Moreover, a significant decrease in electrical resistivity has been observed in films as the preferred orientation changed. The correlation of optical, morphological, and electrical with structural properties has been discussed with annealing temperature.

P078

N_2^+ Implantation Induced Tailoring of Structural, Optical and Electrical Characteristics of Sputtered Molybdenum Thin Films

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This study explores the versatile applications of molybdenum (Mo) thin films in energy storage devices and photovoltaic solar cells, attributed to their remarkable thermal stability, high melting point, and chemical inertness. Mo thin films of various thickness (150, 200, 250, and 300 nm) have been deposited on Si (100) substrates via radio frequency (RF) sputtering in an argon atmosphere at room temperature. Some of these films with different thickness have been implanted with 1×10^{17} N_2^+ cm^{-2} at 30 keV using a current density of 4μA cm^{-2}. The structural, optical and electrical properties of the pre-and post-implanted Mo thin films have been investigated using Grazing Angle X-ray Diffractometer (GXRD), Spectroscopic Ellipsometry (SE), UV-visible spectroscopy and Keithley parametric analyzer.

The structural analysis has revealed that the crystallinity of Mo thin films increases with thickness in as-deposited films. This trend remains the same even after N_2^+ implantation of these films but after implantation crystallinity reduced with respective film thickness. Optical studies using SE reveals a significant increase in absorbance and reflectance in as-deposited and N_2^+ implanted films. Ion implantation has significantly affected the optical constants, including the refractive index and extinction coefficients. A significant increase has been observed in these parameters after implantation as a function of film thickness. UV-visible spectroscopy has confirmed a similar behaviour in reflectance spectra with film thickness and after implantation. Electrical analysis reveals that film thickness and N_2^+ implantation significantly altered the conductivity of the Mo thin films. Specifically, conductivity has increased with film thickness in as-deposited as well as post-implanted films, but has decreased with respective film thickness after implantation. This study has explored the correlations between structural, optical, and electrical parameters as a function of film thickness for as-deposited and N_2^+ implanted Mo films.

P079

Tailoring of Physical Properties of RF Sputtered ZnTe Films: Role of Substrate Temperature

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In this study, Zinc telluride (ZnTe) films were grown on quartz substrate at different substrate temperatures of 300ºC, 400 ºC, 500 ºC, 600 ºC and at room temperature (RT) using RF sputtering technique. The dependence of physical properties on substrate temperature was investigated using various characterization techniques. The thickness of films has been measured using Spectroscopy Ellipsometry (SE) and it come out to be in the range 200 nm – 1000 nm for films deposited at different substrate temperature. The structural investigation using Glancing incidence angle x-ray diffraction (GXRD) reveals that room-temperature deposited films are amorphous and that deposited at different substrate temperatures are polycrystalline with a zinc blend cubic structure having the most preferred orientation along the (111) plane. An increase in the crystallite size (from 14.23±0.2 to 68.88±1.04 nm) is observed with increased substrate temperature. This leads to a reduction in microstrain and dislocation density. The optical studies using UV-Vis-NIR spectroscopy reveal that the transmittance of films increases with substrate temperature. Further, the shift in transmission threshold towards lower wavelength with substrate temperature results in the increase in optical band gap from 1.47± 0.02 to 3.11±0.14 eV. The surface morphology of films studied using atomic force microscopy (AFM) reveals that there is uniform grain growth on the surface The various morphological parameters such as roughness, particle size, particle density, skewness, and kurtosis are determined. From current-voltage characteristics, it is analyzed that conductivity of films increases with substrate temperature The observed variations in structural, optical, and morphological parameters have been discussed and correlated. The existence of a wide band gap (3.11 eV), high crystallinity, high transmittance and high conductivity for the ZnTe films produced at 600ºC make it a suitable candidate for use as a buffer layer in solar cell applications.

P080

Reusable MoS2-Modified Antibacterial Fabrics with Photothermal Disinfection Properties for Repurposing of Personal Protective Masks

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The current pandemic caused by SARS-CoV-2 has seen a widespread use of personal protective equipment, especially face masks. This has created the need to develop better and reusable protective masks with built-in antimicrobial, self-cleaning, and aerosol filtration properties to prevent the transmission of air-borne pathogens such as the coronaviruses. Herein, molybdenum disulfide (MoS2) nanosheets are used to prepare modified polycotton fabrics having excellent antibacterial activity and photothermal properties. Upon sunlight irradiation, the nanosheet-modified fabrics rapidly increased the surface temperature to ~77 °C, making them ideal for sunlight-mediated self-disinfection. Complete self-disinfection of the nanosheet-modified fabric was achieved within 3 min of irradiation, making the fabrics favorably reusable upon self-disinfection. The nanosheet-modified fabrics maintained the antibacterial efficiency even after 60 washing cycles. Furthermore, the particle filtration efficiency of three-layered surgical masks was found to be significantly improved through incorporation of the MoS2-modified fabric as an additional layer of protective clothing, without compromising the breathability of the masks. The repurposed surgical masks could filter out around 97% of 200 nm particles and 96% of 100 nm particles, thus making them potentially useful for preventing the spread of coronaviruses (120 nm) by trapping them along with antibacterial protection against other airborne pathogens.

P081

Physical and Optical Insights of Holmium Doped Borate Glass for Optimization of Efficient Laser System and Luminescent Devices

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Borate glass doped with Holmium (Ho^{3+}) having different concentration were synthesized via melt quenching method. Physical properties including Density (ρ), Molar volume (V_m), Crystalline volume (V_c), Interionic distance (R_i), Field strength (F), Polaron radius (R_p), Oxygen packing density (OPD), Refractive index (n), Molecular electronic polarizability (α_m), Reflection loss (R_L), Transmission coefficient (T), Dielectric constant (ε), Metallization (M), Molar refractivity (R_m), Optical electronegativity (χ_{opt}), and Optical dielectric constant (ε_{opt}) were investigated with the variation of the concentration of Ho^{3+} ions. Absorption spectra was recorded in range of 200nm-1500nm and eight peaks are observed. Using the Davis and Mott relation, both indirect and direct optical band gap (E_g^{opt}) were calculated. Further, the as-prepared glasses possess the electrical characteristics that are explained by the Urbach energy (ΔE) determined from the absorption spectrum. Judd Offelt theory is employed for the evaluation of JO parameter. The known result affirm the glasses potential in green luminescent devices as well as a green component in white LED fabrications.

P082

Hydrothermal synthesis, characterization and gas sensing of In_2O_3: Effect of reaction time

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Nitrogen dioxide is an extremely hazardous and detrimental gas that poses a serious threat to human beings and the environment. So, it is of utmost importance to develop a cost-effective and selective sensor that can efficiently detect the NO_2 gas. In this work, indium oxide was synthesized using a hydrothermal method by optimizing the reaction time at 130 ^{0}C. The synthesized samples were studied by using XRD, FE-SEM, FTIR and UV-Vis. An effective, economical and simple gas sensor was fabricated by drop-casting the synthesized material on a glass substrate. The gas-sensing characteristics of the sensor were studied at different operating temperatures and different concentrations of nitrogen dioxide gas. For the sample with reaction time equal to 16 hours, response equal to 43.75 % was observed for 10 ppm of NO_2 gas at 100 ^{0}C. The response of the sensor was checked for 10-2 ppm of gas. The repeatability of the sensor was checked for three successive cycles of 10 ppm of NO_2 gas. For studying the selectivity, the response of the sensor was tested for H_2S and CO gas also at the optimized temperature and the sensor displayed high selectivity for NO_2 gas. The study concludes that the indium oxide-based sensor with a reaction time of 16 hours can be potentially used for detecting extremely low concentrations of NO_2 gas.

P083

Development, characterization and in-vitro cytocompatibility analysis of dual-crosslinked alginate methacrylate hydrogels

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While cellular culture has been successful in growing and differentiating certain cell types, the same for certain cell types have eluded researchers. As a natural polymer, alginate can be grafted with methacrylate groups to enable its photo-crosslinking property. Combining this with its inherent tendency to ionic-crosslink with divalent ions, one can make a dualcrosslinked alginate gel that shows a viscoelastic nature similar to the extracellular matrix (ECM) of our cells.In this study, methacrylate-modified alginate scaffolds were prepared using photo-crosslinking and dual-crosslinking methods. The two gels were characterized through physical, chemical as well as rheological assessments, and L929 fibroblast cells were grown on these cells to compare their viability and activity in those scaffolds against each other.The results, so far, suggest that these cells grow better in dual-crosslinked gels in comparison to photo-crosslinked gels, as suggested by the increased number of cells in the former, possibly due to the larger linear viscoelastic region in its structure.

P084

Synthesis of Novel Hybrid Magnetic Core-shell MOF for Environmental Application

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Encapsulating an active guest compound into Metal-Organic Frameworks (MOFs) is a promising technique to achieve properties that are absent in the pristine MOFs and guest molecules. Contrary to the conventional guest encapsulation into the MOF cavities, coreshell composites exhibit better performance in terms of pores accessibility ultimately ensuring optimal diffusion while presenting a unique architecture that prevents the agglomeration and the leaching of the active guests and ensures a tight interaction between core and shell, leading to synergistic effects. Recently, many core-shell MOF hybrids have been reported in various fields, wherein MOFs were hybridized with metal oxides to overcome the intrinsic issues of the parent MOFs. Herein, a novel MOF was synthesized and further transformed into a core-shell hybrid via a sequential growth strategy. This work presents a comprehensive understanding of designing a core-shell MOF hybrid with MOF morphology adjustment as a shell on top of a metal oxide core.

P085

Reduction in Electromagnetic Interference Pollution using Activated Charcoal doped Polyaniline Nanocomposites

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Activated charcoal (AC) embedded polyaniline-based nanocomposites were synthesized using the chemical oxidative polymerization synthesis route in their emeraldine salt form. For the growth of nanocomposites, the four concentrations of activated charcoal i.e. 2, 4, 6 and 8 wt.% were added in the polyaniline (PANI) matrix. The growth of desired samples has been confirmed using the X-ray diffraction and Raman spectroscopy. XRD pattern of prepared samples indicates that the prepared samples are crystalline in nature which may be due to use of methylene orange as surfactant. Moreover, Raman spectra of prepared samples contains various required fundamental bands and the intensities of these bands' changes significantly with the introduction of activated charcoal particles in PANI matrix. The increase in the ratio of quinoid to benzenoid rings (from 0.31 to 0.54) reveal the increase in electrical conductivity with increase in loading concentration activated charcoal nanoparticles in PANI. The enhancement in A_Q/A_B ratio suggested to utilization of the nanocomposite samples as shielding materials to reduce the electromagnetic interference pollution in the X-band frequency range (8.1 to 12.4 GHz). Pristine PANI as well as nanocomposite samples contain the excellent values of total shielding effectiveness i.e. pristine PANI exhibits total shielding effectiveness ~36.71 dB whereas 8wt% activated charcoal doped PANI nanocomposite sample exhibit total shielding effectiveness ~48.98 dB. The excellent results for shielding properties make these nanocomposites suitable candidates for industrial application.

P086

Graphene Oxide Fused Hydrogel Membrane for Remediation of Marine Oil Pollution

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Marine pollution due to oil remains a prominent environmental concern, primarily driven by escalating incidents of oil spills, intensive petroleum operations, and discharges from ships. Oily wastewater discharged from ships and seagoing vessels exacerbates the problem, posing a significant threat to coastal soil quality, water bodies, aquatic ecosystems, and human health. This study explores the development and application of graphene oxide (GO) fused hydrogel membrane designed to efficiently remove oily wastewater generated from ships, cargoes and other water vehicles. The hydrogel membrane, synthesized through a facile in-situ polymerization method, incorporates graphene oxide for enhanced mechanical strength, adsorption capacity, and selective permeability. Characterization of the GO-hydrogel composite revealed a highly porous structure with superior hydrophilicity and oleophobicity, facilitating the effective separation of oil from water. Continuous flow experiments demonstrated the membrane's high emulsion separation capacity and reusability over multiple cycles. Furthermore, field-collected marine emulsion samples confirmed the membrane's practical applicability, significantly reducing oil concentration. The results suggest that the GO-fused hydrogel membrane is a promising, sustainable solution for mitigating marine oil pollution, offering advantages in terms of efficiency, environmental compatibility, and operational feasibility. Developed filtration systems present a promising alternative to the currently deployed high-investment and high-maintenance mechanical oil-water separation systems. These advancements offer the potential for more efficient, cost-effective, and environmentally friendly solutions to address the pressing issue of marine oil pollution.

P087

Assessment on Elimination of Acetic Acid Residue from Collagen of *Labeo rohita* scale to enhance its biomaterial applications

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Collagen is the main structural protein of most hard and soft tissues in animals and the human body, which plays an important role in maintaining the biological and structural integrity of the extracellular matrix (ECM) and provides physical support to tissues. Fish collagen is an upcoming biomaterial and is regarded as one of the most beneficial and widely used biomaterials in the field of tissue engineering, cosmetics, and drug delivery. Fish collagen has excellent biocompatibility, biodegradability and weak antigenicity thus, can be explored as a primary resource in medical applications such as collagen shields in ophthalmology, sponges for wounds/burns, and basic matrices for cell culture systems. It is also primarily extracted from freshwater and marine fish skin and scales. In the present study, *Labeo rohita* (Rohu) scales were extracted by pepsin-acetic acid solubilized collagen and dialyzed against distilled water and then freeze-dried using a lyophilizer to explore its properties as bio scaffold. The processed fish scale collagen is characterization with FE-SEM to study its structural morphology, TGA to study its thermodynamic properties, agar well diffusion assay to study its antimicrobial activity. FESEM results of lyophilized pepsin-acetic acid solubilized fish scale collagen showed intermingled collagen fibres, budding collagen fibres forming a loose and highly porous structure. The thermal weight loss behaviour of lyophilized pepsin solubilized collagen was analysed by thermogravimetric analysis (TGA) to know collagen's thermal endurance and degradation. The TGA plot of isolated collagen showed a first weight loss of 17.92% at 240.25ºC. The second weight loss of 55.24% was observed at 404.44ºC. The third or final weight loss of 73.18% was noticed at 789.53ºC. In the present study, collagen did not show any zone of inhibition, which means that it does not show any antimicrobial properties. These results suggest that the elimination of acetic acid residue from isolated collagen from fish scale is recommended to produce effective biocompatible collagen scaffolds that can provide a stable environment for the growth of cells. Thus, these fish scale collagen derived scaffolds could be very effective as biocompatible materials for extracellular matrix regeneration and tissue bioengineering.

P088

Effect of surfactant on morphology and thermoelectric properties of SnTe material

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Tin telluride is an efficient thermoelectric material with FCC crystal structure and two valence band structure. This study utilized a simple solvothermal approach to synthesize tin telluride nanostructures with varying concentrations of surfactant. It was found that the size, shape, and thermoelectric performance of the produced nanostructures are significantly influenced by the concentration of Polyvinylpyrrolidone (PVP) surfactant. XRD, FESEM, EDS, FTIR, and Raman spectroscopy were employed to investigate the crystal structure, morphology, composition, and optical properties of the produced SnTe nanostructures. Thermoelectric properties are measured in the temperature range of 300-400 K. As the concentration of PVP increases, the Seebeck coefficient increases from 25.68 μV/K to 44.65 μV/K at 400 K. A considerable increase in the Seebeck coefficient enhances the power factor as surfactant concentration increases.

P089

Evaluation of thermoelectric properties of porous nanostructures of Bi2 xMgxTe3-ySey materials

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Thermoelectricity is a clean green technology that presents a viable sustainable energy source to address the current energy crisis. Bi2Te3 is a promising metal chalcogenide for waste heat recovery Here, the influence of magnesium and selenium substitution on the thermoelectric properties of Bi2Te3 is examined. The Bi2-xMgxTe3-ySey samples were prepared by the solvothermal method. Structural and morphological properties were analyzed by XRD and FESEM, which confirmed the rhombohedral crystal structure and nanoplate-like morphology. The substitution of magnesium and selenium dopants into the host matrix was established by the difference in crystallite size and strain caused in the lattice. The porous behavior of prepared materials was confirmed by measured densities and FESEM. Vibrational modes present in samples were found by Raman spectroscopy. Hall effect measurement was used to determine carrier mobilities and concentrations. The electrical conductivity is enhanced with doping. The maximum power factor of 8.8 x10-4 Wm-1K-2 with co-doping. The lattice distortion caused by dual substitution provides ultra-low lattice thermal conductivity of ~0.12 Wm-1K-1 due to phonon scattering by strain field effect and mass fluctuations. A maximum zT of ~0.63 was obtained at room temperature for co-doped sample. The thermoelectric figure of merit (zT) increases two-fold as a result of the decrease in thermal conductivity and power factor enhancement.

P090

Advancements in Prosthetic Lower Limb Technologies: A Comprehensive Analysis of Materials, Shapes and Performance Factors

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The manuscript presents a comprehensive analysis of prosthetic lower limbs, with a focus on advancements in materials, shapes and parameters affecting performance to enhance functionality and comfort for amputees. Through an in-depth comparative analysis, the study examines prosthetic lower limbs constructed from various materials, including carbon fiber, epoxy resins, and matrix composites, with carbon fiber and glass fiber emerging as the most commonly utilized materials. Additionally, the manuscript investigates the comparative analysis of prosthetic lower limbs based on different shapes, such as mono limbs, C-shaped blades, and J-shaped blades. Performance analysis covers factors like fit alignment, material properties, component design, and application in activities such as running, walking, and jumping. Maintenance considerations and biomechanical aspects, including gait analysis, range of motion, balance and stability, and energy storage/release, are also discussed. Overall, the manuscript aims to provide insights into optimizing prosthetic limb design and function to enhance user comfort and mobility. It emphasizes the importance of ongoing research and development efforts in advancing prosthetic limb technologies to continually improve the quality of life for amputees.

P091

Utilizing Surgical Gloves in Bitumen Modification: A Sustainable Approach to Medical Waste Management

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Medical waste management presents significant challenges due to its hazardous nature and environmental impact. Traditional disposal methods, such as incineration and landfilling, are resource-intensive and may pose risks to public health and the environment. This paper explores an innovative approach to medical waste management by investigating the feasibility of utilizing surgical gloves in bitumen modification. Bitumen is a binder in flexible pavements. The majority of highways, around 80-90%, are built using flexible pavements. Through a comprehensive literature review, this study identifies gaps in current research regarding incorporating surgical gloves into bitumen matrices. Bitumen modification plays a crucial role in enhancing the performance and durability of asphalt pavements. However, limited research exists on using surgical gloves as a modifier for bitumen. This paper investigates the potential of surgical gloves as a novel modifier by conducting a comparative analysis with traditional rubber modifiers, including natural rubber, natural rubber latex, styrene-butadiene rubber (SBR), and crumb rubber. The study evaluates the physical, rheological, and aging properties of bitumen modified with surgical gloves and traditional rubber modifiers to assess their effectiveness in improving asphalt performance. Key findings indicate that surgical gloves exhibit promising potential as a bitumen modifier, demonstrating comparable or superior performance in specific properties compared to traditional rubber modifiers.

P092

30 keV Ar^+ implantation-induced surface disorder in RF sputtered ZnO films: Structural, morphological, and optical properties

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RF sputtered polycrystalline zinc oxide (ZnO) films are implanted with 30 keV Ar^+ ions at various fluences ranging from $1x10^{15}$ to $2x10^{16}$ ions cm^{-2}. Raman spectra reveal the presence of the E_2 (low), E_2 (high), and A_1 (LO) Raman modes in virgin and implanted ZnO films. A gradual fall and rise in peak intensity of E_2 (high) mode and A_1 (LO) respectively is observed with increases in ion fluence. However, the E_2 (low) Raman mode broadens and merges completely with disorder-induced broadband at higher fluences. Moreover, the deconvolution of the A_1 (LO) Raman peak affirms the presence of defect-related Raman modes in implanted samples. A gradual fall in crystallinity of implanted ZnO films with increasing ion fluence is displayed by the glancing incidence angle X-ray diffraction (GXRD) pattern. Atomic force microscopy (AFM) images show grain size reduction and a fall in the surface roughness value of films after implantation. The implantation-induced structural disorder is further correlated with the variation in diffuse reflectance and optical band gap values. The low reflectance values of implanted films assure their suitability as transparent windows and anti-reflective coating in various optoelectronic devices.

Keywords: Zinc oxide, films, GXRD, AFM

P093

"Uses Of Recycled Aggregate For The Application In Concrete"

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This paper presents a comprehensive review of the utilization of recycled aggregates in concrete, offering an in-depth analysis of their properties, applications, challenges, and future perspectives. In the context of increasing environmental concerns and the depletion of natural aggregate resources, the use of recycled aggregates offers a sustainable alternative, contributing to waste reduction and resource conservation. This review synthesizes current research findings on the physical, chemical, and mechanical properties of recycled aggregate concrete (RAC), comparing them with those of conventional concrete. It also explores the production methodologies, focusing on the recycling processes and quality control measures. The paper further highlights various real-world applications, underlining the performance and sustainability aspects through case studies. Despite the promising potential, the review identifies several challenges and limitations, including technical complexities, economic considerations, and regulatory barriers. The future perspectives of RAC are discussed, emphasizing the need for technological advancements and a more robust regulatory framework to facilitate wider adoption. This review aims to provide a holistic understanding of recycled aggregates in concrete, fostering a more sustainable approach in the construction industry.

P094

Validation Of In Vitro Detection Of Ketamine Hydrochloride And Its Derivative, Norketamine, Through B-Cd@Agnps Using In Silico Methods

In this study, we synthesized and functionalized silver nanoparticles (AgNPs) with betacyclodextrin (β-CD) to investigate their interaction with ketamine, a colorless pharmaceutical compound which is among the most often utilized drugs in sexual assault. The β-CD@AgNPs were thoroughly characterized using UV-vis spectroscopy, Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), transmission electron microscopy (TEM), and dynamic light scattering (DLS). Successful synthesis and functionalization were confirmed by distinctive spectral and morphological signatures. Interaction of the β-CD@AgNPs with ketamine resulted in a visible color change from pale yellow to greyish white and the formation of crystals. UV-Vis spectroscopic analysis indicated the emergence of a new absorption peak, signifying the formation of a novel complex between ketamine and the β-CD@AgNPs and an established limit of detection of 0.003mg/ml. This interaction likely occurs through inclusion complex formation or surface adsorption, demonstrating the nanoparticles' sensitivity and specificity towards ketamine. In silico studies provided a vivid know-how on the pharmacodynamics of ketamine and also revealed the role of β-CD in the detection of ketamine. This sensitive detection technique not only facilitates the identification of ketamine but also holds potential for detecting pharmaceutical waste in water. The observed physicochemical changes and spectral shifts highlight the application of β-CD@AgNPs in environmental monitoring and drug detection, offering a promising approach for addressing contamination by pharmaceutical residues.
KEYWORDS: β-CD@AgNPs, Ketamine, Date rape drugs, molecular docking, Characterization techniques.

P095

In Silico Study of *Curcuma caesia*-Derived Compounds Targeting Key Oncogenic Pathways for Anticancer Therapy

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Cancer being one of the most common malignant diseases develops under the effect of processes like metastasis, invasion, angiogenesis and inflammation. The well -known treatment methods like chemotherapy and radiotherapy are both expensive and come with bunch of side effects. To address these concerns, medicinal plants may be the best option to chemotherapy medications in terms of side effects and cost-effectiveness. One of the traditional herbal plant *Curcuma caesia Roxb*. (Black turmeric), a member of Zingiberaceae family is a perennial herb found throughout north-east, central India, Papi Hills of East Godavari, West Godavari, and Andhra Pradesh. Despite being used as a spice, food preservative and coloring agent *C. caesia* treats diseases like leukoderma, asthma, tumours, piles, bronchitis, bruises and also found to have potential anti- cancer effect. The present study uses in silico approaches such as computer modelling and bioinformatics to unravel the molecular pathways underlying *Curcuma caesia's* anticancer action having a goal to identify and describe the bioactive chemicals, as well as their interactions with important cancer cell signalling pathways. We used molecular docking and virtual screening techniques to predict the binding affinities and contact stability of the derived compounds with important oncogenic proteins such as p53, Bcl-2, and EGFR. Several phytochemicals from *C. caesia* were shown to have excellent binding affinity and specificity to various target proteins in oncogenic pathways, providing mechanistic insight into how these compounds can alter critical proteins implicated in cancer progression. Our *in-silico* findings provide a thorough understanding of the plant's anticancer potential, including its capacity to interact with and inhibit essential proteins involved in cancer cell growth and survival. These findings pave the way for additional experimental validation and the development of new anticancer therapies based on *Curcuma caesia* molecules. This study emphasizes the need of incorporating computational techniques into the drug discovery and development process, especially for natural compounds with complicated bioactivities. Future research will include *in-vitro* and *in-vivo* tests to validate these findings and determine the therapeutic value of *Curcuma caesia*-derived chemicals in cancer treatment.

P096

Bioglasses derived from agro-food waste for bone regeneration applications

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The hybrid resources, including agro-food ashes (rice husk ash and eggshell powder) and conventional chemicals, were used to synthesize the bioglasses by the melt-quench technique. The synthesized glasses were analyzed and tested employing different experimental techniques to assess their suitability as bioactive material. The substitution of MgO for CaO in these glasses alters their structural and physical properties. The glass's bioactivity was assessed through in-vitro testing in the simulated body fluid (SBF). The introduction of MgO gradually decreases the leaching of the ions from the glasses in SBF, resulting in slow dissolution of the glass. The hydroxyapatite layer forms on the glasses during immersion periods of different days. The Ca/P ratio in the hydroxyapatite layer is in the range of 1.6-4.1. The cytotoxicity of the glasses for different dosages and times was also assessed using the MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide) assay test. Human peripheral blood mononuclear cells (PBMC) were used to assess the biocompatibility of the glasses. The cell viability > 80% was achieved in all the samples, indicating the non-toxic effect of the glasses up to a higher sample concentration. The controlled dissolution rates and non-toxic effect make them highly valuable in bone regeneration, grafting, and dental procedures. Utilizing biowastes not only provides waste management-related problems but also could be an alternative, eco-friendly, sustainable source without affecting the bioactivity and biocompatibility of these glasses.

P097

Graphene oxide based nano catalysts for the valorisation of lignocellulosic biomass components: A review

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Graphene oxide (GO) based nano catalysts have gained significant attention in the field of lignocellulosic biomass valorisation due to their exceptional catalytic properties and high surface area. Lignocellulosic biomass, a plentiful and renewable resource, offers immense potential for sustainable production of biofuels, chemicals, and materials. However, its complex and resilient structure presents considerable challenges for efficient conversion. GO, with its abundant functional groups and catalytic versatility, presents a promising solution to these challenges. This review explores recent advancements in the development and application of GO-based nano catalysts for the efficient conversion of lignocellulosic biomass. It highlights the catalytic mechanisms, design optimization, and process efficiency improvements enabled by GO nano catalysts. Key studies demonstrate the effectiveness of GO in facilitating critical reactions such as hydrolysis, oxidation, and reduction necessary for the breakdown of lignin and cellulose into valuable products. Additionally, the integration of GO with metal nanoparticles, enzymes, and other catalytic agents is discussed, revealing synergistic effects that enhance overall catalytic performance. Environmental and economic benefits of using GO-based nano catalysts are also considered, emphasizing their potential in green chemistry and industrial applications. Future research directions focus on improving the scalability, recyclability, and functionalization of GO nano catalysts to further advance their application in biomass conversion processes.

P098

"Strengthening the Survival and Medicinal Potency of *Habenaria intermedia* via Tissue Culture Techniques"

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Angiosperm's life history is defined by the presence and extinction of various species, forming a diverse lineage occupying the varied regions of the Earth. They connect to other flower bearing plants by both morphological and physiological characters via haustoria and evolved solitarily for about 12 times forming 292 genera and 4750 species. Orchidaceae, one of the largest families Angiosperm clade have nearly 35,000 species in more than 850 genera. *Habenaria intermedia*, a species of this family are an important constituent of the Asthavarga formulation with three other species of the family and four more herbal plants. Different extracts of the plant parts and their metabolites have shown various pharmacological activities like diuretic, anti-inflammatory, anti-rheumatic, anti-carcinogenic, hypoglycemic activities, anti-convulsive, anti-microbial, relaxation, neuroprotective and antivirus activities. *H. intermedia* are enriched with phytochemicals such as alkaloids, tannins, amino- acids, flavonoids, proteins, carbohydrates, saponins, gums, phenols, glycosides and resins which play an important role in development of immunity and treating other acute diseases. As *H. intermedia* is an endangered species so is at a verge of extinction due to major shift in climatic conditions and habitat loss due to over- exploitation that's why my studies include plant tissue culture to reduce the pressure on natural population of medicinal orchids using methods like Protocorm- like bodies (PLBs) or direct from explant regeneration to regenerate the natural existing species of *H. intermedia.*

P099

Comparative Study on the Photocatalytic Degradation of a Macrolide Using Metal Oxides

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Recalcitrant pharmaceuticals present in aquatic environments pose significant risks to human health, aquatic life, and overall environmental well-being. Advanced oxidation processes (AOPs) are considered effective owing to the production of highly reactive hydroxyl radicals produced through light irradiation. Metal oxides have been widely explored as photocatalyst to achieve the degradations of noxious pollutants. Band gap engineering by possible modification of materials is one of the exciting research areas. This study compares the degradation kinetics of degradation of a macrolide antibiotics using metal oxide under UV irradiation and solar irradiation. The effect of different factors including the initial pH of the solution, the photocatalyst dosage, amount of hydrogen peroxide, the initial concentration of solution has been investigated. At a photocatalyst (TiO2) dosage of 0.825 g/L, a pH of 6.8, addition of 75µL hydrogen peroxide, a maximum degradation of 89% was observed for 5 ppm spiramycin in 120 min. Modified metal oxide nanoparticles were characterized by UV-Vis DRS, XRD, SEMEDS and were found to exhibit enhanced optical properties and an excellent visible light induced photodegradation response towards the degradation of spiramycin. A study of the degradation kinetics confirms the effectiveness of the Langmuir-Hinshelwood equation in determining the reaction rate constant and degradation rate K= 0.0885 L/mg and Kr = 0.3586 mg/Lmin. The reaction rate constants obtained under UV irradiation and Solar irradiation were compared.

P100

Effect of CuO on sinterability and densification of perovskite structure $LaAlO_3$ Electrolyte

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Most of the ceramic materials exhibit poor sinterability due to the existence of predominantly ionic or covalent bonds in them. In the present study, $LaAlO_3$ is synthesized by solid-state reaction method using single and double-stage heat treatment in air to achieve excellent density which is required for an electrolyte. The double-stage heat treatment at a higher temperature i.e., 1000 °C for 2 hours (h) followed by 1500 °C for 4 h increases the porosity in undoped $LaAlO_3$ instead of density. The optimized heat treatment of $LaAlO_3$ is 1450 °C for 4 h. At this heat treatment, the maximum density is achieved by 80 %. To increase the oxygen vacancies in $LaAlO_3$ with increasing density, the CuO of 2.5 and 10 % is used as an aliovalent dopant and sintering aid. In the case of 2.5 % CuO, the highest relative density (~96 %) along with the single phase is observed at the double-stage heat treatment i.e., 1000 °C for 2 h followed by 1450 °C for 4 h. The X-ray diffraction (XRD) confirmed the single-phase $LaAl_{0.975}Cu_{0.025}O_{3-\delta}$ formation. Further, the dopant concentration increases from 2.5 to 10 % leading to the secondary phase formation with reduced density. The X-ray diffraction and scanning electron microscope (SEM) confirmed the single phase with well-resolved grain in CuO doped (2.5 %) $LaAlO_3$.

P101

DE DESIGN OF FLEXIBLE PAVEMENT RAJORI TOWN

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Pavements are required for the smooth, safe and systematic passage of traffic. Pavements are generally classified as flexible and rigid pavements. Flexible pavements are those which have low flexural strength and are flexible in their structural action under loads. Rigid pavements are those which possess noteworthy flexural strength and flexural rigidity.

The profound development in automobile technology has resulted in heavy moving loads on the existing highways for optimization of the transport cost. The existing roads which are designed based on the thumb rules are not able to cater to the heavy wheel loads resulting in the deterioration of the existing roads.

In the project report, our study area is “Transportation” in which we are designing flexible pavement using the CBR method on BABA GHULAM SHAH BADSHAH UNIVERSITY road which links the university with the main city of Rajouri. The motivation of this study is to facilitate the local people. The road is used by Daily traffic such as college buses, four-wheelers, two-wheelers, village people etc.

P102

Dielectric Material Based Multiple Output Multiple Input (MIMO) Antenna for Microwave Applications

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This study investigates the use of a dielectric material-based antenna with two ports, which is designed utilising multiple-input-multiple-output (MIMO) technology. The antenna configuration consists of two rectangular dielectric resonators placed on the upper edges of a dielectric FR4 substrate. The dielectric resonator antenna (DRA) is stimulated using aperture coupling, where the apertures are connected to microstrip lines. The specific configuration of the feeding systems leads to clear divisions or separations within the dielectric antenna parts. The dielectric antennas are positioned in a manner that ensures the highest level of mutual interaction between them. Nevertheless, the strong mutual coupling between the antennas adversely affects the performance of the antenna. In order to enhance the mutual coupling between the antenna elements, rectangular copper striplines are affixed to one side of the dielectric material walls. This is done in order to direct a fraction of the emitted power towards the copper striplines. Therefore, the size of the striplines are carefully modified to optimise the mutual interaction between the antenna ports. Consequently, an impressive level of isolation exceeding 35 dB is attained between the ports. In addition, the arrangement of the antenna allows for a bandwidth of 4.5%, which spans from 6.5 to 6.8 GHz. The results indicate that this innovative MIMO antenna design has considerable promise for a range of microwave applications. The enhanced mutual coupling and expanded bandwidth of this antenna indicate its potential for efficient utilisation in advanced communication systems, radar technologies, and other applications that demand dependable transmission of high-frequency signals. Keywords: Dielectric Antenna, MIMO, Microwave, Isolation (a) (b) (c) Figure 1: Dielectric Antenna Structure (a) Top View, (b) 3DView, (c) Bottom View.

P103

Sustainable Environmental Application of Labelled Supramolecular Solvents for Amitriptyline Determination

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Pharmaceutical contaminants in water bodies pose a significant environmental concern, impacting aquatic ecosystems and human health. The development of efficient and eco-friendly methods for their determination and removal is crucial. Herein, a supramolecular solvent (SUPRAmolecular Solvent) was developed to detect and remove hard-to-sense amphiphilic drugs like amitriptyline. A pyrene-based amphiphile chemoreceptor was synthesized and characterized using various techniques. Dodecanoic acid (DA) and a pyrene-based receptor were used to generate reverse micelle-based self-aggregates of SUPRAS. The unique properties of the supramolecular solvent and the pyrene-based receptor were combined for enhanced amitriptyline extraction and simultaneous determination from water. Experiments were conducted to evaluate the sensing efficiency of the developed aggregates in real-world scenarios. The results showed that the synergistic nano ensemble demonstrated remarkable sensing ability, outperforming conventional methods for amitriptyline (AMT) drug sensing.

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Unveiling the Catalytic and Antimicrobial Potency of CQD@Pd Nanoparticles: A Comprehensive Experimental and Theoretical Analysis

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A novel single-pot method was developed to synthesize a new heterogeneous nano catalyst composed of carbon quantum dots doped with palladium (CQD@Pd-NPs) nanoparticles. *Aegle marmelos* fruit extract served as the precursor for synthesizing the CQDs. Advanced techniques and theoretical studies confirmed the formation of CQD-NPs and CQD@Pd-NPs. Computational analysis revealed a noticeable reduction in the band gap value upon the introduction of Pd atoms into CQDs, indicating increased stability of the CQD@Pd-NPs through electrostatic interactions. The developed nanocatalyst demonstrated effectiveness in Suzuki-Miyaura and Mizoroki-Heck coupling reactions, with high selectivity for product formation. Its exceptional antibacterial properties against *E. coli* and *S. aureus* were supported by bacterial growth visualization, inhibition zone observation, FESEM results, and molecular docking studies. Additionally, the nano catalyst exhibited easy separation from reaction systems and efficient recyclability with minimal activity loss, suggesting its superiority over existing commercial catalysts and its promising potential in industrial applications. Details of the results of these studies[1] will be presented and discussed.

P105

Facile Fabrication of Palm Trunk–Like ZnO Hierarchical Nanostructure–Based Biosensor for Wide-Range Glucose Detection

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Accurate blood glucose monitoring utilizing nanomaterial-based biosensors has the potential to revolutionize diabetes management. Although offering advantages such as high sensitivity and specificity, nanomaterial-based biosensors also face major issues with stability and reproducibility. Herein, high fabrication reproducibility and sensing performance are demonstrated for a palm trunk–like ZnO hierarchical nanostructure–based glucose biosensor. A hydrothermal synthesis method was successfully utilized to grow palm trunk–like ZnO hierarchical nanostructures on pre-seeded silver (Ag) electrodes, which enabled control of two crucial factors responsible for the excellent sensing performance of the fabricated electrochemical glucose biosensor (i.e., fabrication reproducibility and high enzyme immobilization). The glucose-sensing performance of the developed highly stable and reproducible electrochemical glucose biosensor was demonstrated by its ability to detect glucose concentrations over a wide range (up to 31.6 mM glucose) with high sensitivity (108.15 $\mu A/mM/cm^2$). Furthermore, the fabricated electrochemical glucose biosensor was applied to human serum samples, with encouraging results. The developed sensor fabrication platform demonstrates the potential for further use in designing different sensors, either by nanomaterial modification or through the use of flexible conductive electrodes.

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Immobilization of α-transglucosidase on silica-coated magnetic nanoparticles and its application for production of isomaltooligosaccharide from the potato peel

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In this study, the production of isomaltooligosaccharide from potato peel starch was carried out in three steps: liquefaction, saccharification, and transglucosylation. Further, cloning α-transglucosidase gene from *Aspergillus niger* (GH31 family), transforming into *E. coli* BL21 (DE3), overexpressing and purifying the resulting protein for the production of α-transglucosidase. The generated α-transglucosidase was then bound with magnetic nanoparticles, which improved reusability up to 5 cycles with more than 60% activity. All the modifications were characterized using the following methods: Fourier transform infra-red (FT-IR) analysis, Transmission Electron Microscopy (TEM), Field Emission Scanning Electron Microscopy (FESEM), Energy Dispersive X-ray (EDX) spectroscopy, X-Ray Diffraction Spectroscopy (XRD), Thermogravimetric Analysis (TGA), and Dynamic Light Scattering (DLS) analysis. Further, The optimum conditions for transglucosylation were determined by RSM as follows: enzyme-to-substrate ratio 6.9 $U.g^{-1}$, reaction time 9 h, temperature 45°C, and pH 5.5 with a yield of 70 $g.l^{-1}$ (±2.1). MALDI-TOF-MS analysis showed DP of the IMOs in ranges of 2-10. The detailed structural characterization of isomaltooligosaccharide by GC-MS and NMR suggested the α-(1→4) and α-(1→6)-D-Glcp residues as major constituents along with minor α-(1→2) and α-(1→3) -D-Glcp residues.

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Tribocatalytic dye degradation using $CaTiO_3$

Harvesting the waste energy to clean the water is of immense importance. In tribocatalysis we use waste vibrational energy to degrade water pollutants. The triboelectric effect is widely investigated for nano generation whereas tribocatalysis is a new concept that we use to degrade organic pollutant present in the waste water. The term "triboelectric effect" describes the build-up of charges on a material after it comes into frictional contact with a heterogeneous material.

As of now tribocatalysis has been reported in very few materials and $BaTiO_3$ is one of those. In our current study, we used $CaTiO_3$ first time as a tribo catalytic material to remove dye, a typical contaminant, from the waste water. We prepared the material using solid state reaction method, then using X-ray diffraction we confirmed the single phase of $CaTiO_3$ in the prepared material with no impurities. Further we utilized the Raman spectroscopy technique to validate the phase formation of the prepared material where all bands were corresponding to the $CaTiO_3$ only. Scanning Electron Microscopy showed the random morphology of the material. In our tribocatalysis experiment, we used a glass beaker, magnetic stirring, and a polytetrafluoroethylene (PTFE)/Teflon bead to observe the degradation for Rhodamine B dye, and maximum degradation observed was 71% in12 hours. We also experimented with other rpms and discovered that as we changed them, the degradation also changed. For 12 hours, we ran the experiment at 200 and 400 rpm, and the results showed that the deterioration was 35% and 46%, respectively. The experiment was also performed using different beaker materials such as steel at 600 rpm and the observed degradation is 47%. We also carried out the tribocatalysis experiment by varying the other parameters, such as raising the catalyst dose and bead surface roughness, which both increased degradations. We also changed the surface area and found that when less surface comes in contact with the beaker surface then the triboelectric effect was less and as we increase the surface area of the bead the tribocatalytic effect also increases.

This work not only shows a promising strategy that might be employed in environmental remediation and sustainable energy generation, but it also establishes an environmentally friendly method for the oxidative purification of organic pollutants.

P108

Elevated Dielectric and Ferroelectric Performance with High Energy Density in Temperature-Stable $Na_{0.5}Bi_{0.5}Sr_{0.25}TiO_3$-$Nb_2O_5$ Ceramics

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The demand of environment friendly and non-toxic ceramics for fulfilling the ever rising energy storage requirements is consistently being investigated by the researchers. The industrial applications demand splendid integrated properties. This work includes improved recoverable energy storage density (W_{rec} ~ 510 × 10^{-3}J/cm^3) along with satisfactory efficiency η of 65% for NBST ($Na_{0.5}Bi_{0.5}$)$_{0.75}$ $Sr_{0.25}$ TiO_3 – 0.03Nb_2O_5) ceramic synthesized via conventional solid state reaction method. The room temperature dielectric constant (ϵ_r) of the ceramic was found to be 2610 which reached a maximum of 5130 at Curie temperature (T_c = 254 ºC), maintaining low value of dielectric loss (tanδ= 0.06). Pointed P-E loop maintaining low hysteresis showed impressive thermal stability along with superior ΔP i.e. (P_{max}- P_r), high electric breakdown strength (E_b) ~ 47.77 kV/cm, good maximum polarization (P_{max}) ~ 31.96 μC/cm^2 and low remnant polarization (P_r) ~ 5.15 μC/cm^2. These results indicate that the-($Na_{0.5}Bi_{0.5}$)$_{0.75}$ $Sr_{0.25}$ TiO_3 – xNb_2O_5) ceramic can be considered as a favorable choice for energy storage applications.

P109

Demonstrating The Use Of Non- Biodegradable Material (PLASTIC AND RUBBER) IN Asphalt FLEXIBLE PAVEMENT

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Generation of plastic waste and rubber waste is increasing day by day and the necessity to dispose of this waste in a proper way is arising. Nowadays pavements are subjected to various kinds of loading which affects the pavement performance condition that causes various distresses. Use of plastic and rubber in pavement design as an innovative technology not only strengthened the road construction but also increased the road life. In this paper, different tests were reviewed on aggregates, bitumen, and bituminous mixes. The effect of the addition of waste polyethylene in the form of locally available carry bags had been checked on aggregates as well as on bitumen. This review paper critically examines the utilization of non-biodegradable materials, specifically plastic and rubber, in the construction of asphalt flexible pavements. The increasing environmental concerns associated with plastic and rubber waste have prompted researchers and engineers to explore sustainable solutions, and incorporating these materials into road construction has gained attention. This paper evaluates the impact of using plastic and rubber in asphalt pavements, considering factors such as performance, durability, environmental implications, and economic feasibility.

P110

First principle study of two dimensional materials for thermoelectric applications: A computational Approach

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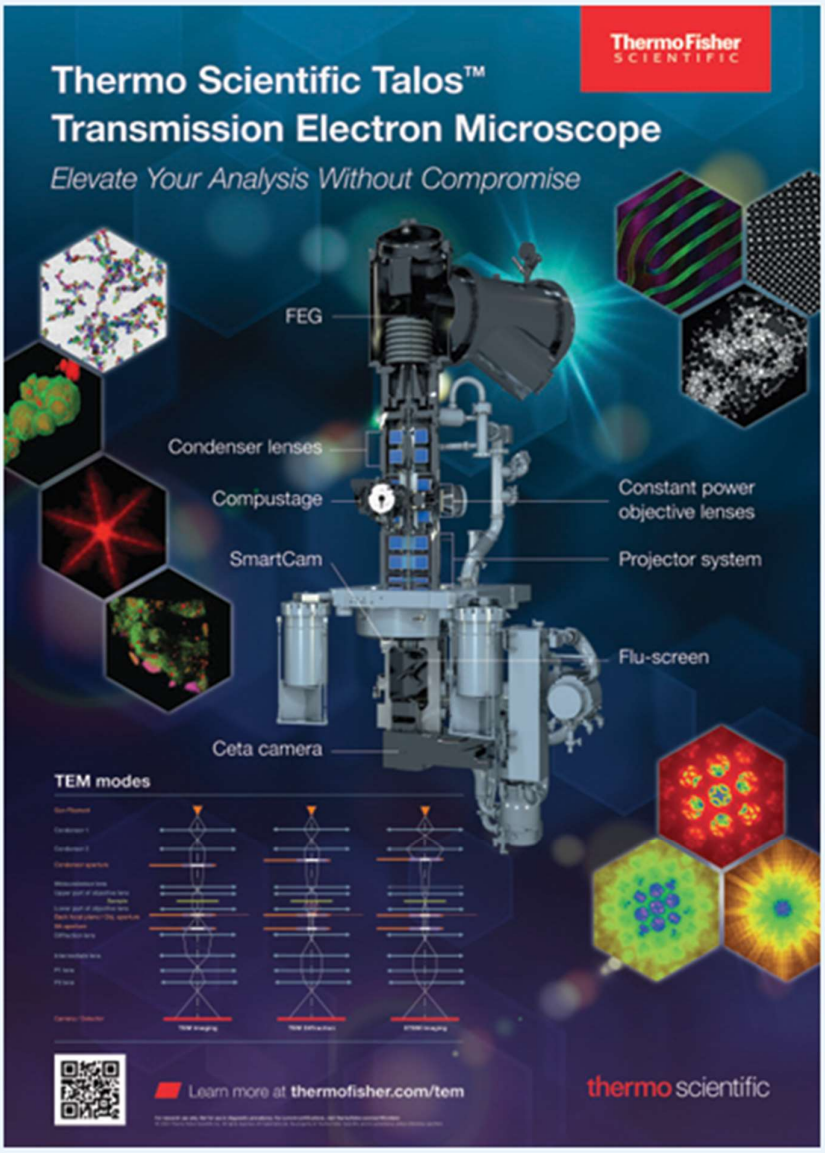
Two-dimensional materials have been the subject of numerous studies since the discovery of graphene. These include optoelectronics, thermoelectricity, photoelectricity, spintronics, superconductivity, sensing technologies, and energy storage systems. This study employs a first-principles approach to scrutinize the dynamic, mechanical, and chemical stability of a novel discovered two dimensional material. Density functional theory is utilised in the electronic structure calculations, which are carried out with Quantum Espresso software. This tool is used in conjunction with Boltztrap to determine transport parameters, which include the Seebeck coefficient, electrical conductivity, and electronic thermal conductivity. This material exhibits semiconductor behaviour with indirect narrow band gap. The Figure of Merit (ZT) is determined by evaluating and integrating transport coefficients and lattice thermal conductivity. It is an essential measure of a material's performance in thermoelectric applications. The obtained results indicate the potential suitability of the investigated material for thermoelectric applications. However, the ZT values can be enhanced and bring thermoelectric technology closer to widespread practical implementation.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