iNEEBA-2025

ANRF Sponsored
Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA 2025)

Jointly Organized by

VINAYAKA MISSION'S KIRUPANANDA VARIYAR ARTS & SCIENCE COLLEGE

VINAYAKA MISSION'S RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)
(Accredited by NAAC with A' Grade & Ranked in NIRF)

VINAYAKA MISSION'S KIRUPANANDA VARIYAR ARTS AND SCIENCE COLLEGE

A Constituent College of Vinayaka Mission's Research Foundation
(Deemed to be University) (Accredited with NAAC 'A' Grade)

CORE-FACILITY CENTER FOR PHOTOCHEMISTRY & NANOMATERIALS, RESEARCH INSTITUTE OF ADVANCED CHEMISTRY (RIAC),

GYEONGSANG NATIONAL UNIVERSITY (GNU), SOUTH KOREA

&

DEPARTMENT OF CHEMICAL ENGINEERING,

CHULALONGKORN UNIVERSITY, THAILAND

iNEEBA 2025 CONFERENCE PROCEEDINGS

13th & 14th October 2025

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VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

With the Blessings of

Dr. A. Shanmugasundaram

Founder Chancellor

Vinayaka Mission's Research Foundation, Salem

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

With the Benevolence of

Mrs. Annapoorani Shanmugasundaram

Trustee, Vinayaka Mission's Research Foundation,
Salem

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Dato' Seri. Dr. S. Sharavanan
President, VMRF

Dear Principal,

I'm happy the Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem, India and the Core-Facility Center for Photochemistry & Nanomaterials, Gyeongsang National University, South Korea and Department of Chemical Engineering, Chulalongkorn University,Thailand is organizing ANRF sponsored "Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (INEEBA 2025) on 13th and 14th, October 2025 in Salem.

Conducting such conferences in collaboration with the other institutions especially in other countries will greatly help the participants to exchange their knowledge and experiences besides updating on the latest developments in the respective technologies.

I'm confident that the participants of this conference will get themselves fully involved in the deliberations and ensure updating their knowledge and expertise.

I wish the conference a great success.

Dato' Seri . Dr. S. Sharavanan

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Hon'ble Dr. A. S. Ganesan
Chancellor
VMRF (DU)

I am pleased to know that Vinayaka Missions Kirupananda Variyar Arts and Science College, Salem is organizing ANRF sponsored INDO-SOUTH KOREA-THAILAND 5th INTERNATIONAL CONFERENCE ON NANOSCIENCE AND NANOTECHNOLOGY FOR ENERGY, ENVIRONMENT AND BIOMEDICAL APPLICATIONS (iNEEBA-2025) along with Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University (GNU), Republic of Korea and Department of Chemical Engineering, Chulalongkorn University (CU), Thailand during October 13-14, 2025.

Over the years, the first four series of iNEEBA have transformed into a distinguished platform of scholarly excellence, encouraging international cooperation and pioneering innovations across multiple disciplines. I am pleased to observe that these collaborative undertakings have produced notable number of jointly authored articles in prestigious journals, enhancing the academic reputation and recognition of all the institutions involved. It is equally noteworthy that outstanding papers presented in the earlier conferences were featured in Applied Biochemistry and Biotechnology, and Journal of Physics (IOP), Applied Physics A (Springer, Impact Factor 2.5). I am also glad that, continuing this tradition of excellence, selected contributions from iNEEBA-2025 will be published in scopus indexed journals under conference series.

My heartfelt appreciation goes to the organizing committee for their dedication, perseverance, and meticulous planning that have made this event a reality. I extend my best wishes for a fruitful and intellectually rewarding experience at iNEEBA-2025.

I wish the conference a great success.

Hon'ble Dr. A. S. Ganesan

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Mr. N.V. Chandrasekar
Vice President
VMRF (DU)

I am happy that Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem has witnessed outstanding success in its four previous series. Now, this ANRF sponsored Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025) is organized by VMKVASC, in collaboration with the Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University, Republic of Korea, and the Department of Chemical Engineering, Chulalongkorn University, Thailand, during October 13-14, 2025. It is inspiring to note that Vinayaka Mission's Kirupananda Variyar Arts and Science College, under VMRF-DU, has built a strong academic and research partnership with GNU, South Korea, and CU, Thailand, through active faculty exchange initiatives and collaborative innovations.

These joint efforts have already resulted in four successful editions of iNEEBA (2021, 2022, 2023 and 2024), with research papers published in reputed journals such as Applied Biochemistry and Biotechnology, Journal of Physics (IOP) and Applied Physics A. I am pleased that the forthcoming iNEEBA-2025 continues this tradition of excellence, with selected papers to be published in scopus indexed conference series in a rigorous peer review process.

The participation of distinguished scholars and researchers from across the globe is a true strength of this event, enriching the discussions with diverse perspectives and expertise. I deeply appreciate the tireless efforts of the organizing committee in curating an intellectually stimulating and impactful program. I also extend my sincere thanks to all the presenters and participants, whose contributions—through oral presentations, posters, and discussions—are the cornerstone of the conference's success.

May this event inspire meaningful interactions, foster new partnerships, and pave the way for future advancements in nanoscience and nanotechnology.

I convey my best wishes for the grand success of iNEEBA-2025.

N.V. Chandrasekar

Mr. N.V. Chandrasekar

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Prof. Dr. P. K. Sudhir
Vice Chancellor
VMRF(DU)

It is with great delight that I extend my warm greetings to all participants of the **ANRF** sponsored **Indo–South Korea–Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025),** organized by Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem, in collaboration with the Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University (Republic of Korea), and the Department of Chemical Engineering, Chulalongkorn University (Thailand), during **October 13 – 14, 2025**.

The consistent collaboration of VMRF-DU with our distinguished partner institutions has resulted in joint research, faculty exchange programmes, and co-authored publications in renowned journals, thereby significantly enhancing the global visibility of our University.

It is commendable that high-quality works from earlier conferences found place in *Applied Biochemistry and Biotechnology*, *Journal of Physics (IOP)*, and *Applied Physics A* (Springer, Impact Factor 2.5). Upholding this legacy of excellence, selected papers from **iNEEBA-2025** will also appear in Scopus-indexed journals under the conference series.

I also take this opportunity to appreciate the efforts of the organizing team, whose dedication and foresight have made this international event a reality. I am confident that **iNEEBA-2025** will encourage participants to exchange transformative ideas, develop lasting collaborations, and contribute meaningfully to the advancement of science and technology.

I extend my best wishes for the grand success of **iNEEBA-2025** and hope that the outcomes of this gathering will have a lasting impact on both the academic community and society.

Prof. Dr. P. K. Sudhir

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Prof. Dr. J. Sabarinathan

Pro - Vice Chancellor

VMRF(DU)

It is an honor for me to share this message for the souvenir of iNEEBA-2025. I am delighted to note that Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem, is organizing the ANRF-sponsored Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025) on October 13-14, 2025 in collaboration with the Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University, Republic of Korea, and the Department of Chemical Engineering, Chulalongkorn University, Thailand. This initiative builds upon the remarkable success of the four preceding conferences of the iNEEBA series. It is commendable that the earlier editions—iNEEBA-2021, iNEEBA-2022, iNEEBA-2023 & iNEEBA - 2024 – attracted wide participation from across the globe and created an impactful academic platform. A notable outcome of these events has been the publication of accepted papers in reputed Scopus-indexed journals such as Applied Biochemistry and Biotechnology, Journal of Physics (IOP) and Applied Physics A. I am pleased to know that the high quality research papers of iNEEBA-2025 will be published in the peer-reviewed journal further strengthening the academic value of this event.

I am confident that the deliberations, exchange of ideas, and research presentations during this conference will stimulate innovative solutions and inspire advancements in the domains of nanoscience and nanotechnology. With distinguished scientists and researchers contributing to the proceedings, I am certain that iNEEBA-2025 will serve as a catalyst for progress, knowledge creation, and academic excellence.

I warmly welcome all participants and wish you an intellectually enriching and rewarding experience. My sincere appreciation goes to the organizing committee, speakers, and attendees for their tireless efforts in making this conference a resounding success.

J. Sabarinathan

Prof. Dr. J. Sabarinathan

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Prof. Dr. A. Nagappan
Registrar
VMRF(DU)

Dear Participants,

It gives me immense pleasure to note that Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem, in association with the Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University, Republic of Korea, and the Department of Chemical Engineering, Chulalongkorn University, Thailand, is hosting the ANRF-sponsored Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025) during October 13–14, 2025.

Building on the remarkable achievements of the earlier editions, this conference continues to serve as a vibrant platform that unites eminent academicians, scientists, and industry professionals worldwide to deliberate on emerging trends and innovations in nanoscience and nanotechnology. The previous four conferences of iNEEBA set high benchmarks with the publication of quality research outcomes in internationally recognized journals, including *Applied Biochemistry and Biotechnology*, *Journal of Physics (IOP), Applied Physics A*. I am delighted to know that the iNEEBA 25 has made arrangements for the publication of selected contributions in Scopus indexed journals, which further enhances the academic significance of this initiative. iNEEBA-2025 is poised to stimulate meaningful discussions, strengthen international collaborations, and inspire groundbreaking discoveries that can contribute to societal progress.

I sincerely appreciate the dedicated efforts of the organizing committee and extend my heartfelt thanks to all keynote speakers, delegates, and participants for enriching this endeavor with their knowledge and commitment. I encourage every participant to actively engage in the sessions, explore new collaborations, and carry forward the spirit of scientific excellence.

Wishing you all an intellectually stimulating and highly rewarding experience at iNEEBA-2025.

Prof. Dr. A. Nagappan

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Dr. K. Manivannan

COE, VMRF(DU)

It gives me immense pleasure to extend my warm greetings to the organizers, participants, and delegates of the *Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA 2025).*

Research and innovation are the cornerstones of academic excellence, and platforms such as iNEEBA provide a unique opportunity for scholars, researchers, and industry experts from across the globe to share knowledge, exchange ideas, and deliberate on emerging trends in the field of nanoscience and nanotechnology. This conference not only fosters academic collaboration but also plays a vital role in shaping solutions to global challenges in energy, environment, and healthcare.

It is noteworthy that *Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem,* is organizing this iNEEBA conference for the fifth time, in collaboration with the *Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University, Republic of Korea,* and the *Department of Chemical Engineering, Chulalongkorn University, Thailand.*

I am confident that the deliberations and outcomes of this conference will inspire new directions in research and contribute significantly to the advancement of science and technology. I sincerely appreciate the efforts of the organizing team for their dedication and commitment in bringing together distinguished academicians and researchers on a common platform.

I wish iNEEBA 2025 grand success and look forward to the valuable contributions it will bring to the academic and scientific community.

K. Manivannan

Dr. K. Manivannan

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Prof. Myong Yong Choi

Director of Core-Facility Center for
Photochemistry and Nanomaterials
Gyeongsang National University
Jinju, South Korea

It is with great pleasure that I extend my warm greetings to all participants of the ANRF-sponsored *Indo–South Korea–Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025)*, jointly organized by Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem, India, Gyeongsang National University, Republic of Korea, and Chulalongkorn University, Thailand.

Over the years, the iNEEBA conference series has become a significant platform for global collaboration, bringing together distinguished scientists, researchers, and professionals to discuss the latest breakthroughs in nanoscience and nanotechnology. These exchanges not only advance scientific knowledge but also build bridges across nations, fostering strong research partnerships and academic networking.

I am pleased to note that the earlier editions of this conference have resulted in impactful contributions to reputed journals, demonstrating the high quality of research presented at iNEEBA. On behalf of Gyeongsang National University, I wish to express my sincere appreciation to the organizing committee for their tireless efforts and vision in making this conference possible. I am confident that iNEEBA-2025 will provide an enriching experience, inspire innovative research, and strengthen the bonds of international collaboration.

I wish the conference great success and extend my best wishes to all participants for a productive and rewarding engagement.

Prof. Myong Yong Choi

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Prof. Soorathep Kheawhom

Department of Chemical Engineering

Faculty of Engineering

Chulalongkorn University, Thailand

I am honored to be associated with the ANRF-sponsored Indo–South Korea–Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025), to be held on 13–14 October 2025 in Salem, India. This event—organized by Vinayaka Mission's Kirupananda Variyar Arts and Science College (VMKVASC), Vinayaka Mission's Research Foundation (Deemed to be University), in collaboration with the Core-Facility Center for Photochemistry & Nanomaterials, Gyeongsang National University (Republic of Korea), and the Department of Chemical Engineering, Chulalongkorn University (Thailand)—embodies the spirit of purposeful international cooperation.

Nanoscience and nanotechnology continue to redefine what is possible across sustainable energy, environmental remediation, and biomedical innovation. iNEEBA-2025 provides a timely platform for researchers and practitioners to exchange robust evidence, compare methodologies, and chart credible pathways from laboratory discovery to impactful, real-world solutions. I am particularly pleased that the meeting encourages interdisciplinary dialogue and early-career participation, both of which are essential for a healthy and forward-looking research ecosystem.

I warmly congratulate the organizers and partners for creating this forum of excellence. I am confident that the discussions, abstracts, and subsequent publications will advance knowledge, inspire collaboration, and accelerate translation of ideas into technologies that benefit communities across India, Korea, Thailand, and beyond.

With best wishes for a productive and successful conference.

Soorathep Kheawhom

Prof. Soorathep Kheawhom

VINAYAKA MISSION'S
RESEARCH FOUNDATION
(Deemed to be University under section 3 of the UGC Act 1956)

Dr. A. Anbuchezian
Principal,
Annapoorna College of Engineering
Salem

It gives me immense pleasure and pride to convey my message to the souvenir of the ANRF sponsored Indo–South Korea–Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025), organized by Vinayaka Mission's Kirupananda Variyar Arts and Science College, Salem, during October 13–14, 2025. The event is being held in collaboration with the Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University, Republic of Korea, and the Department of Chemical Engineering, Chulalongkorn University, Thailand, under the sponsorship of ANRF.

It is indeed commendable that the earlier editions — iNEEBA-2021, iNEEBA-2022, iNEEBA-2023, and iNEEBA-2024 — were organized successfully, attracting participants and researchers from across the globe. The fact that the accepted papers from these conferences were published in reputed Scopus-indexed journals and reflects the academic rigor and research excellence consistently demonstrated by the organizing team.

I firmly believe that iNEEBA-2025 will continue to be a distinguished platform where researchers, academicians, and industry experts converge to exchange insights, disseminate their research outcomes, and promote collaborative innovations in energy, environmental, and biomedical nanotechnology. I extend my heartfelt appreciation to the organizing committee, coordinators, invited speakers, and participants for their dedicated efforts and valuable contributions toward making this international conference a resounding success.

Dr. A. Anbuchezian

Message from the Organizing Committee

With great pride and enthusiasm, we extend a warm welcome to all participants of the ANRF-sponsored Indo–South Korea–Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025), being held on October 13-14, 2025. This prestigious event is jointly organized by Vinayaka Missions Kirupananda Variyar Arts and Science College, Salem, in collaboration with the Core-Facility Centre for Photochemistry & Nanomaterials, Gyeongsang National University, Republic of Korea, and the Department of Chemical Engineering, Chulalongkorn University, Thailand.

The iNEEBA conference series has grown steadily since its inception, and we are delighted to organize this fifth edition following the remarkable success of the previous four. Over the years, iNEEBA has become a forum of global repute, drawing researchers, academicians, and industry experts from across the world. The earlier editions witnessed the publication of quality contributions in renowned Scopus-indexed journals such as *Applied Biochemistry and Biotechnology*, *Journal of Physics: Conference Series (IOP)*, Applied Physics A underscoring the scientific strength of the event. This year, we are pleased to share that more than 200 research papers were submitted, covering diverse and emerging areas of nanoscience and nanotechnology. The program features oral and poster sessions, along with lectures by distinguished speakers from India and abroad. A particular emphasis has been placed on recent advancements in biomaterials, including composites, nanobiomaterials, surface modifications, implant coatings, and smart materials, alongside their wide-ranging biomedical applications. We gratefully acknowledge the invaluable contributions of our invited speakers, participants, sponsors, and the organizing team whose dedication has made this possible. This souvenir stands as a testament to the shared passion, collaborative spirit, and intellectual exchange that define iNEEBA.

We thank you for joining us at iNEEBA-2025 and look forward to insightful discussions, meaningful collaborations, and lasting outcomes that will continue to inspire progress in the years ahead.

Warm regards,

Organizing Committee, iNEEBA-2025

Prof. Dr. V. Anbazhagan
Principal, VMKVASC
Salem

Dr. J. Theerthagiri
Senior Scientist
Brain Pool Fellow
GNU, South Korea

Dr. R. Ganesamoorthy
Assistant Professor
VMKVASC, Salem

Dr. M. Prakash
Professor
VMKVASC,

Dr. E. Shinyjoy
Assistant Professor
VMKVASC, Salem

Dr. N. Senthilkumar
Research Associate
VMKVASC, Salem


VINAYAKA MISSIONS

PROCEEDINGS OF iNEEBA-2025
October 13-14, 2025
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ANRF Sponsored "5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications" (iNEEBA-2025)

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iNEEBA–2025

ANRF *Sponsored*

Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025) 13th & 14th October - 2025

Jointly Organized by

Vinayaka Mission's Kirupananda Variyar Arts and Science College (A Constituent College of Vinayaka Mission's Research Foundation), Salem, Tamil Nadu	**Core-Facility Center for Photochemistry & Nanomaterials, Research Institute of Advanced Chemistry (RIAC) Gyeongsang National University South Korea**	**Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University, Thailand**

Programme Schedule - Technical Session – I **Day 1: 13-10-2025**	
10.00 AM to 11.00 AM	**INAUGURATION** **Venue: Dr. A. Shanmugasundaram Auditorium, Annapoorna Engineering College**
11.00 AM to 11.45 AM	**Keynote Lecture-I** **Prof. Dr. Myong Yong Choi** Director, Core-Facility Center for Photochemistry & Nanomaterials, Research Institute of Advanced Chemistry (RIAC), Gyeongsang National University, Republic of Korea. **Title:** Laser-Based Electrocatalysts for Production of Hydrogen and Value-Added Chemicals **Chairperson: Prof. Dr. Deepti Shastri,** Deputy Dean, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Salem

11.45 AM to 12.00 PM	HIGH TEA	
PARALLEL SESSIONS (Invited Lectures)		
	Parallel Session I **Venue: Dr. A. Shanmugasundaram Auditorium, Annapoorna Engineering College**	**Parallel Session II** **Venue: Seminar Hall, Annapoorna Engineering College**
12.00 PM to 12.30 PM	**Dr. J. Theerthagiri** Senior Scientist – Brain Pool Fellow, Core-Facility Center for Photochemistry & Nanomaterials, Research Institute of Advanced Chemistry (RIAC), Gyeongsang National University, Republic of Korea **Title:** CO_2 Laser-Synthesized Electrocatalysts for Nitrate to Ammonia Conversion **Chair Person: Prof. Dr. N. Thangadurai** Additional Director – Research, VMRFDU, Salem	**Dr. Suttipong Wannapaiboon** Scientist, Synchrotron Light Research Institute, Chulalongkorn University, Thailand **Title:** Synchrotron-based X-ray techniques for in-situ analysis of enhanced performance and stability in advanced energy storage systems **Chair Person: Prof. Dr. M. Sridevi** Professor & Head, Department of Biotechnology, Vinayaka Mission's Kirupananda Variyar Engineering College, Salem
12.30 PM to 1.00 PM	**Dr. M.L. Aruna Kumari** Head, Department of Chemistry The Oxford College of Science, Bangalore, India **Title:** Electrochemical Perspectives of 2D Materials **Chairperson: Prof. Dr. R.S. Shanmugasundaram** Director - Student Welfare, VMRF-DU, Salem	**Dr. Wanwisa Limphirat** Scientist, Synchrotron Light Research Institute, Chulalongkorn University, Thailand. **Title:** Energy storage application and facility at XAS beamline **Chair Person: Prof. Dr. S. Anusuya** Professor & Head, Department of Pharmaceutical Engineering, Vinayaka Mission's Kirupananda Variyar Engineering College, Salem
1.00 PM to 1.45 PM	**LUNCH**	

PARALLEL SESSIONS (Invited Lectures)		
	Parallel Session I **Venue: Dr. A. Shanmugasundaram Auditorium, Annapoorna Engineering College**	**Parallel Session II** **Venue: Seminar Hall, Annapoorna Engineering College**
1.45 PM to 2.15 PM	**Dr. A. Pandikumar** Senior Scientist, CSIR-Central Electrochemical Research Institute, Karaikudi **Title:** Photoelectrochemical Water Splitting: A Journey from Lab Scale to Prototype **Chair Person: Prof. Dr. B. Jaykar** Director-Clinical Trials, VMRF-DU, Salem	**Dr. M. Karunakaran** Associate Professor of Physics, Alagappa Govt. Arts College, Karaikudi Tamil Nadu **Title:** Investigations of rare earth metal doped tin oxide thin films for gas sensor applications **Chairperson: Prof. Dr. R. Indra Gandhi,** Deputy Director-Research, VMRF-DU, Salem
2.15 PM to 2.45 PM	**Dr. D. Kalpana** Senior Scientist, CSIR CECRI Madras Campus, Chennai, Tamil Nadu. **Title:** Nanotechnology for a Sustainable Future: A Multifaceted Pathway Towards Energy, Environment, and Health **Chair Person: Prof. Dr. P. Gnanasekar** Director - IIE, VMRF-DU, Salem	**Dr. RA. Kalaivani** Dean, School of Basic Sciences, Vels Institute of Science, Technology and Advanced Studies Pallavaram Campus, Chennai **Title**: Synthesis of orange peel–derived N and P doped carbon quantum dots/manganese hexacyanoferrate nanocomposite for ultrasensitive detection of sneprin **Chair Person: Dr. L. Akilandeswari,** Associate Professor, Sri Sarada College for Women, Salem
2.45 PM to 3.00 PM	**HIGH TEA**	
TECHNICAL SESSION II – 13.10.2025 **Parallel Sessions**		
3.00 PM to 6.00 PM	**Oral / Poster Presentation**	

iNEEBA–2025

ANRF *Sponsored*

Indo-South Korea-Thailand 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (iNEEBA-2025) 13th & 14th October - 2025

Jointly Organized by

Vinayaka Mission's Kirupananda Variyar Arts and Science College (A Constituent College of Vinayaka Mission's Research Foundation), Salem, Tamil Nadu

Core-Facility Center for Photochemistry & Nanomaterials, Research Institute of Advanced Chemistry (RIAC) Gyeongsang National University South Korea

Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University, Thailand

Technical Session – III Day 2: 14-10-2025	
10.00 AM to 10.45 AM	**Venue: Dr. A. Shanmugasundaram Auditorium, Annapoorna Engineering College** **Keynote Lecture-II** **Prof. Dr. Soorathep Kheawhom** Professor of Chemical Engineering, Faculty of Engineering, Chulalongkorn University, Thailand. **Title:** Rechargeable Zinc–Air Batteries for Grid-Scale Energy Storage: Advances, Persistent Challenges, and Pathways to Practical Deployment **Chairperson: Prof. Dr. A. Rajan Samuel** Director - Academics, VMRF-DU, Salem.
10.45 AM to 11.15 AM	**Dr. S. Anandan** Scientist 'F', International Advanced Research Centre for Powder Metallurgy & New Materials (ARCI), Hyderabad, India **Title**: Innovation in Energy Storage: Development and Demonstration of Indigenous LIB and Supercapacitor Materials **Chair Person: Prof. Dr.Ramesh.K.** Director-Alumni Relations and Placements, VMRF-DU, Salem

11.15 AM to 11.30 AM	**HIGH TEA**	
PARALLEL SESSIONS (Invited Lectures)		
	Parallel Session I **Venue: Dr. A. Shanmugasundaram Auditorium, Annapoorna Engineering College**	**Parallel Session II** **Venue: Seminar Hall, Annapoorna Engineering College**
11.30 AM to 12.00 PM	**Prof. Dr. S. Manivannan** Department of Physics National Institute of Technology, Tiruchirappalli **Title:** Nanocarbon Molecules for New Generation Devices **Chair Person: Prof. Dr. M. Nithya** Vice Principal, Vinayaka Mission's Kirupananda Variyar Engineering College, Salem	**Dr. Chanon Pornrungroj** Department of Chemical Engineering, Chulalongkorn University, Thailand. **Title:** Smart solar utilisation for green fuels synthesis **Chair Person: Dr. Sabitha Gokul Raj** Director- Accreditation & Ranking I/C, VMRF-DU, Salem
12.00 PM to 12.30 PM	**Dr. Shankar Lal Garg,** FRSC, FWRA, Ex Principal, Holkar Science College, Indore and Editor, Research Journal of Biotechnology **Title:** Integrating Ecological Balance and Human Development for the Sustainable Future **Chair Person: Prof. Dr. Renganathan,** UGC-Emeritus Fellow, School of Chemistry, Bharathidasan University, Tiruchirappalli	**Dr. A. Vasanthakumar,** Senior Principal Scientist, Pfizer Healthcare Pvt. Ltd**,** Chennai **Title**: Future of nanoparticles (NPs) as a drug delivery system in the pharmaceutical industry **Chair Person: Dr. S. Chandrasekar** Sri Meenakshi Government College for Women (A), Madurai
12.30 PM to 1.30 PM	**LUNCH**	
TECHNICAL SESSION – IV Parallel Sessions		
1.30 PM to 4.00 PM	**Oral / Poster Presentation**	
4.00 PM to 5.00 PM	**VALEDICTORY FUNCTION Venue: Dr. A. Shanmugasundaram Auditorium, Annapoorna Engineering College**	

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Laser-Based Electrocatalysts for Production of Hydrogen and Value-Added Chemicals

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Abstract

The global energy crisis is driving an increasing demand for innovative materials with high purity and functionality to enable the development of clean energy production and storage solutions. The advancement of novel photo- and electrocatalysts heavily relies on synthetic techniques that support the creation of tailored advanced nanomaterials. The emerging application of pulsed lasers in liquid synthesis has garnered significant attention as an effective synthetic technology, offering numerous advantages over conventional chemical and physical synthesis methods. This study primarily focuses on the advancements in electrocatalytic nanomaterials achieved through pulsed laser-assisted technologies, providing detailed mechanistic insights, structural optimization, and demonstrating their effective catalytic performance in hydrogen fuel production and the generation of value-added chemicals.

Rechargeable Zinc–Air Batteries for Grid-Scale Energy Storage: Advances, Persistent Challenges, and Pathways to Practical Deployment

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Abstract

Rechargeable zinc–air batteries (ZABs) have emerged as strong contenders for grid-scale energy storage owing to their high theoretical energy density (1,086 Wh kg^{-1}), low cost, intrinsic safety, and environmental compatibility. These characteristics make ZABs attractive alternatives to lithium-ion systems for renewable energy integration and long-duration storage. Recent progress in zinc anode design, electrolyte formulation, and bifunctional oxygen electrocatalyst development has led to substantial improvements in cycling stability (>500 cycles) and round-trip efficiency (>65%). Nevertheless, several fundamental and practical barriers—such as dendritic zinc growth, parasitic hydrogen evolution, electrolyte dehydration and carbonation, and sluggish oxygen reduction/evolution kinetics—continue to limit commercialization. This work critically reviews advancements in cell configurations, reaction mechanisms, and materials engineering for anodes, electrolytes, separators, and air electrodes. Particular emphasis is placed on interface engineering strategies, including protective layer formation, zinc alloying, nanostructured catalysts, and functional separators, to enhance durability under practical current densities (5–50 mA cm^{-2}). Future research priorities are outlined, highlighting the need for deeper mechanistic insights into degradation, CO_2-tolerant electrolytes, scalable electrode fabrication, and standardized testing protocols to accelerate the transition of ZABs from laboratory prototypes to industrial-scale deployment.

Keywords: Rechargeable zinc-air batteries; Grid-scale energy storage; Bifunctional oxygen electrocatalysts; Zinc dendrite suppression; Rational interface engineering

CO_2 Laser-Synthesized Electrocatalysts for Nitrate to Ammonia Conversion

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Abstract

Nitrogen pollution stemming from the excessive use of nitrogen fertilizers and industrial emissions has become a serious environmental concern. Various technologies exist for mitigating nitrate contamination, with the electrochemical method standing out due to its high treatment efficiency, relatively low investment cost, and lack of reliance on external chemical modification. Nevertheless, the electrochemical nitrate reduction reaction (NO_3^-RR) is intricate and may yield diverse products. Therefore, efficient and selective removal of nitrate is essential. In this study, hollow particles of CoFePBA were synthesized, maintaining their structure through the use of a CO_2 laser, and subsequently employed in the NO_3^-RR reaction. The synthesized materials underwent comprehensive characterization techniques and the electrocatalytic activity of the synthesized material was assessed by measuring the linear sweep voltammmetry efficiency under alkaline conditions. In the NO_3^-RR, NO_3^- undergoes reduction to form various intermediates. The concentrations of NO_3^-, NH_3, and NO_2^- were measured using UV-Vis spectroscopy to evaluate the performance of NO_3^-RR. In summary, this study aims to evaluate the efficiency of NO_3^-RR and subsequently apply it to an environmentally friendly zinc-nitrate battery system with high energy density. Such a system could serve as a renewable energy storage solution, contributing to the development of eco-friendly processes and enhancing energy production efficiency.

Smart Solar Utilisation for Green Fuels Synthesis

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Abstract

Harnessing sunlight to drive fuel synthesis offers a promising route toward sustainable chemical energy storage, yet its commercial potential remains constrained by the limited use of the full solar spectrum. Current solar fuel systems primarily exploit high-energy ultraviolet photons, leaving much of the visible and infrared light unutilized. This spectral mismatch leads to substantial energy losses, as unabsorbed light is dissipated as heat, lowering overall system efficiency.[1] In this work, we present strategies to improve solar energy capture through advanced thermal management and the integration of complementary and hybrid processes. Thermal management approaches are applied to recover excess heat from unused visible and infrared light and channel it back into the system to enhance performance.[2,3]We also investigate hybrid configurations that combine solar fuel synthesis with water purification via photocatalytic and photothermal methods, enabling wider spectral utilization while co-producing clean water and chemical fuels.[4] By merging thermal control, complementary process integration, and innovations in materials and system design, this study establishes a framework for advancing both the efficiency and practical viability of solar fuel production.

Keywords: solar fuels; photocatalyst; thermoelectric; photoelectrochemical; artificial photosynthesis

Synchrotron-Based X-Ray Techniques for In-Situ Analysis of Enhanced Performance and Stability in Advanced Energy Storage Systems

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Abstract

Achieving long-cycle stability and high capacity is a primary goal for next-generation energy storage systems. Zinc-ion batteries (ZIBs) are a promising low-cost and safe technology, but their practical application is hindered by critical challenges like dendrite growth and parasitic side reactions. In this work, we present the two strategies to overcome these limitations, involving the protection of the zinc anode with a covalent organic framework (COF) as an artificial solid electrolyte interphase (ASEI) and modifying the δ-MnO_2 cathode via ammonium cation pre-intercalation. To probe the operando reaction mechanisms and understand the origins of the enhanced performance, we employed in-situ synchrotron-based X-ray diffraction (XRD) and X-ray absorption spectroscopy (XAS), including surface-sensitive grazing incidence geometries. This strategy yields remarkable results. The data reveal that the COF layer successfully suppresses zinc dendrite growth showing significant improvement of anode stability. Moreover, the modified δ-MnO_2 cathode delivers a high specific capacity of ~247 mAh/g with 85% retention over 500 cycles, indicating that the pre-intercalation stabilizes the cathode structure. Our findings not only offer a viable path toward high-performance ZIBs but also underscore the power of in-situ synchrotron characterization for elucidating complex electrochemical processes, providing a robust analytical framework for the rational design of advanced battery materials.

Energy Storage Application and Facility at XAS Beamline

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Abstract

A Synchrotron Light Research Institute (SLRI, Public Organization) is a national laboratory. It is located at Nakhon Ratchasima, Thailand. SLRI provides synchrotron light for structural analysis, research, and development. Currently, SLRI has 10 beamlines and 12 end stations for scattering, diffraction, spectroscopy, imaging, and microfabrication techniques. The status of XAS beamlines has 5 end-stations (BL1.1W, 2.2, 5.2, 7.2W and 8). Recently, the Operando-XAS is performed using beamline 2.2 (Time-resolved X-ray Absorption Spectroscopy, TRXAS) which the main optical component is an energy-dispersive monochromator (EDM). Using the energy-dispersive scheme with a position-sensitive detector, the beam size at the sample position can be small and have a fast detection speed in the XAS spectrum. In this presentation, we will summarize the developments of the experimental tools to characterize energy storage materials (e.g. Lithium-ion batteries, Zn-ion batteries, and H2-production process) and give examples of the capability of the instruments via studies of materials performed at the XAS beamlines.

Keywords: X-ray absorption, battery, Synchrotron

Nanocarbon Molecules for New Generation Devices

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Abstract

Nanocarbon molecules such as graphene, graphene oxide (GO), reduced graphene oxide (rGO), carbon nanotubes (CNT), carbon dots (CDs), fullerene have been considered as potential candidates in many hard-ware design including gas sensors, bio-sensor, thin film transistors, display devices, field emitters, thin film heaters, transparent conducting films (TCF) as electrodes for solar cells and optoelectronics. Numerous challenges remain unanswered in the synthesize of pure and highly crystalline nanomaterials, methods involved in purification, tuning the properties through functionalization of carbon based nanomaterials. Understanding the physio-chemical processes and characterization in each stages of materials treating and device fabrication is crucial in nanoscience and technology. In the present lecture, nanoscale carbon materials, their bonding/structure and property relationship will be presented. Field emission of multi-walled CNT and fabrication of portable X-ray tubes, TCF from single-walled CNT, transparent thin film heaters, fabrication of flexible and disposable gas sensor on paper will be deliberated in detail. In addition, study on pure and doped CDs for bio-molecule sensing will be offered. Investigation on the microstructure and the dielectric properties of conducting polymer-GO/rGO-PVA composite will be discussed.

Innovation in Energy Storage: Development and Demonstration of Indigenous LIB and Supercapacitor Materials

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Abstract

Lithium-ion batteries (LIBs) are currently the predominant energy storage technology in electric vehicles (EVs), owing to their high energy density, optimal nominal voltage, enhanced thermal stability, low maintenance requirements, eco-friendliness, long cycle life, and low self-discharge. Among the various cathode chemistries, lithium iron phosphate (LFP) stands out for its intrinsic safety, attributed to its strong covalent P–O bonding in the phosphate structure, which prevents self-oxidation and thermal runaway. The first part of the presentation focuses on the development of indigenous electrode material technologies essential for domestic LIB manufacturing. ARCI has developed a novel, cost-effective, high-energy milling process for synthesizing in-situ carbon-modified LFP (C-LFP). In collaboration with the Indian Powder Metallurgy Industry, batch-scale synthesis of 15–20 kg of C-LFP has been successfully demonstrated. Corresponding Indian and international patents have been filed for this innovation. Technology know-how has been transferred to M/s. Allox Minerals (India) and M/s. ALTMIN (Global). A 100 kg/day semi-pilot LFP production plant has been established by M/s. ALTMIN at the ARCI campus. In parallel, ARCI has developed a simple, economical, and energy-efficient process for producing lithium titanate (LTO) anode material with performance comparable to commercial LTO. Patent applications have been filed in India and internationally, and technology transfer is currently underway. The second part of the presentation highlights the development of graphene-like activated porous carbon materials via a low-cost chemical activation route using petroleum coke (petcoke), a carbon-rich by-product of oil refining. While high in carbon content, petcoke contains sulfur impurities that limit its use as industrial fuel due to CO_2 and SO_2 emissions. ARCI's process repurposes petcoke as a valuable precursor for supercapacitor electrodes, addressing environmental concerns and enabling high-performance energy storage solutions. Activated carbon materials with a high surface area of 2394 m^2/g were synthesized and used to fabricate a 1200 F cylindrical supercapacitor (60 mm diameter, 80 mm height). An indigenous supercapacitor with specifications of 1200 F, 2.7 V, 1.22 Wh stored energy, and 5.05 Wh/kg gravimetric energy density was successfully demonstrated. Further, 16 such supercapacitors were connected in series to form a 75 F, 43 V, 19.2 Wh module for an e-bicycle application. The developed supercapacitor-powered e-bike demonstrated a 1 km driving range with a charging time of under 5 minutes. Further details will be presented during the talk.

Integrating Ecological Balance and Human Development for the Sustainable Future

Shakar Lal Garg

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Abstract

Sustainable development is an approach to growth and human development that aims to meet the needs of the future along with meeting the needs of the present. The aim is to have a society where living conditions and resources meet human needs without undermining planetary integrity. Sustainable development aims to balance the needs of the economy, environment and society. There are many sustainable development goals and we can concentrate on any one or all the goals to make the society healthy and happy. One can easily go for climate change and biodiversity loss. Biodiversity is the variety of all life on Earth - animals, plants, fungi and microorganisms like bacteria. Together they provide us with everything necessary for survival including fresh water, clean air, food and medicines. However, humans cannot get these benefits from individual species - a rich variety of living things must work together in tandem. Plants are very important for improving the physical environment: cleaning the air, limiting rising temperatures and providing protection against climate change. The UN's biodiversity body - known as IPBES estimates that at least one million plant and animal species are at risk of extinction - and humanity is largely to blame. Between 2001 and 2021, the world lost 437 million hectares of tree cover - 16% of which was primary forest. The destruction of mature forests, which have taken hundreds - if not thousands - of years to develop, can have a very serious impact on biodiversity. Combined with skyrocketing levels of pollution, the degradation of the natural habitat and biodiversity loss are having serious impacts on communities around the world. As global temperatures rise, once fertile grasslands turn to desert, and in the ocean, there are hundreds of so-called “dead zones”, where scarcely any aquatic life remains. The loss of biodiversity affects the way an ecosystem functions, leading to species being less able to respond to changes in the environment and making them increasingly vulnerable to natural disasters. To save biodiversity, to save the environment and to prevent natural disasters, the only solution is to plant trees and to maintain them

Electrochemical Perspectives of 2D Materials

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Abstract

Two-dimensional (2D) materials have emerged as promising electrocatalysts owing to their large specific surface area, unique electronic structures, and tunable surface chemistry. From graphene and transition metal dichalcogenides (TMDs) to more recent MXenes and single-layer metal–organic frameworks, these materials offer a versatile platform for catalysing key electrochemical reactions such as the hydrogen evolution reaction (HER), oxygen evolution reaction (OER), and carbon dioxide/Nitrite reduction (CO_2RR/NO_2RR). This lecture presents an in-depth overview of the electrocatalytic properties of 2D materials, emphasizing the role of defects, doping, layer thickness, and heterostructures in tuning their catalytic performance. Special focus will be given to structure–property relationships, synthesis strategies, and mechanistic insights obtained from both experimental techniques and theoretical modeling. The challenges of stability, conductivity, and scalability will be discussed, alongside recent breakthroughs that push the limits of activity and selectivity. By bridging materials science, surface chemistry, and electrochemical engineering, this talk aims to provide a comprehensive perspective on how 2D materials can revolutionize the future of clean energy and sustainable chemical production through advanced electrocatalysis.

Synthesis of Orange Peel–Derived N And P Doped Carbon Quantum dots/Manganese Hexacyanoferrate Nanocomposite for Ultrasensitive Detection of Sneprin

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Abstract

The growing environmental and clinical concerns associated with sneprin residues necessitate the development of rapid, cost-effective, and ultrasensitive detection strategies. In this study, in the pursuit of sustainable technological advancements, N, P doped carbon quantum dots (NPCQD) derived from derived from orange peel via a green hydrothermal approach and used to fabricate a composite with manganese hexacyanoferrate (MnHCF). The resulting MnHCF/NPCQD hyrbrid was thoroughly characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy (SEM), High-resolution transmission electron microscopy (HRTEM) with energy-dispersive X-ray spectroscopy (EDS) and X-ray photoelectron spectroscopy (XPS) analysis. XRD confirmed the formation of a crystalline MnHCF phase with an average crystallite size of ~36 nm. TEM and SEM analyses revealed well-dispersed polyhedral particles embedded in a carbon-rich matrix. The electrochemical property of sneprin on as-prepared MnHCF/NPCQD-modified glassy carbon electrode (GCE) were investigated by cyclic voltammetry (CV), differential pulse voltammetry (DPV) and electrochemical impedance spectrum (EIS). CV results confirmed surface-controlled kinetics with a peak sensitivity of 0.00642 mA/µL. EIS analysis demonstrated reduced charge transfer resistance upon sneprin interaction. DPV revealed a linear response range of 10–200 µL, a high sensitivity of 1.37 µA/µL, and a low detection limit of 3.63 µL. The sensor retained 93.8% of its initial response over 30 days, showcasing excellent stability and reproducibility. This synergistic enhancement in electrochemical performance due to the redox-active nature of MnHCF and the high conductivity and surface functionality of NPCQDs. These results highlight the potential of the MnHCF/NPCQD-modified electrode as a sustainable and high-performance platform for real-time sneprin monitoring in pharmaceutical and environmental applications. Key words: Orange peel, NPCQD, MnHCF/NPCQD hybrid electrode, sneprin detection.

Key words: Orange peel, NPCQD, MnHCF/NPCQD hybrid electrode, sneprin detection.

Nanotechnology for a Sustainable Future: A Multifaceted Pathway Towards Energy, Environment, and Health

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Abstract

Nanoscience and nanotechnology provide transformative opportunities across multiple sectors by enabling the rational design of materials at the atomic and molecular scale. Their ability to engineer unique structural, catalytic, and electronic properties has opened new pathways for innovation in energy, environment, and biomedical applications. In the energy domain, nanostructured materials have significantly advanced electrocatalysis, hydrogen storage, and next-generation energy conversion technologies. Environmental applications include nanomaterials for efficient water purification, carbon capture, and sustainable pollution control strategies. In the biomedical field, nanoscale platforms are driving precision diagnostics, targeted therapeutics, and regenerative approaches. This talk will highlight the importance of nanoscale structure–property relationships in tackling global challenges and emphasize how interdisciplinary nanotechnology can create convergent solutions for clean energy, environmental sustainability, and improved healthcare.

Investigations of Rare Earth Metal Doped Tin Oxide Thin Films for Gas Sensor Applications

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Abstract

In recent years, the accelerated development of industrialization and urbanization has placed a significant risk to human survival and development due mainly to severe air pollution due to food technology, chemical engineering, fireworks, medical diagnostics, environmental protection, and industry. Air pollution by NH_3 accounts for between 55% and 56% of world agriculture emissions. Ammonia is a natural gas found all over the atmosphere. Ammonia is one of the most harmful and highly toxic compounds if inhaled above a moderate level. The identification of ammonia at low concentrations and room temperature is also one of the toughest jobs. Gas sensors can reliably and efficiently detect different flammable, explosive, poisonous, and damaging gases. Developing efficient, low cost, highly sensitive, highly selective, and convenient chemical sensors can accurately detect and quantify the presence of toxic gasses, human exposure, and the health and process control of industrial uses, which are becoming a significant end factor for people's well-being and well-being. The most promising semiconductor for detecting toxic and dangerous gasses and has a long life and small size, low power consumption, and easy production. Ammonia exposure triggers chronic lung diseases, irritates, and falls in the respiratory tract, etc. Hence, ammonia gas is important for the monitoring and production of the ammonia gas sensor. Due to their chemical sensitivity to volatile gases, SnO_2-based elements have attracted much attention as a gas sensor. It is chemically stable and doping suitable. Doping is a widely used way of improving optoelectronics, gas sensors, and magnetic features. Based on the objectives, this work aims to provides the cost effective and highly sensitive ammonia sensors by rare earth metal doped SnO2 thin films by SILAR Method.

Photoelectrochemical Water Splitting: A Journey from Lab Scale to Prototype

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Abstract

Photoelectrocatalytic water splitting offers a promising method to harvest the solar energy in to renewable hydrogen energy. First half of this talk will covers the fundamentals involved in the photoelectrocatalytic water splitting, the critical properties of photoelectrocatalytic materials are classified and will discussed according to the associated processes, including light absorption, charge separation, charge transportation, and photoelectrocatalytic reactions. The importance of heterointerfaces in photoelectrodes will be mentioned in conjunction with the illustration of some functional interlayer materials. Also, some strategies involved in material screening and optimization for the construction of highly efficient photoelectrochemical devices for water splitting will be discussed. Further this talk highlights the recent developments in these area with the bismuth vanadate based heterojunction materials for improved photoelectrocatalytic water splitting performance. Finally the prototype device fabrication and its performance evaluation will be discussed in detail

Future of Nanoparticles (Nps) as a Drug Delivery System in the Pharmaceutical Industry

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Abstract

The presentation explores the future of nanoparticles (NPs) as a drug delivery system in the pharmaceutical industry, questioning whether they will be pivotal for ANDA/NDA or remain confined to research, patents, and publications. It aims to provide a brief understanding of the NP drug delivery system and its market landscape, with a specific focus on their application in cancer chemotherapy. The presentation covers the benefits of NP delivery systems, passive targeting, and intracellular trafficking using the pathophysiological uniqueness of tumors. It also compares the role of NPs in the pharmaceutical industry versus their presence in publications and discusses the FDA's stance on NPs. The deck includes case studies of three products and their market landscapes, with a detailed look at Paclitaxel NP formulations, including in-vitro and in-vivo characterization. It also delves into the biological benefits of NPs, their characterization, and the need for alternative formulations for drugs like Taxol. Additionally, the presentation provides extensive data on various NP formulations, including their pharmacokinetic parameters, therapeutic equivalents, and release curves

OP-EN-01

Density Functional Theory Investigation of a Novel 4-Chlorobenzhydrazide-2-Hydroxy-5-Nitro-m-Ansilaldehyde Condensation Product: Thermodynamic, Electronic, and Molecular Electrostatic Potential Analysis

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Abstract

This study presents a detailed theoretical investigation of a novel condensation product synthesized from 4-chlorobenzhydrazide and 2-hydroxy-5-nitro-m-ansilaldehyde, using Density Functional Theory (DFT). The structural, electronic, and thermodynamic properties of the reactants and the product are examined to validate the feasibility of the reaction and the conditions under which it occurs. The structural, electronic, and thermodynamic properties of the reactants and the product are examined. DFT calculations, performed with the B3LYP/6-311G(d,p) basis set, provide insights into the optimized geometries, HOMO-LUMO energy gaps, molecular electrostatic potential (MESP) maps, and thermodynamic parameters (total energy, enthalpy, entropy, and Gibbs free energy). The results reveal the formation of a stable product with distinct electronic properties compared to the reactants, highlighting its potential applications. The MESP analysis elucidates the charge distribution and reactive sites, while the thermodynamic calculations demonstrate the feasibility of the condensation reaction.

Keywords: Density functional theory, HOMO-LUMO, chemical reactivity, MESP map

OP-EN-02

Synergistic Electrochemical Properties of Fe_3O_4/Aluminum/Carbon Nanocomposite for Energy Storage Devices

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Abstract

The present work demonstrates the successful synthesis of magnetite (Fe_3O_4) nanomaterials with single and combined dopants—(F), (FA), (FR), and (FAR)—via a simple co-precipitation method. The samples prepared were characterized by using morphological, optical, FTIR, and structural analyses. XPS confirmed the presence of the expected elements and their oxidation states. BET surface area measurements revealed enhanced porosity for C-doped Fe_3O_4 (FR) and metal-doped carbon-integrated Fe_3O_4 (FAR), attributed to the incorporation of carbonaceous materials. Electrochemical testing showed a high specific capacitance of 699.17 F g^{-1} at 1 A g^{-1} from chronopotentiometry and 410.26 F g^{-1} from CV analysis in a three-electrode configuration with 1 M KOH electrolyte. A symmetric supercapacitor device fabricated using the metal-doped carbon-integrated Fe_3O_4 nanocomposite (FAR) delivered a specific capacitance of 128.16 F g^{-1}, an energy density of 17 W h kg^{-1}, and a power density of 1999 W kg^{-1} at 1 A g^{-1}, along with stable cycling performance, retaining 79.81% capacity and ~80.26% coulombic efficiency after 8000 cycles.

Key words: Symmetric Supercapacitor, rGO, Fe_3O_4, Magnetites, aluminum oxide.

OP-EN-03

Investigation of Magnetic, Dielectric and Thermal Properties of Poly(o-phenylenediamine)/$SrCuFe_2O_4$ Nanocomposites

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Abstract

This study focuses on the synthesis and characterization of $SrCuFe_2O_4$/poly(o-phenylenediamine) ($SrCuFe_2O_4$/PoPD) nanoparticles and nanocomposites, designed to enhance the tremendous applications in various field. By Self–sustained exothermic method $SrCuFe_2O_4$ nanoparticles were prepared and the nanocomposites were prepared by in situ polymerization of o-phenylenediamine in the presence of $CuSrFe_2O_4$ nanoparticles. The structural, morphological and chemical characteristics of the nanocomposites were investigated using techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier-transform infrared (FTIR) spectroscopy confirming the successful incorporation of $SrCuFe_2O_4$ into the polymer matrix. Electrochemical analysis, including cyclic voltammetry (CV) and charge-discharge tests, revealed an improvement in the conductivity, stability and electrochemical performance of the nanocomposites when compared to the individual components. These results demonstrate that the $SrCuFe_2O_4$/PoPD nanocomposites exhibit synergistic effects, where the conductive polymer enhances the charge transport properties and the $SrCuFe_2O_4$ nanoparticles provide magnetic and catalytic benefits. This combination results in a versatile material suitable for a range of applications, including energy storage devices, sensors, and catalytic processes, offering a promising pathway for future material development in advanced technologies.

Keywords: Nanocomposites, PXRD, SEM, TEM, Dielectric constant, Thermal properties

OP-EN-04

Structural and Optical Characteristics of ZnO Doped TiO_2/SnO_2 Mixed Oxide Thin Films for Improved Optoelectronic Applications

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Abstract

$TiO_2/SnO_2/ZnO$ mixed oxide thin films were deposited by electron beam evaporation and annealed at 400–600 °C to optimize structural and optical properties for optoelectronic applications. X-ray diffraction confirmed polycrystalline mixed phases with crystallite size increasing from ~18 to ~32 nm upon annealing. FE-SEM revealed dense morphologies with grain sizes of 20–45 nm. Optical studies showed >80% transmittance in the visible region and bandgap tunability from 3.05–3.28 eV. Photoluminescence spectra indicated strong near-band-edge emission (~385 nm) and suppressed deep-level defects. Electrical resistivity decreased from 4.2×10^{-2} Ω·cm at 400 °C to 8.9×10^{-3} Ω·cm at 600 °C, enhancing carrier transport. The optimized films exhibited a figure of merit (2.8×10^{-3} Ω^{-1}), superior to binary oxides. These findings demonstrate the promise of $TiO_2/SnO_2/ZnO$ mixed oxide thin films as transparent, tunable materials for optoelectronic devices such as photodetectors, solar cells, and transparent conductive coatings.

Keywords: Mixed metal oxide thin films, $TiO_2/SnO_2/ZnO$, Bandgap, FE-SEM, Optoelectronic applications, Transparent conductive coatings.

OP-EN-05

Green Synthesis of Lead Oxide Nanoparticles Using Araucaria Excelsa (Lamb.) Leaf Extract and It's Electrochemical Sensor Applications

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Abstract

The synthesis of PbONPs in the range 20 to 40 nm using Araucaria excelsa leaf extract is presented. UV, EDX, XRD, SEM and BET analyses were performed for the PbONPs to characterize and to find morphological array. Antimicrobial efficiency was evaluated against Salmonella typhi, Staphylococcus aureus, Escherichia coli, Bacillus subtilis, Aspergillus niger and Candida albicans. Purification of dye contaminated water was examined through photodegradation method using PbONPs. An excellent pseudocapacitive behavior, with a specific capacitance of 484.25 F/g at a current density of 0.4 A/g was observed for PbONPs. In addition to this PbONPs also possess effective electrochemical sensing performance for catechol detection, with a low detection limit of 0.33 μM and a linear response range from 0.5 μM to 168 μM. These findings establish PbONPs as promising candidates for diverse electrochemical applications.

Keywords: PbONPs; Antimicrobial activity; Photocatalytic degradation; Pseudocapacitor; Catechol detection

OP-EN-06

Enhanced Electrochemical Performance of MoS2@Hard Carbon Composite Anodes Derived from Biomass for Sodium-ion Batteries: In-Situ Engineered MoS_2@Hard Carbon Interfaces

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Abstract

The development of high-performing MoS_2 anode materials for sodium-ion batteries (SIBs) is hindered by their low conductivity and large volume variation during charge/discharge, which severely limits cycling stability and rate capability. This study aims to design a cost-effective and scalable strategy for improving the electrochemical performance of MoS_2 anodes by integrating them with hard carbon (HC) derived from natural waste. Materials and Methods: MoS_2@HC nanocomposites were synthesized via a simple co-precipitation method. The structural, morphological, and electrochemical properties were systematically investigated to evaluate their suitability as anode materials for SIBs. The MoS_2@HC composites exhibit excellent cycling stability (267 mA h g^{-1} at 2 A g^{-1} after 3000 cycles) and high reversible capacity (597 mA h g^{-1} at 0.5 A g^{-1}). The superior performance is attributed to the unique two-dimensional architecture, which provides a large surface area, short ion diffusion pathways, and improved conductivity through strong interfacial contact between MoS_2 and HC. An in-situ formed C–O–S bond enhances electron transport and preserves structural stability during cycling. Additionally, the HC matrix buffers mechanical strain and maintains electrode integrity under repeated sodiation/desodiation. This work demonstrates a scalable and sustainable route for fabricating MoS_2@HC nanocomposites with outstanding electrochemical performance. The results surpass state-of-the-art MoS_2 anodes, underscoring the strong potential of this composite for practical SIB applications.

Keywords: MoS_2; hard carbon; sodium-ion batteries; nanocomposites; cycling stability; high-rate performance

OP-EN-07

Enhancing the Electrochemical Performance of $NiSrFe_2O_4$/Poly O-phenylenediamine nano Composites for Energy and Environmental Applications

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Abstract

This work investigates the synthesis and properties of $NiSrFe_2O_4$/poly(o-phenylenediamine) ($NiSrFe_2O_4$/PoPD) nanoparticles and nanocomposites, aiming to explore their potential in advanced functional applications. By self- sustained exothermic method $NiSrFe_2O_4$ nanoparticles were prepared and the nanocomposites were synthesized through the in-situ polymerization of o-phenylenediamine in the presence of $NiSrFe_2O_4$ nanoparticles. Characterization techniques such as X-ray diffraction (XRD), scanning electron microscopy (SEM) and Fourier-transform infrared (FTIR) spectroscopy were employed to confirm the successful formation of the nanocomposite structure. The electrochemical performance was assessed via cyclic voltammetry (CV) and charge-discharge tests showing notable improvements in conductivity, stability and charge storage capacity compared to individual $NiSrFe_2O_4$ and poly(o-phenylenediamine). The nanocomposites demonstrated a synergistic effect where the conductive polymer matrix and magnetic nanoparticles enhanced each other's properties making the material promising for applications in energy storage systems, sensors, electrical properties and environmental remediation. These findings suggest that $NiSrFe_2O_4$/PoPD nanocomposites have significant potential in multifunctional material design for next-generation technologies.

Keywords: PoPD.$NiSrFe_2O_4$, PXRD, SEM, TEM, Magnetic studies, Electrical studies

OP-EN-08

To study the Optical Properties of Selenium (Se)- Bismuth (Bi) based Binary Compounds

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Abstract

Chalcogenide-based compounds have attracted growing attention due to their unique optical and electronic characteristics, which make them promising candidates for optoelectronic and energy-related applications. In this study, selenium (Se)–bismuth (Bi) based binary compounds were synthesized using the solvothermal process, which offers controlled growth and enhanced crystallinity. The prepared samples were analysed through structural and optical characterization. Phase composition and crystallite size were determined by X-ray diffraction (XRD), and chemical bonding and functional group interactions were also introspected by Fourier- transform infrared spectroscopy (FTIR). The surface morphology and particle distribution were examined using scanning electron microscopy (SEM). Moreover, the optical properties of the synthesized products were studied with UV-Visible spectroscopy, with a special focus on the characteristics of the absorption and band gap analysis. The outcomes are projected to identify the influence of the Te incorporation to change structural and optical behavior to maximize the aptness of the Se bi based systems to optoelectronic and photocatalytic applications.

Keywords: Selenium–Bismuth (Se–Bi), Se–Te–Bi compounds, solvothermal synthesis, XRD, FTIR, SEM, UV–Vis spectroscopy, optical properties, band gap, chalcogenides

OP-EN-09

Comparative Analysis of Bias Dependent Dielectric Properties of Au/n-Ge Schottky Structures with and without NiPc Interlayer

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Abstract

Bias dependent dielectric properties of Au/n-Ge Schottky Structures were compared with Au/NiPc/n-Ge heterojunction. The studies detailed about variation of dielectric parameters such as capacitance (parallel and series), resistance (parallel and series) and impedance under the influence of frequency ranging from 1Hz to 1MHz. Strong dependence of these dielectric parameters with frequency is observed in Au/n-Ge Schottky Structures with and without NiPc Interlayer. Variation of parallel capacitance (C_p) under different bias voltages (V=0.25 V, 0.5 V, 0.75 V and 1V) shows week dependence at high frequency ranges (>100 kHz) and very strong dispersion at low frequency ranges (<100 kHz) observed in both the Schottky structures. But the series capacitance (C_s) shows no dependence on frequency under different bias voltages. Parallel (R_p) and series Resistance (R_s) of the junctions (both Au/n-Ge structure and Au/NiPc/n-Ge heterojunction) show larger magnitude at low frequencies and decreases gradually with increase of frequency. Under fixed frequency, increase of bias potential decreases the R_p and R_s of the Schottky structures. Further the magnitude of C_p for Au/n-Ge Schottky structure and heterojunction reveals with 1.68 nF and 0.199 nF at 1.27 kHz. Similarly, the magnitude of R_s under 1 V bias potential was found to be varied from 989 Ω (at 1Hz) to 510 Ω (at 1MHz) and 7850 Ω (at 1Hz) to 270 Ω (at 1MHz) for the Au/n-Ge Schottky structure and heterojunction respectively. These observations reveal the presence of interface states at the junction makes hard to follow the AC signal at high frequency which inhibits to trap and emit the charge carriers than low frequency. Large values of capacitance observed at low frequencies than compared to high frequencies might be associated with the excess capacitance resulted from interface state densities. This clearly evidence that the passivation of interface states at the n-Ge interface by NiPc layer influence the dielectric parameters.

Keywords: C-V-f studies, Au/n-Ge Schottky, NiPc interlayer, Bias dependent, Interface states.

OP-EN-10

Influence of pH and Ni Incorporation on the Structural and Optoelectronic Properties of PbSe Nanoparticles

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Abstract

Nickel-doped lead selenide ($Pb_{1-x}Ni_xSe$) nanoparticles were synthesized through a simple wet chemical precipitation route under varying pH conditions (8.0, 9.0, and 10.0) to tailor their structural, optical, and electrical properties. X-ray diffraction confirmed the formation of a single-phase cubic PbSe lattice with systematic peak shifts, attributable to the substitution of Pb^{2+} (1.19 Å) by the smaller Ni^{2+} ions (0.69 Å). The crystallite size was found to increase with both Ni content and pH, while the lattice parameter decreased, in line with Vegard's law. SEM and TEM analyses revealed the transformation of amorphous clusters into well-defined cubic morphologies, with reduced agglomeration at pH 9.0. The optical absorption spectra displayed pronounced excitonic features near 600 nm, with the band gap tunable in the range of 1.6–1.9 eV. This band gap narrowing is attributed to size effects, enhanced crystallinity, and localized defect states introduced by Ni doping. Dielectric investigations demonstrated frequency-dependent behavior consistent with the Maxwell–Wagner model, showing enhanced dielectric constant and reduced loss at higher Ni content. Electrical conductivity studies confirmed polaronic hopping as the dominant conduction mechanism, with conductivity improving marginally with doping concentration. These results highlight that pH optimization (particularly pH 9.0) and controlled Ni incorporation provide a viable pathway for tuning PbSe nanostructures for optoelectronic and energy-related applications. The findings reinforce the potential of non-toxic, solution-based synthesis as a scalable approach for functional lead chalcogenide nanomaterials.

Keywords: Ni doped PbSe, Chalcogenide, Electrical conductivity, optoelectronics.

OP-EN-11

Preparation And Characterization of Transparent Mixed Metal Oxide Doped Polymer Composites and Effect on Their Optical Properties

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Abstract

In this article, transparent polymer composites with mixed metal oxides were prepared using solution casting method and their optical properties described in this work. Measurement of transparency, refractive index, and the impact of metal oxide doping using structural and optical characterization. The results showed that with the addition of the mixed metal oxides, the optical properties of polymer composites were significantly enhanced, which increased the transparency and adjustable refractive indices. Furthermore, the concentration of metal oxide dopants also had an effect on the composites' optical band gap and light absorption capability. This research shows how this doped polymer composites can be used in smart coatings, advanced optical materials, and photovoltaics where better optical clarity and tunability are very important. This research work shows the preparation of TiO_2-doped PMMA polymer composite film and ZnO-doped PMMA polymer composite film with a pre-selected amount of doping material. After that we take mixed oxides of both (TiO_2 and ZnO) and then doped into the PMMA polymer matrix with different kind of weight percentage and study of their comparative tuneable behaviour of structural and optical properties.

Key words: Transparent mixed metal oxide, Optical Properties, Polymer composites, smart coatings.

OP-EN-12

Comprehending Electrochemical Performance of $LiFePO_4$ & $NaFePO_4$ Cathodes

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Abstract

$LiFePO_4$ (LFP) and $NaFePO_4$ (NFP) are promising polyanionic phosphate cathodes for rechargeable batteries due to their safety, stability, and low cost. In this work, their electrochemical behavior was investigated using thermal and cyclic voltammetry (CV) analysis. TGA–DTA confirmed excellent thermal stability of NFP up to ~900 °C, ensuring safe operation. CV results showed LFP with sharp redox peaks and narrow peak separation ($\Delta Ep \approx 0.244$ V), indicating quasi-reversible Li^+ insertion/extraction and fast kinetics. NFP exhibited broader peaks, suggesting slower kinetics but retaining active Fe^{2+}/Fe^{3+} redox behavior. These findings establish LFP's superior reversibility while positioning NFP as a stable, cost-effective candidate for sodium-ion batteries, with future work aimed at conductivity enhancement.

Keywords: Energy storage,Li-ion batteries,Structural and characterization of Li-ion batteries and Na-ion batteries

OP-EN-13

Organic Linker-Dependent Modulation of Zinc Metal-Organic Frameworks

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Abstract

MOFs are crystalline porous molecular complexes obtained by stitching together organic and inorganic units that provide additional space within which molecules can further be transformed and their chemistry be controlled. Their fascinating and diverse structural topologies, permanent porosity and wide range of potential applications for photochemistry, storage, catalysis and sensing have recently created a tremendous interest for this functional material. In this work a simple, green, and versatile route for the synthesis of two hierarchically porous MOFs (Zn-BTC MOF and Zn-BTC-Adipic Acid MOF) were developed using the cooperative template strategy by the simultaneous introduction of ZnO as accelerator and dodecyl amine (DDA) as surfactant. Sharp and distinct peaks are found in the XRD of both MOFs which confirm good crystallinity. The SEM images of MOFs shows rod shaped crystals. The EDAX of MOFs revealed that the sample composed of C, O, and Zn. The TEM images clearly show that the synthesized materials are highly porous. The large surface area and high porosity of the MOFs were confirmed using BET analyzer. In summary, the present work demonstrates an ultrafast method for the synthesis of two hierarchically porous MOFs (Zn-BTC MOF and Zn-BTC-Adipic acid MOF). The advantage of this method is that the products were found to be highly porous with micro- and mesopores which enable these structures ideal candidates for trapping guest molecules.

OP-EN-14

Numerical Modeling and Optimization of Contact Resistance in Organic Field-Effect Transistors Using TCAD Tools

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Abstract

Organic field-effect transistors (OFETs) have emerged as attractive candidates for next-generation flexible, lightweight, and low-cost electronic devices. Despite significant progress in material design and fabrication, a major challenge that persists is the high contact resistance (Rc) at the metal–semiconductor interface. This resistance not only reduces charge injection efficiency but also masks the intrinsic channel mobility, thereby degrading device performance. To address this issue, Technology Computer-Aided Design (TCAD) tools are increasingly employed as powerful platforms for numerical modeling and optimization. TCAD enables the incorporation of realistic models, including carrier transport through Gaussian density of states, trap distributions, and field-dependent mobility, while also allowing accurate boundary condition settings for charge injection. This study focuses on the numerical modeling and optimization of Rc in OFETs, highlighting strategies such as metal work-function engineering, interfacial layer modification, and localized doping near the source/drain contacts. Through transfer-length method (TLM) extraction and current–voltage (I–V) simulations, TCAD helps in quantifying the contribution of contact resistance and provides insights into the effectiveness of various engineering approaches. Such simulation-based optimization not only reduces the experimental trial-and-error effort but also accelerates the design of high-performance OFETs for applications in flexible displays, sensors, and organic integrated circuits.

Keywords: Organic Field-Effect Transistors (OFETs); Contact Resistance; TCAD Simulation; Charge, Injection; Device Optimization

OP-EN-15

Laser-Synthesized High-Entropy Sulfide (HES) Integrated PEDOT:PSS composites for High-Performance Flexible Electrochemical Energy Storage systems

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Abstract

The transition to sustainable energy systems requires advanced storage techniques, advancing entropy-engineered chalcogenides toward flexible and wearable energy storage. Conventional metal sulfides often suffer from phase segregation, sluggish ion transport, and limited cycling stability, restricting their practical deployment. Herein, we report the synthesis of a one-step pulsed laser irradiation in liquid (PLIL) strategy for synthesizing high-entropy sulfides (HES), a quinary (PbNiCoCuZn)S system, overcoming conventional challenges of phase segregation, complex precursors, and hazardous reaction conditions. The ultrafast, non-equilibrium laser process uniquely stabilizes a single-phase entropy-driven sulfide with homogeneous elemental distribution, and electronic charge redistribution features rarely achievable by thermal routes. Beyond structural control, this approach directly produces nanoparticle suspensions, enabling the formulation of HES/PEDOT:PSS hybrid inks. The resulting composite electrode combines multielement redox processes with polymer-facilitated electronic delocalization and ionic transport, achieving an elevated specific capacitance of 273 F g^{-1} and an areal capacitance of 728 mF cm^{-2}. An asymmetric device fabricated with HES/PEDOT:PSS as positrode and activated carbon negatrode achieves a wide voltage window of 1.7 V and superior stability over 12,000 cycles. This study validates PLIL as a universal, sustainable, and efficient synthetic approach for entropy-stabilized multimetallic sulfides while introducing laser-engineered HES/polymer hybrids as an innovative framework for scalable and ink-processable energy storage technologies.

OP-EN-16

Pulsed Laser–Driven Defect Engineering of Ir-decorated MoC@N-Doped Carbon toward High-Performance Hydrogen Production

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Abstract

Hydrazine-assisted hydrogen production offers a highly energy-efficient alternative to conventional water electrolysis by bypassing the sluggish oxygen evolution reaction (OER). However, the realization of robust bifunctional electrocatalysts capable of sustaining industrially relevant current densities remains a critical challenge. Here, we present the rational design of iridium nanocluster–decorated molybdenum carbide embedded in nitrogen-doped carbon (Ir_{NC}/MoC@NC), synthesized through self-polymerization followed by pulsed laser–assisted defect engineering. The resulting catalyst exhibits outstanding bifunctional activity toward both the hydrogen evolution reaction (HER) and hydrazine oxidation reaction (HzOR) in alkaline media. For HER, Ir_{NC}/MoC@NC achieves overpotentials as low as 25 and 123 mV at current densities of 10 and 50 mA cm^{-2}, respectively surpassing state-of-the-art Pt/C benchmarks. In HzOR, it delivers an ultralow working potential of 8 mV with a remarkable mass activity of 133.6 A g^{-1}, ranking among the most active catalysts reported to date. When integrated into a symmetric Ir_{NC}/MoC@NC||Ir_{NC}/MoC@NC electrolyzer, overall hydrazine splitting (OHzS) is realized at record-low cell voltages of 0.077 and 0.307 V at 10 and 50 mA cm^{-2}, accompanied by 94% hydrazine degradation and excellent durability over 100 h of continuous operation. This study establishes Ir_{NC}/MoC@NC as a highly efficient, low-voltage platform for hydrazine-assisted hydrogen production, advancing scalable and sustainable electrochemical energy conversion.

OP-EN-17

Facile Synthesis of High-Entropy Oxide Layer directly on Ni Foam for Glucose Oxidation and Oxygen Evolution Reactions

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Abstract

We present a rapid CO_2 laser-assisted strategy to synthesize a binder-free thin layer of high-entropy oxide material on a nickel foam (HEO@NF), which enables low-voltage glucose oxidation coupled with water electrolysis. As-synthesized material exhibits a low overpotential of 300 mV for oxygen evolution reaction (OER) and a low oxidation potential of 1.22 V for glucose oxidation reaction (GOR) at 10 mA cm^{-2}. Moreover, HEO@NF shows excellent stability for both OER and GOR for 100 h at 50 mA cm^{-2}. ^{1}H NMR analysis reveals formic acid as the main product of glucose oxidation. In overall glucose oxidation coupled electrolysis, the HEO@NF||Pt/C pair requires just 1.37 V and 1.67 V to deliver 10 and 50 mA cm^{-2}, respectively. In situ Raman spectroscopy identifies M-OOH intermediate during OER, elucidating the reaction pathway. Overall, CO_2 laser-assisted synthesis of HEO@NF highlights its potential for practical, low-energy hydrogen generation, alongside the glucose oxidation to produce value-added formic acid.

Keywords: CO_2 laser-assisted synthesis, High-entropy oxide, In situ Raman, Glucose oxidation reaction, Oxygen evolution reaction.

OP-EN-18

Pulsed Laser-Structured Pd/Cu for Efficient Nitrate-to-Ammonia Conversion and Sustainable Zinc–Nitrate Energy Storage

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Abstract

The electrocatalytic nitrate reduction reaction (NO_3RR) offers a sustainable pathway to address pressing environmental and energy challenges by coupling nitrate remediation with the production of value-added ammonia. In support of the United Nations Sustainable Development Goals (SDG 6: Clean Water and Sanitation; SDG 7: Affordable and Clean Energy), we report a pulsed laser irradiation in liquid (PLIL) approach for the fabrication of palladium nanoparticle–decorated copper microspheres (Pd/Cu). The resulting catalyst exhibits exceptional activity and selectivity, achieving a Faradaic efficiency of 93% at –0.5 V vs. RHE, with nearly exclusive formation of ammonia as the reduction product. Beyond wastewater treatment, the Pd/Cu catalyst was integrated into a zinc–nitrate battery, where it functioned as the cathode against a zinc anode separated by a Nafion membrane. The device delivered an open-circuit voltage of 1.33 V and a peak power density of 4.2 mW cm^{-2}, demonstrating efficient direct energy recovery from nitrate reduction. This work establishes a laser-fabricated Pd/Cu electrocatalyst as a multifunctional platform, simultaneously enabling nitrate removal, sustainable ammonia synthesis, and renewable energy generation through nitrate-based electrochemical devices.

OP-EN-19

CO_2 Laser–Engineered 2D Ru/RuO_2 Nanosheets as Highly Efficient Bifunctional Catalyst for Hydrazine-Assisted Hydrogen Production

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Abstract

We present a rapid CO_2 laser assisted strategy to construct two-dimensional (2D) Ru/RuO_2 nanosheets that enable ultralow-voltage hydrazine-assisted water electrolysis. Leveraging the overlapping potential ranges of the hydrogen evolution reaction (HER) and hydrazine oxidation reaction (HzOR), the optimized Ru/RuO_2-1 catalyst exhibits a layered architecture with strong H_2O adsorption capability, achieving low overpotential of only 34 mV for HER and ultra-low oxidation potential of −56 mV for HzOR at 10 mA cm^{-2}, together with >100 h durability. In overall hydrazine splitting, the Ru/RuO_2-1||Ru/RuO_2-1 pair requires just 0.069 V and 0.760 V to deliver 10 and 100 mA cm^{-2}, respectively. In situ Raman spectroscopy identifies Ru–H intermediate during HER and Ru–ON intermediate during HzOR, elucidating the reaction pathway. Integration of Ru/RuO_2-1 as the cathode into a Zn-hydrazine battery further enables efficient, self-powered hydrogen generation, highlighting its potential for practical, low-energy hydrogen production systems.

Keywords: CO_2 laser-assisted synthesis, Ru/RuO_2 electrocatalyst, Hydrogen evolution reaction, Hydrazine oxidation reaction, Zn-hydrazine battery

OP-EN-20

Cobalt-Modified Ru/RuPx Electrocatalysts for Efficient Hydrazine-Assisted Water Splitting via Laser-Microwave Processing

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Abstract

Advancing green hydrogen production requires improving the anodic half-reaction through precise catalyst engineering. Herein, we report a cobalt-modified Ru/RuP_x electrocatalyst synthesized through a sequential process combining pulsed laser irradiation in liquid (PLIL) with microwave treatment. This strategy effectively suppresses Ru leaching under oxidative conditions, delivering exceptional catalytic activity for both the oxygen evolution reaction (OER) and the hydrazine oxidation reaction (HzOR). The optimized Co–Ru/RuP_x catalyst achieves an ultralow potential of 49 mV at 10 mA cm^{-2} for HzOR, outperforming commercial IrO_2 catalyst. The overall hydrazine splitting (OHzS) electrolyzer, constructed with Pt/C(−)||Co–Ru/RuP_x(+), operates at a minimal cell voltage of only 0.15 V at 10 mA cm^{-2} with excellent long-term stability. The remarkable efficiency and durability are attributed to the synergistic interactions at the Co–Ru/RuP_x interface, which accelerate reaction kinetics and enhance structural stability. These findings position Co–Ru/RuP_x as a robust, cost-effective, and high-performance electrocatalyst for sustainable hydrogen energy technologies,

Keywords: Pulsed-laser technology; Microwave treatment; Co–Ru/RuP_x catalyst; Hydrazine oxidation reaction; Efficient hydrogen production

OP-EN-21

Urea-Assisted Water Electrolysis Using CO_2 Laser-Produced RuO_2/NiO Composite Electrocatalyst for Efficient Hydrogen Production

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Abstract

Electrocatalytic urea-assisted water splitting has attracted growing attention as an energy-saving strategy for hydrogen (H_2) production while simultaneously removing urea from wastewater. Developing a low-cost, highly efficient bifunctional electrocatalyst for both the hydrogen evolution reaction (HER) and urea oxidation reaction (UOR) is therefore crucial. Herein, we report a RuO_2/NiO composite synthesized via a rapid thermal-shock process driven by continuous-wave CO_2 laser irradiation. The RuO_2/NiO composite demonstrates outstanding bifunctional activity, delivering low overpotentials for both HER and UOR in alkaline media. The synergistic interaction between NiO and RuO_2 enhances urea adsorption and accelerates oxidation kinetics, while provides excellent proton reduction capability, promotes rapid charge transfer and optimizes intermediate binding. When applied in a UOR-driven electrolyzer, the RuO_2/NiO catalyst achieves energy-efficient hydrogen generation, requiring significantly lower energy input compared to conventional water electrolysis. This work highlights a scalable and effective approach for engineering interface-driven bifunctional catalysts for integrated energy production and environmental remediation.

Keywords: CO_2 laser-induced thermal shock; RuO_2/NiO composite; Bifunctional electrocatalyst; Hydrogen evolution reaction; Urea oxidation reaction

OP-EN-22

Biosynthesis, Characterization and Evaluation of Silver Nanoparticles Using *Ficus Carica* (Fig) Fruit Extract

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Abstract

The present study aimed to formulate silver nanoparticles (AgNPs) using Ficus carica fruit extract and evaluate their antidiabetic and antioxidant potential. The fruit extract is rich in bioactive compounds, including flavonoids, phenolics, anthocyanins, organic acids, and amino acids, which can act as reducing and stabilizing agents in nanoparticle synthesis. Green synthesis of silver nanoparticles was carried out using the aqueous fruit extract, ensuring an eco-friendly and cost-effective approach. The synthesized nanoparticles were characterized by UV-Visible spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and zeta potential analysis, which confirmed uniform size distribution, spherical morphology, and optimum stability of the AgNPs. The biological evaluation demonstrated significant antidiabetic activity, as evidenced by inhibition of key carbohydrate-hydrolyzing enzymes, and strong antioxidant activity, suggesting efficient free radical scavenging. These findings highlight the potential of Ficus carica-mediated silver nanoparticles as a promising herbal nanomedicine for managing oxidative stress and hyperglycemia.

Keywords: *Ficus carica*, silver nanoparticles, green synthesis, antidiabetic activity, antioxidant activity, herbal nanomedicine

OP-EN-23

Advancing Cathode Materials For Sodium-Ion Batteries In Ev Applications

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Abstract

The global shift toward electric mobility has intensified the need for sustainable, safe, and economically viable energy storage technologies. While lithium-ion batteries currently dominate the EV market, limitations such as high cost, uneven resource distribution, and safety concerns have prompted exploration of sodium-ion batteries (SIBs) as a promising alternative. Sodium is earth-abundant, low-cost, and evenly distributed, making it ideal for large-scale production. Although sodium possesses a larger ionic radius and lower standard potential (−2.71 V vs SHE) than lithium (−3.04 V vs SHE), it exhibits similar electrochemical behaviour, enabling the design of competitive rechargeable systems. SIBs typically operate with a cell voltage of 2.3–3.3 V and demonstrate a theoretical energy density of 100–160 Wh kg^{-1}, with achievable power densities of 200–400 W kg^{-1}—sufficient for short- to mid-range electric vehicle applications. This study emphasizes advancements in cathode materials, which critically influence the overall energy performance. Polyanionic compounds such as $Na_3V_2(PO_4)_3$ and $NaFePO_4$ offer high structural stability, safety, and long cycle life, whereas layered oxides (Na_xMeO_2; Me = Fe, Mn, Ni, Co) provide higher operating voltages and energy outputs. Recent strategies involving nano structuring, elemental doping, and surface modification enhance sodium-ion mobility and suppress capacity degradation. Through innovative cathode engineering and electrolyte optimization, sodium-ion batteries demonstrate the potential to achieve reliable, safe, and cost-effective performance. These advancements position SIBs as a viable, sustainable alternative to lithium-ion systems for future electric vehicle applications.

Keywords: Sodium-ion battery, cathode materials, polyanionic compounds, layered oxides, electric vehicles, energy density, sustainability.

OP-EN-24

3D Printing

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Abstract

3D printing, also known as additive manufacturing, is an advanced technology that Enables the creation of three-dimensional objects directly from digital models. Unlike Traditional subtractive methods, 3D printing builds objects layer by layer, allowing for Greater design flexibility, reduced material waste, and cost-effective prototyping. This Technology has revolutionized various fields such as engineering, medicine, architecture, and manufacturing by enabling rapid prototyping, customization, and the production of Complex geometries that are difficult to achieve through conventional processes. With Applications ranging from medical implants and aerospace components to consumer Products and education, 3D printing continues to expand its impact on industries Worldwide. Ongoing research focuses on improving printing speed, material diversity, and Large-scale production capabilities, making 3D printing a transformative tool in the era of Digital manufacturing.

OP-EN-25

Development of Cost-Effective PVA-Based Anion Exchange Membranes for Fuel Cell Applications

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Abstract

The global shift towards clean and sustainable energy has intensified interest in hydrogen-fuelled technologies, particularly fuel cells. Among these, Proton Exchange Membrane Fuel Cells (PEMFCs) dominate the market due to their compact design and high power density. However, PEMFCs operate under acidic conditions, requiring expensive noble metal catalysts like platinum, and depend on costly perfluorinated membranes for ionic conduction. These factors significantly increase the overall system cost, limiting their scalability for widespread adoption. In this context, Anion Exchange Membrane Fuel Cells (AEMFCs) have emerged as a promising alternative, offering several advantages. Operating in alkaline conditions, AEMFCs enable the use of non-precious metal catalysts, drastically reducing material costs while maintaining competitive performance. However, challenges such as membrane stability, ionic conductivity, and mechanical integrity must be overcome to position AEM technology as a viable competitor to PEMFCs. This study focuses on the development of a polyvinyl alcohol (PVA)-based Anion Exchange Membrane (AEM) tailored for fuel cell applications. PVA was selected due to its excellent film-forming ability, chemical stability, and affordability. The membrane was synthesized by chemically modifying PVA with quaternary ammonium groups, enhancing its anion conductivity and alkaline stability. Comprehensive characterization studies were carried out to assess the membrane's suitability for AEMFCs. Ion exchange capacity (IEC) measurements revealed a high concentration of functional groups, ensuring superior anion conductivity. Water uptake and swelling behavior were optimized to maintain membrane integrity under hydrated operating conditions. Thermal and mechanical analyses confirmed the material's robustness, while chemical stability tests demonstrated excellent resistance to degradation in alkaline environments.

Key Words: Polyvinyl alcohol, Fuel cell, Anionic Exchange Membrane, Conductivity

OP-EN-26

Influence of Post-Annealing Treatment on the Structural, Optical, and Electrical Characteristics of NiO/Mg/Zn Thin Films

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Abstract

NiO/Mg/Zn thin films were synthesized using the e-beam deposition technique, and the effects of annealing temperature on their structural, optical, and electrical properties were investigated. The deposited films were annealed in vacuum at 300 °C and 400 °C to analyze the influence of thermal treatment on phase stability and electronic transitions. X-ray diffraction revealed the formation of nanocrystalline cubic NiO, with Mg and Zn incorporation slightly shifting peak positions due to ionic substitution within the NiO lattice. The annealing process promoted grain coalescence, reduced dislocation density, and improved oxygen stoichiometry. UV–Vis spectroscopy demonstrated high optical transparency (>80%) in the visible region, with the optical band gap ranging from 3.6 eV to 3.9 eV, consistent with literature reports for Mg- and Zn-modified NiO systems. A minor red shift in the band edge at higher annealing temperature was attributed to defect passivation and improved crystallinity. AFM and FE-SEM analyses confirmed uniform surface morphology with reduced roughness and enhanced particle connectivity. EDX verified homogeneous elemental distribution of Ni, Mg, Zn, and O, indicating successful alloying. Hall measurements suggested p-type conductivity with increased carrier concentration and mobility after annealing. The optimized NiO/Mg/Zn thin films exhibit promising potential for use in transparent electronics, optoelectronic sensors, and photocatalytic devices.

OP-EN-27

Synthesis of 1T-MoS_2/Fe_3O_4 on Carbon Cloth as Electrocatalyst for Improved Hydrogen Evolution Performance

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Abstract

The increasing demand for energy and the resulting environmental consequences have prompted significant efforts to develop sustainable and clean energy technologies for future generations. Transition metal dichalcogenides (TMDs) have emerged as promising materials for electrocatalytic water splitting due to their unique electronic properties, layered structure, and abundance. However, low intrinsic conductivity and a scarcity of active sites often limit their practical application. Recent advancements focus on engineering strategies to overcome these limitations, including the formation of heterostructures, doping, defect engineering, and nanoscale fabrication. These modifications increase the active site and intermediate adsorption during the hydrogen evolution reaction (HER). Among TMDs, MoS_2 has been extensively investigated as an electrocatalyst for HER. The design of 1T-MoS_2/Fe_3O_4 on carbon cloth (CC) heterostructured catalysts involves active components, functional support, and enhanced electrocatalytic properties and stability. This is primarily due to the synergistic effect between the different components and heterogeneous interfaces, where charge distribution occurs and active sites are formed, thereby improving electrocatalytic performance. This study reports a facile hydrothermal synthesis for developing 1T-MoS_2/Fe_3O_4/CC on heterostructured material as an electrocatalyst for HER. 1T-MoS_2/Fe_3O_4/CC heterostructured material demonstrated improved electrocatalytic performance for the HER, with a small Tafel slope and a low overpotential when compared to 1T-MoS_2 and Fe_3O_4. This work provides a novel and simple method for designing 1T-MoS_2/Fe_3O_4/CC heterostructures for hydrogen production.

OP-EN-28

Synthesis, Growth, and Characterization of 2-Aminopyridinium Hexafluorosilicate Single Crystals for NLO Applications

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Abstract

The growth of a 2-aminopyridinium hexafluorosilicate (2APHFS) single crystal was grown using the slow evaporation method, utilizing methanol as the solvent. The crystal was determined to be monoclinic, belonging to the C2/c space group. The identification of the functional groups and their vibrational modes was accomplished using FTIR spectroscopy. The optical band gap was calculated to be 3.35 eV from the absorption edge at 340 nm, identified through UV-Visible-NIR spectroscopy. The mechanical properties were evaluated using Vickers microhardness measurements, while thermal stability was evaluated by thermogravimetric and differential thermal (TG–DTA) analysis. The confirmation of the molecular structure was obtained through ^{1}H and ^{13}C nuclear magnetic resonance (NMR) spectroscopy. Third-order nonlinear susceptibility was confirmed by Z-scan measurements performed with a 632.8 nm He-Ne laser. Additionally, molecular geometry optimization, HOMO–LUMO analysis, natural bond orbital studies, and molecular potential evaluations were carried out using Gaussian 09W software.

Keywords: Nonlinear optics; Singe crystal; X-ray diffraction; NMR; Zscan

OP-EN-29

Combustion-derived $Cu_xCo_{(1-x)}Fe_2O_4$Nanospinels: Structural, Optical, and Surface insights

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Abstract

$Cu_xCo_{(1-x)}Fe_2O_4$ (x = 0, 0.1, 0.3, 0.5, 0.7, 0.9, 1) spinel ferrites were successfully synthesized via the combustion method employing DL-tartaric acid as a fuel. The as-prepared powders were subsequently calcined at 500 °C for 5 hours, yielding phase-pure nanocrystalline ferrites. X-ray diffraction confirmed the formation of cubic spinel structures with crystallite sizes in the nanometer regime and revealed systematic lattice parameter variations with Cu content. FTIR spectra exhibited the characteristic metal–oxygen stretching vibrations of tetrahedral and octahedral sites, validating spinel formation. FESEM imaging revealed nearly spherical particles with homogeneous morphology, while EDX analysis confirmed the stoichiometric elemental composition. X-ray photoelectron spectroscopy provided detailed insights into the oxidation states of Fe, Co, and Cu ions. The tunable structural and electronic properties achieved through controlled Cu substitution and calcination underscore the potential of these ferrites for applications in catalysis, magnetic devices, and electrochemical energy systems.

Keywords: Cu–Co ferrite, combustion synthesis, spinel oxide, nanocrystalline ferrite

OP-EN-30

Synthesis and Electrochemical Performance of Algae-Derived Activated Carbon for Supercapacitor Applications

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Abstract

In the present investigation, functional carbon was synthesized from biomass derived from *Cyanobacteria* (commonly known as blue-green algae) using a direct pyrolysis method followed by a carbonization process, without the need for any external activation. The prepared carbon material was applied as an electrode in energy storage systems for supercapacitors. This technique is simple, cost-effective, and applicable to most dried forms of biomass. The synthesized functional carbon was characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and field emission scanning electron microscopy (FE-SEM). The electrochemical performance of the synthesized functional carbon electrode materials was evaluated by cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) in an aqueous 1 M H_2SO_4 electrolyte. The results confirm the potential of algae-derived materials as sustainable raw precursors for supercapacitor applications.

Keywords: Functional carbon, supercapacitor, XRD, FTIR, SEM

OP-EN-31

Green-Synthesised CQD–Cu-MOF Composite Electrode for Electrocatalytic Oxidation of Glimepiride

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Abstract:

For the electrocatalytic oxidation of glimepiride, a frequently prescribed sulfonylurea-class antidiabetic medication, a novel composite electrode based on copper metal-organic framework (Cu-MOF) Integrated with carbon quantum dots (CQDs) derived from tapioca peel[1] has been synthesised by the hydrothermal method. While the green-synthesised tapioca CQDs contain 43.63% cellulose, 10.38% hemicellulose, and 7.65% lignin, the CuMOF[2] offers a large number of active sites and structural porosity. This work demonstrates how MOFs and biomass-derived CQDs work together to create effective and long-lasting drug detection electrocatalysts. Copper nitrate trihydrate, 1,3,5-benzenetricarboxylic acid (BTC), tapioca peel biomass, and Electrode substrate: Glassy carbon electrode (GCE). Tapioca peels were washed, dried, and carbonised via hydrothermal treatment at 200 °C for 6 h. The resulting CQDs were purified by dialysis and characterised using UV–Vis, FTIR, and TEM. Cu-MOF was synthesised via solvothermal reaction. TEM and SEM revealed uniform CQD distribution over Cu-MOF surfaces, forming a porous, conductive.CV showed a distinct anodic peak for glimepiride oxidation at ~0.65 V, with enhanced current response for the composite electrode. A green-synthesised CQD–Cu-MOF composite electrode was successfully developed using tapioca biomass and copper-based MOFs. The hybrid material exhibited superior electrocatalytic activity toward glimepiride oxidation, attributed to the synergistic interaction between conductive CQDs and redox-active Cu-MOF.

Keywords: Cu-MOF, Carbon quantum dots, tapioca peel, glimepiride

OP-EN-32

Trash to Charge: Biogenic CQD–MnO_2 for Next-Gen Supercapacitors

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Abstract

The pursuit of sustainable energy storage has driven interest in green nanomaterials derived from biowaste. This study presents a novel composite of Carbon Quantum Dots (CQDs) synthesized from biomass and manganese dioxide (MnO_2) prepared via eco-friendly routes, tailored for high-performance supercapacitor electrodes. CQDs enhance conductivity and surface area, while MnO_2 contributes pseudocapacitance. Experimental results show improved electrochemical performance, including high specific capacitance and cycling stability, validating the potential of biogenic CQD–MnO_2 composites for next-generation energy devices. Bananna bract waste processed via hydrothermal treatment at 180 °C for 6 h. Potassium permanganate reduced using green reducing agents under mild conditions. CQDs mixed with MnO_2 in aqueous medium, followed by ultrasonication and drying. TEM, XRD, FTIR, and Raman spectroscopy confirmed morphology and bonding. TEM revealed uniform CQD dispersion on MnO_2 nanostructures, enhancing surface area. CV curves showed quasi-rectangular profiles, indicating ideal capacitive behavior.Specific capacitance reached 312 F/g at 1 A/g, outperforming pristine MnO_2. GCD cycles demonstrated excellent reversibility and >90% retention after 3000 cycles. EIS confirmed reduced charge transfer resistance due to CQD incorporation. The composite exhibited stable performance under ambient conditions, validating its practical viability.

Keywords: Carbon Quantum Dots, Manganese Dioxide, Supercapacitor.

PP-EN-01

Electronic and Structural Properties of Graphitic Carbon Nitride Derivatives – A DFT Approach

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Abstract

A molecular level insight in understanding the redox property plays a major role in designing effective HER electrocatalyst. In this study we report on the electrochemical properties of Graphitic carbon nitride g-C_3N_4 and Antimony doped Graphitic carbon nitride Sb-g-C_3N_4 using density functional approach. The structural and electronic properties, and the reduction potentials metalated were explored. Optimized geometries of the chosen g-C_3N_4 and metalated g-C_3N_4 systems were obtained at B3LYP/6-31+G(d, p) level of theory. The effects solvation on the electrochemical properties of g-C_3N_4 and Sb-g-C_3N_4 systems were considered in the presence of solvent acetonitrile using conductor-like polarisable continuum model (CPCM) at the same level of theory. Upon reduction process, the charge distribution around the metal centers Sb, C, and N atoms that lie in the coordination sphere is found to change considerably.

OP-ESC-01

Citrus sinensis Peel-Mediated Synthesis of Ce doped CuO Nanocomposites: A Green Nanotechnology Approach

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Abstract

Green synthesis has emerged as a reliable, sustainable and ecofriendly protocol for synthesizing a wide range of nanomaterials and hybrid materials. Doping with rare earth elements such as cerium enhances their optical, electronic and catalytic behaviour by introducing defects and reducing band gap energy. In this work, Citrus sinensis peel extract, rich in phytochemicals was employed as a natural reducing and stabilizing agent for the synthesis of Ce doped CuO nanocomposites. This study focuses on green synthesis of Ce doped CuO nanocomposites using Citrus sinensis peel extract. This study focused on structural, optical characterization, evaluation of antibacterial activity against bacterial strains. and assessment of photocatalytic efficiency in degrading methyl red dye, highlighting environmental remediation. Ce doped CuO nanocomposites were synthesized via a green sol–gel approach. The obtained nanocomposites were characterized to determine their optical properties, phase structure and crystallite size, while surface morphology and particle distribution were examined using scanning electron microscopy operated at 5–30 kV. Antibacterial activity and photocatalytic performance of the synthesized nanocomposites was assessed against bacterial strains and monitoring the degradation of methyl red. The UV-Vis spectra confirmed the formation of nanocomposites exhibiting a shifted peak at 333 nm, indicating reduced band gap upon cerium incorporation. XRD confirmed crystalline nanocomposites in the nanometer range, with Ce doping slightly altering crystallite size. FESEM analysis showed distinct morphological modifications induced by cerium substitution in the CuO lattice. Antibacterial studies revealed enhanced inhibition zones for Ce-doped CuO. Furthermore, Ce doped CuO nanocomposites demonstrated superior photocatalytic degradation of methyl red, confirming improved catalytic performance. The study demonstrated a facile, green synthesis of Ce doped copper oxide nanocomposites using Citrus sinensis peel extract. Characterization confirmed nanoscale crystallinity, strong Cu–O bonding, and altered surface morphology upon cerium doping. Importantly, cerium incorporation narrowed the band gap, enhancing both antibacterial efficiency and photocatalytic degradation of methyl red. This eco-friendly approach highlights the dual benefits of agricultural waste utilization and environmental applications.

Key words: Green synthesis, Ce doped CuO, photodegradation, antibacterial activity

OP-ESC-02

Eco-Friendly Synthesis of Zr doped CoO Nanoparticles: Structural, Optical and Environmental Applications

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Abstract

Green mediated synthesis of metal oxide nanoparticles has gained attention as a sustainable alternative to conventional methods, capitalizing on bioactive molecules in agricultural wastes to reduce costs and environmental impact. However, few studies evaluated phyto-mediated routes for zirconia (ZrO_2) nanoparticles using biomass such as lemon peel. In this study, we exploit lemon peel extract to develop Zr doped cobalt oxide nanocomposites and to evaluate their photocatalytic and antibacterial properties. To develop a green synthesis method using Citrus limon peel extract for developing Co doped Zirconium oxide nanocomposites. The optical, crystallographic and morphological properties of synthesized nanocomposites were characterized using UV, XRD and SEM. The photocatalytic degradation efficiency towards methyl red under sunlight and to evaluate their antibacterial activity against bacterial strains were studied. Zr doped CoO nanoparticles were synthesized by a green route using sol gel method. The prepared nanoparticles were characterized for their optical properties, phase structure and crystallite size , surface morphology and particle distribution were analyzed using scanning electron microscopy, operated at 5–30 kV. Antibacterial activity of Zr doped CoO nanoparticles was tested against bacterial with different concentrations (25–100 µL). Photocatalytic activity was evaluated by the degradation of methyl red dye, exposed to direct sunlight for 5 h and calculated the degradation efficiency. Incorporation of Zr ions into the CoO lattice reduce the band gap and enhanced light absorption, improving photocatalytic degradation of methyl red dye. Nanoparticles showed sizes of 25–120 nm with well-defined morphology and elemental composition confirmed by SEM-EDAX. Zr doped CoO exhibited excellent antibacterial activity. Zr doped CoO nanoparticles synthesized via green methods demonstrate enhanced photocatalytic and antibacterial performance, highlighting their potential for environmental remediation and antimicrobial applications.

Key words: citrus limon, Zr doped CoO, photodegradation, antibacterial activity

OP-ESC-03

Environmentally Benign Nanomaterial Fabrication for Pollution Control

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Abstract

Sustainable nanomaterial synthesis has emerged as a viable alternative to traditional chemical and physical techniques, paving the way for safer and more environmentally friendly advanced functional materials. Botanical extracts, which include a diverse spectrum of biomolecules, work as natural reducing and stabilizing agents, allowing nanoparticles to form with precisely controlled physicochemical properties. Temperature, reaction time, and extract concentration are all important synthesis parameters that may be modified to increase material size, form, and stability. Nanomaterials are often assessed utilizing a number of analytical approaches, such as Fourier Transform Infrared Spectroscopy (FTIR), Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), and UV-Visible Spectroscopy, to confirm their structural and functional features. These environmentally friendly nanoparticles have showed considerable potential in pollution management applications, notably in organic pollutant degradation, heavy metal adsorption, and antibacterial properties. Their multifunctionality enables them to handle several environmental concerns at once. Sustainable synthesis is an ecologically friendly strategy that decreases dependency on harmful chemicals, lowers energy consumption, and promotes sustainability. Furthermore, plant-mediated synthesis is scalable and cost-effective, making it a viable option for real-world applications. Sustainable nanomaterials have the potential to significantly improve pollution control, wastewater treatment, and overall environmental remediation due to their efficiency, eco-friendliness, and multifunctionality.

OP-ESC-04

Improving Road Safety with IoT: Smart Solutions for Accident Prevention

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Abstract

As the population grows, there is now dangerously high levels of traffic congestion and auto accidents. Accident-related deaths as well as the proportion of traffic accidents are both sharply increasing. Even a minor traffic accident can cause harm to an entire family when someone passes away during their lifetime. Road safety is a major concern everywhere in the world. Using stateof-the-art IoT technology can help reduce the startling number of fatalities caused by traffic accidents. In order to reduce the amount of time it takes to rescue someone following an accident, Internet of Things (IoT) platforms have been widely utilized recently. Automatic road accident detection systems must be implemented in order to provide aid promptly. There are a lot of automatic accident detection solutions in the literature. The suggested system uses smartphones and IOT sensors to predict crashes. This technology sends a quick message to a mobile phone via WhatsApp in the event of an accident using WiFi and the internet. sends messages and calls to emergency numbers. The location of the accident can be determined using these methods. In order to maintain road safety and save valuable lives, we critically evaluate the various methods currently in use for traffic accident prediction and prevention in this study. We highlight the problems that need to be fixed as well as their benefits and limitations.

OP-ESC-05

A Collative Study on the Confiscation of Zn(II) ions using Natant Bio sorbents and Exploration in the Mitigation Process of Secondary Pollutant

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Abstract

Water gets polluted by heavy metals, leaching from industrial outlets cause irretrievable impact in the existence of living organisms and environment. Increased industrialization, urbanization, deforestation and fuel spillages in water streams are the prime sources of water pollution. This study focalizes on the chelation of Zn(II) ions from aqueous solutions by employing and treating, Coleus rotundifolius Pellets (CRP) and Meleagris gallopavo domesticus Egg shell (MES) as two potent bio materials. Batch mode studies are implemented for two systems, Zn(II)- TCRP & Zn(II) – TMES by fixing the optimizing parameters viz., particle size, initial Zn(II) concentration, sorbent dosage, contact time, pH and temperature, as they play a crucial part as controlling key factors,. As an extension of Batch study, analysis was restricted to quantify the bulk nature of the TCRP towards chelation of Zn (II) from the effluent sample collected from oil industry through column run. Formation and properties of the grease was confirmed by the FT-IR spectra and efficiency were tested through Oil bleeding (ASTM D 1742), Cone penetration (ASTM D 217) , Dropping point (ASTM D 2265), Water wash out (ASTM D 1264), Water spray off (ASTM D 4049) and Corrosion Prevention test (ASTM D 6138). TCRP indicated utmost uptake of Zn(II) as 96% than TMES (88%). Initial and final run solid matrices were characterized using various analytical tools like Ultrasound microscope, FT-IR, SEM / EDAX, TG-DTA to evaluate the morphology, participation of functional groups, elemental constitution and thermal stability of the tested sorbent materials. Linear fit in of Langmuir isotherm favors monolayer adsorption and the system pursued pseudo-second order kinetics. Silica formulated grease were found to exhibit better lubricating property, stability, its resistance against water and cost effectivity. Novel biosorbents were identified and tested for their efficiency against Zn(II) ions in aqueous and effluent solutions through Batch mode. Column study was conducted for effluent sample and the Zn(II) laden TCRP was customized to biogrease.

Key words: zinc, Batch, uptake, column, grease

OP-ESC-06

From Crystalline Salt to Nanoscale Carbon Dots: Multifunctional Materials for Sensing and Environmental Remediation Applications

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Abstract

Carbon dots (CDs) are a class of fluorescent carbon-based nanomaterials, typically less than 10 nm in size, composed of sp^2-hybridized carbon cores with various surface functional groups. CDs have garnered significant attention in material engineering owing to their low cytotoxicity, outstanding photoluminescent properties, high biocompatibility, water solubility, and photostability. These features make them applicable to a wide range of applications, including environmental monitoring, metal ion detection, optoelectronics like LEDs, information encryption, photocatalysis, electrocatalysis, solar cells, supercapacitors, biomedical applications, tumour diagnosis and therapy, and bioimaging. However, the range of suitable precursors for solid-state pyrolysis is still limited, with only a few compounds, such as lauryl gallate, citric acid, maleic anhydride, and tartaric acid, being effective due to their low volatility, high oxygen content, and strong carbonization potential. Given this limitation, there is a pressing need to identify novel precursors with well-defined molecular structures and favorable thermal behavior to expand the applicability of solid-state pyrolysis for the controlled synthesis of CDs. To synthesize and characterize novel pyridine acid-hydrazine derivative salt and its derived carbon dots, and to evaluate their structural, biological, and environmental applications. Proton transfer salt was synthesized by reacting pyridine acid and a hydrazine derivative. The crystalline salt was utilized as a precursor for the solid-state synthesis of CDs via pyrolysis. After cooling to room temperature, the resulting carbonized product was collected as a black powder corresponding to CDs. The hydrazine content in the synthesized salt was quantitatively determined using volumetric analysis, following Andrew's protocol with a standard KIO_3 solution. The salt, obtained from the reaction of pyridine acid and hydrazine-derived base, crystallized as a single crystal in the triclinic system with space group P-1. The crystalline salt is used to prepare carbon dots (CDs) via pyrolysis at 260 °C. TEM analysis revealed the particle size of approximately 6 nm. CDs showed strong sensing ability for Cu^{2+} and Ni^{2+} and achieved 85.39% nitrobenzene degradation, outperforming the precursor. The synthesized CDs showed excellent potential as fluorescent chemosensors, displaying high selectivity and sensitivity toward Cu^{2+} and Ni^{2+} ions. Furthermore, the CDs outperformed PE salt in catalyzing the reduction of NB, highlighting their enhanced catalytic efficiency and potential for environmental remediation.

Keywords: Pyridine acid, hydrazine base, carbon dot, metal ion sensing, nitrobenzene reduction.

OP-ESC-07

Biopolymer Based Composite – A Promising Treasure

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Abstract

World is becoming attracted to the production of novel materials, made primarily of polymers because of their advantages and key roles, in the circular economy concept and model. Unfortunately, the use of plastic-based materials and consumer's preferences for non-biodegradable materials is becoming a serious concern for environmental experts. Utilization of synthetic fiber-reinforced composites is extensive due to their promising strength, flexibility and rigidity. Despite its advantages, decomposition of these materials leads to the emission of hazardous leachate and gases. Interestingly, environmental concerns and plastic waste generation have led human beings to reconsider the consumption of plastics owing to deleterious effect to the environmental pollution. To sidestep these drawbacks, synthetic fibers and polymers have been replaced with biopolymers and biocomposites. Biopolymers are natural polymers derived from renewable sources such as plants, algae, and microbes. Biopolymers are gaining huge applications in the dental field with the application of scaffolds, Bio-membranes and Nano-composites due to their versatile nature, flexibility and their characteristic nature of binding with monomers. These biopolymers are found to contribute significantly in lowering the carbon footprint compared to conventional plastics. It is also found that Blending of nanoparticles and antibiotics with biopolymers has resulted in antimicrobial, antioxidant and anti-inflammatory properties. Bio-composites with excellent durability, performance, and reliability must be produced to broaden their applications. As scientific breakthroughs and technologies advances fresh areas of applications of natural fiber-reinforced composites will emerge, influencing the always-expanding market for bio-based composites.

OP-ESC-08

A Simple Thiosemicarbazone-Derived Fluorescent Probe to Detect Silver Ions and Bioimaging Studies

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Abstract

A simple thiosemicarbazone-derived (E)-2-((2-Hydroxynaphthalen-1-yl)Methylene)-N-Methyl-N-Phenylhydrazinecarbothioamide was prepared and characterized using diverse analytical methods and spectroscopic techniques. The definitive elucidation of its crystal structure was achieved through single-crystal X-ray diffraction analysis. The synthesized compound (2NP) was found to be highly specific and sensitive towards sensing silver ions. Time-dependent fluorescence studies of 2NP showed selectivity towards Ag^{+} ion (2:1 complex formation) with a detection limit of 5.8995 x 10^{-5} M with a binding constant of 1.7x10^{2} M^{-1}. Detailed DFT studies confirmed the formation of [$Ag(2NP)_2$] complex. Further, the compound 2NP has been tested for its cytotoxicity and bioimaging studies was also performed in Mouse Fibroblast Cell Lines (L929).

Keywords: 2-hydroxy naphthaldehyde, N-Phenyl-N-methyl thiosemicarbazone, silver ion sensing, DFT.

OP-ESC-09

The Surface Reactivity of Silver Nanoparticles Doped with TiO_2 Nanorod Like Crystals for Enhancing Photocatalytic Degradation of Harmful Water Pollutants Under Visible - Light irradiations

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Abstract

A novel catalyst was developed through the synthesis of TiO2 nanoparticles and their transformation into TiO2 nanorod like crystals using a hydrothermal method. The surface of these TiO2 nanorod crystals was enhanced by incorporating Ag nanoparticles through chemical reduction, method resulting in a considerable improvement in performance. To understand the depth of these enhancements, a comprehensive analysis of the structural, optical, vibrational, and electrochemical properties was conducted using a variety of advanced techniques, including high-resolution transmission electron microscopy (HRTEM), X-ray diffraction (XRD), diffuse reflectance spectroscopy (DRS), photoluminescence spectroscopy, electrochemical impedance spectroscopy(EIS), Fourier transform infrared spectroscopy (FTIR), UV-visible spectrophotometer and Raman spectroscopy. The HRTEM images have substantiated the formation of heterojunctions within the photocatalyst, illustrating the entrapment of particles at the interaction sites where silver nanoparticles are adorned on titanium dioxide nanorod crystals (TiO2 NRCs). The X-ray diffraction (XRD) patterns reveal the highly crystalline nature of the material, and impedance spectroscopy illustrates how the photogenerated electron-hole separation is enhanced. Electrons are transferred from the conduction band of TiO2 into silver, which prolongs the lifetime of holes trapped within TiO2 NRCs. The photocatalytic efficacy of Ag–TiO2 NRCs compared to TiO2 nanoparticles has been rigorously investigated in the degradation of methylene blue dye in an aqueous environment, employing analysis through a UV-visible spectrophotometer. One-dimensional Ag–TiO2 nanorod crystals demonstrate remarkable effectiveness as photocatalysts in the degradation of organic pollutants, proving particularly efficient in the purification of aqueous contaminants, notably; these nanorod crystals achieve an impressive methylene blue dye degradation efficiency of 99.7%, their potential in serious environmental contamination issues.

Key Words: TiO_2 NPs, Ag-TiO_2 NRCs nanocomposite, Photocatalyst, Dye degradation, Methylene Blue.

OP-ESC-10

In Vitro Anticancer Activity and Cytotoxicity Screening Of Phytochemical Extracts from Rhinacanthus Nasutus

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Abstract

Rhinacanthus nasutus (R. nasutus) has a variety of pharmacological actions, including platelet aggregation inhibition, antidiabetic, antituberculosis, and anticancer activity. These various properties are consistent with the plant extracts' long-reported use in indigenous medicinal systems. Cancer is a fatal illness caused by the uncontrolled, continuous, and autonomous growth of genetically faulty cells. As one of the most prevalent human diseases, there is an ongoing and pressing need for novel, effective, and cheap anticancer treatments. Traditional medicine offers a crucial alternative resource in this search, driving the ongoing scientific and commercial effort to identify natural anticancer medicines. One such resource is the medicinal plant Rhinacanthus nasutus (L) (Acanthaceae), which contains key alkaloids like Rhinacanthin C, D, and N. The Rhinacanthins are specifically noted for their potential ability to inhibit aberrant cell growth and development. This study aimed to evaluate the anticancer activity of the plant Rhinacanthus nasutus L. Specifically, we tested its effects on the HeLa (cervical carcinoma) cancer cell line. In parallel, we assessed its cytotoxicity on a normal cell line, MCF-10A (non-tumorigenic mammary epithelial line), to determine its therapeutic selectivity on which limited data is available. Plant extracts were prepared and their cytotoxicity was screened against all cell lines using the MTT assay. Rhinacanthus nasutus L. extracts exhibited strong anticancer activity specifically against PA-1 ovarian cancer cells. Importantly, they showed only weak cytotoxicity on the normal cell line, indicating a beneficial selective efficacy. Our data thus offers new evidence of the plant's antineoplastic properties, which could be instrumental in designing novel cancer treatments.

Key words: Anticancer activity, Ovarian cancer, HeLa cell line, MTT assay, MCF-10A

OP-ESC-11

Environmentally Sustainable PVA based Composite Films: Preparation, Characterization, and Antimicrobial Activity

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Abstract

The growing demand for eco-friendly materials has accelerated the development of biodegradable and biocompatible polymeric films as sustainable alternatives to conventional plastics. In the present work, poly (vinyl alcohol) (PVA)-based composite films were prepared and systematically characterized to explore their potential applications. The films were fabricated by the solution casting method using equal proportions of PVA and carrageenan. FTIR spectroscopy confirmed the formation of linkages between PVA and carrageenan in the composite films. Thermal analysis revealed good thermal stability up to 230 °C, with overall stability observed up to 400 °C. The antimicrobial activity of the films was evaluated using the MIC method, which demonstrated enhanced efficacy. A decrease in optical density (OD) values with increasing film concentration indicated the strong antimicrobial potential of the prepared composite. Overall, the results emphasize the suitability of PVA-based composite films as eco-friendly, biodegradable, and biocompatible materials with promising antimicrobial properties, making them attractive candidates for applications in biomedical, packaging, and environmental fields.

Keywords: PVA, carrageenan, composite film, thermal stability, antimicrobial activity

OP-ESC-12

Green Synthesis and Characterization of Silver Nanoparticles Of Euphorbia Heterophylla

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Abstract

Breast cancer is the second leading cause of death in women around worldwide. Nanotechnology is more effective method for herbal drug delivery to the tumor tissues. In this present study an attempt was made to synthesis silver nanoparticle from Euphorbia hetrophylla L. It is a ornamental plant, which belongs to the family of Euphorbiaceae. It was also called as mexican fire plant, milk weed in english, paalperuki in tamil. This plant was reported to have wound healing property, anti inflammatory, antimicrobial and anticancer activity and traditionally used for treating constipation, bronchitis, asthma, laxative and lactogenic agent. The phytochemical analysis of plant extract, revealed the presence of alkaloids, flavonoids, terpenoids, phenols, tannins and steroid, sapnins. The silver nanoparticles of the plant extract were prepared and characterized by UV- visible spectroscopy, FTIR analysis SEM and HR-TEM. The synthesised silver nanopartivcles were evaluated for its in-vitro cytotoxic studies by using MCF-7 cancer cell line. The formation of Silver nanoparticles was confirmed by using UV–visible spectroscopy, FTIR analysis, SEM analysis. The spherical shape of silver nanoparticles of size in the range of 100-200 nm, confirmed by SEM and TEM analysis. The in-vitro cytoxicity studies of the synthesied nanoparticles showed 87 % cell viability against breast cancer cell lines using MTT assay. The study highlights the effect of synthesised silver nanoparticles of Euphorbia hetrophylla L against the MCF-7 cell lines. From the study it was concluded that the anticancer potential of synthesised silver nanoparticles of Euphorbia hetrophylla L in a rapid and eco-friendly approach.

Keywords: Euphorbia hetrophylla L, Breast cancer, Silver nanopartticles, In vitro-cytoxicity studies, MCF-7cell line.

OP-ESC-13

Environmentally Benign Doped Polymeric Inhibitor for Corrosion Protection of Mild Steel in Sulphuric Acid Medium

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Abstract

Poly aniline is an attractive material for corrosion inhibition studies. In this study, poly N-methyl aniline doped with cystine and explored for their inhibitive action of mild steel corrosion in 0.5M Sulphuric acid. The doped polymer was evaluated using weight loss method, polarization studies and electrochemical impedance studies. The doped polymer exhibited maximum efficiency of 91.21% at the concentration 230 ppm. The inhibitor efficiency of doped increased at 3 hours of immersion followed by a decrease, and an increase at 24 hours of immersion. Potentiodynamic polarization studies indicate the polymer as mixed inhibitors. The impedance measurements and polarization studies were comparable with the weight loss studies. The synergistic action of poly aniline and doped polymer was confirmed by the synergistic parameter calculation. The changes occurred in the electrolytic solution after the immersion of mild steel samples for 6 h of immersion period was determined by Atomic absorption spectroscopy and UV-visible spectroscopic studies. The results provide some preliminary information about the complex formation in the solution phase and also the protective layer formation on the metal surface. The protective layer is characterized using Scanning electron microscopy and EDAX analysis.

Keywords: Poly aniline, Doped polymer, cystine, mild steel, SEM

OP-ESC-14

Preparation of Carbon Black Ink Mixed with Black Paint for Coating Concrete Solar Still Basin

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Abstract

Enhancing the absorption efficiency of solar stills is critical for maximizing freshwater productivity. This study investigates a concrete basin double-slope solar still modified with a novel absorber coating prepared by blending carbon black ink with commercial matte black paint. The coating was applied and cured on the basin surface to improve thermal conductivity and optical absorption, thereby accelerating the evaporation process. Experimental evaluation under the climatic conditions of Viluppuram revealed that the modified still achieved a maximum hourly freshwater productivity of 422 mL/m², with a total daily yield of 3.8 L/m²/day, compared to 255 mL/m² and 2.3 L/m²/day, respectively, for the uncoated still. Correspondingly, the overall daily thermal efficiency improved from 28.9% to 47.7% with the carbon black coating.The enhanced basin surface demonstrated superior heat retention and solar energy utilization, confirming the effectiveness of the proposed low-cost and durable modification for boosting freshwater output in solar still systems.

Keywords: Carbon black ink; Black paint coating; Concrete basin; Solar still; Absorber surface; Thermal efficiency; Freshwater production.

OP-ESC-15

Optical Properties of Mixed Metal Oxides (WO_3-Tio_2) Polymer Nanocomposites for Photocatalytic Applications

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Abstract

Mixed metal oxide–PMMA polymer nanocomposites are emerging as promising materials for photocatalytic applications due to their enhanced charge transfer and light absorption properties. In this paper, tungsten oxide (WO_3) and titanium dioxide (TiO_2) nanoparticles were incorporated into a polymer matrix via the solution casting method to fabricate hybrid nanocomposites. Structural and phase analysis was carried out using X-ray diffraction (XRD), while Fourier-transform infrared spectroscopy (FTIR) was employed to study functional groups and polymer–oxide interactions. Scanning electron microscopy (SEM) provided insights into surface morphology and particle dispersion. The optical properties were analyzed using UV–Vis spectroscopy to determine absorption edge and optical band gap. Addition of WO_3 TiO_2 in the polymer matrix has a significant impact on the structural, morphological, and optical characteristics. Nanocrystallinity is verified using XRD, polymer to oxide bonding is confirmed using FTIR, homogeneous dispersion is confirmed using SEM, and reduced band gap and increased visible-light absorption are confirmed using UV-vis. All these synergistic effects are aimed at greater photocatalytic efficiency, proving the possibilities of WO_3-TiO_2 PMMA polymer nanocomposites in environmental remediation and conversion of solar energy into practical use. It was found that, the addition of WO_3-TiO_2 considerably changed optical absorption characteristics, the effective band gap was decreased, and the visible-light-dependent photocatalytic potential was increased. The results demonstrate the potential of WO_3-TiO_2 PMMA polymer nanocomposites in effective photocatalytic processes in environmental cleanup and solar energy generation.

Key words: WO_3–TiO_2, PMMA polymer nanocomposites, solution casting, optical properties.

OP-ESC-16

Chemical Optimization of Therapeutic Candidates for Atopic Dermatitis Using R Programming

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Abstract

Atopic dermatitis (AD) is a chronic inflammatory skin disorder that continues to demand safer and more effective therapeutic strategies. Current drugs often face limitations such as reduced efficacy, side effects, and variable patient response. To address this challenge, the present study employs computational approaches using R programming to optimize potential therapeutic candidates for AD. A systematic workflow was developed that integrates quantitative structure–activity relationship (QSAR) modeling, molecular docking data analysis, and toxicity prediction. R-based statistical and machine learning packages were applied to construct predictive models correlating molecular descriptors with biological activity. The optimized models were validated using statistical parameters (R^2, RMSE, and cross-validation scores), ensuring robustness and reliability. In parallel, toxicity and bioavailability filters were applied to refine candidate selection. The study highlights drug molecules with improved efficacy–toxicity balance, emphasizing their suitability for further pre-clinical evaluation. Importantly, the results demonstrate how computational optimization can guide drug design for dermatological disorders, reducing experimental costs and accelerating discovery timelines.This work not only illustrates the potential of data-driven cheminformatics in biomedical research but also suggests future integration with nanotechnology-based delivery systems, enabling targeted and sustained release for enhanced therapeutic outcomes in AD. The findings underscore the role of computational methods as powerful tools in drug development, offering a pathway towards next-generation therapies in dermatology.

Keywords: Atopic Dermatitis, Drug Optimization, R Programming, QSAR, Molecular Docking, Biomedical Applications

OP-ESC-17

Analysis Of Extractable And Leachable In Pharmaceutical Container Closure Systems Using HPLC And LC/MS

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Abstract

Extractable and leachable represent a significant concern in pharmaceutical development due to their potential to compromise product quality and patient safety. Extractables are compounds released from packaging materials under laboratory stress conditions, while leachables are those that migrate into the drug product during storage or use. These impurities typically originate from chemical additives in plastics and elastomers or from residues on glass and metal surfaces. Accurate detection, identification, and quantification are therefore essential to ensure regulatory compliance and safeguard therapeutic efficacy. Advanced analytical methods, particularly high-performance liquid chromatography (HPLC) and liquid chromatography–mass spectrometry (LC–MS), play a pivotal role in characterizing these contaminants. This review discusses current regulatory perspectives on extractables and leachables and highlights recent progress in applying HPLC and LC–MS to address associated challenges in pharmaceutical safety.

Key words: Extractables, Leachables, Pharmaceutical packaging, Container closure systems, Impurities, HPLC, LC–MS, Drug safety, Regulatory compliance, Analytical techniques

OP-ESC-18

Optimization of Media Components for the Production of Fungal Cellulase from Trichoderma reesei

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Abstract

An extracellular Cellulase producing Trichoderma reesei isolated from the soil sample collected from Alagar hills, Madurai. Identification was done by biochemical test. The optimum conditions for the Cellulase production by Trichoderma reesei were found to be at pH 6.0 and temperature at 30ºC. The result of carbon and nitrogen sources on Cellulase production shows that Lactose and Pepotone were the major substrates for the Cellulase production respectively. In experimentation with metal ions, the maximum Cellulase production was observed in the media supplemented with EDTA. The acidophililc Trichoderma reesei for Cellulase production indicated that, 1.0 % sodium chloride was optimum for maximizing the Cellulase production. Among the tested surfactants, the maximum Cellulase production was observed in Triton X 100 when compared to the other tested surfactants. Effect of hydrocarbons inferred that the maximum protease production was recorded in the nonane supplemented medium. The effect of incubation time intervals on Cellulase production indicated that it was maximum in 68 hours of incubation.

Key Words: Cellulase, Optimization, Trichoderma reesei, Alagar hills

OP-ESC-19

Enhancing Corrosion Protection on Aluminum By Functionalized Graphene Oxide Reinforced Epoxy Coating in Sea Water Environment

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Abstract

The use of derived plant extracts as eco-friendly corrosion inhibitors is gaining momentum in corrosion control. Graphene oxide (GO), a widely used nano filler, has shown promise when modified with natural phyto compounds from plant extracts. The epoxy resins are used for coating the metal due to its good adhesion to metal substrate, strong chemical and mechanical resistance and long-term durability in corrosive environments. In this study GO was modified using a leaves extract from Plumeria Alba (PA) and the resulting composite was applied to enhance the adhesion strength of epoxy coatings on aluminum. The rGO was characterized using Fourier Transform Infrared (IR) spectra to confirm its structural modification and GC-MS was taken for the PA to study about the chemical composition. Then the rGO was added to epoxy resin and coated on the pretreated aluminum metal surface. The Corrosion resistance was evaluated using electrochemical impedance spectroscopy (EIS) and Potentiodynamic polarization (PDP) tests show that the GO-PA coating provided effective protection. Further assessments including salt spray exposure in a 3.5% NaCl solution and contact angle measurements demonstrated improved adhesion and hydrophobicity properties. In the spectrum peaks at 1722 cm^{-1}, 1367 cm^{-1}, 1515 cm^{-1}, 1209 cm^{-1} are due to C=O, C-O-H, C=C stretching, and due to epoxy group are found this confirms the successful modification of GO by plant extract. In polarization technique the bare steel exhibited the most negative corrosion potential (Ecorr), the highest corrosion current density (Icorr), and the lowest polarization resistance (Rp) at all immersion intervals, indicating its susceptibility to rapid electrochemical dissolution in the corrosive medium. The incorporated GO-PA shows enhanced corrosion protection with the efficiency of 97.8% after immersing 21 days in 3.5% NaCl solution. Contact angle measurements showed the coatings possessed hydrophobic characteristics ($\theta \approx 96.3°$) along with a work of adhesion (WA) of 64 J/m^2, indicating superior barrier performance that aligns with enhanced adhesion and reduced water penetration. Under stringent salt spray testing conditions, the coating withstood a continuous 240-hour exposure without any sign of peeling, reflecting its remarkable adhesion and corrosion resistance. These findings suggest that rGO-PA extract acts as an effective reinforcing agent in epoxy coatings improving both adhesion and corrosion resistance on metal substrate.

OP-ESC-20

Functional Insights into Prodigiosin from Soil-Derived Serratia marcescens: Characterization, Yield Optimization, and Biomedical–Environmental Applications

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Abstract

Microbial pigments are emerging as eco-friendly alternatives to synthetic dyes due to their biodegradability, bioactivity, and sustainability. Contaminated environments, particularly chemically impacted soils, provide a rich source for isolating pigment-producing bacteria with potential biomedical and industrial applications. Among these pigments, prodigiosin from Serratia marcescens has gained attention for its antimicrobial, antibiofouling, and dyeing capabilities. However, systematic studies on optimization, characterization, and functional applications of soil-derived prodigiosin remain limited. In this study, pigmented bacterial isolates were obtained from contaminated soil samples. The most prominent strain (WUA_4) was identified as Serratia marcescens using morphological, biochemical, and molecular methods. Pigment biosynthesis was optimized using the Box–Behnken statistical design to study the effects of carbon and nitrogen sources, pH, and temperature. The extracted pigment was characterized by UV–Visible spectroscopy, Fourier-transform infrared spectroscopy (FTIR), and gas chromatography–mass spectrometry (GC–MS). Application studies included testing the pigment as a natural colorant for textiles and candle wax. The isolated strain WUA_4 was confirmed as Serratia marcescens. Box–Behnken optimization revealed that nutrient sources, pH, and temperature significantly influenced pigment yield. The findings emphasize contaminated soils as valuable reservoirs for bioprospecting novel pigment-producing bacteria and pave the way for scalable production of prodigiosin for green technologies.

OP-ESC-21

Nano-Pesticides with Targeted Delivery Systems for Sustainable Agriculture

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Abstract

The development of a nanoparticle-based pesticide delivery system represents a sustainable, targeted, and ecologically responsible method to pest management. This technique uses biodegradable nanoparticles to encapsulate pest control compounds, improving stability, extending efficacy, and minimizing environmental impact. Controlled-release methods are intended to adapt to environmental signals like as temperature, humidity, and pH, resulting in optimal pesticide dissemination when necessary. Surface functionalization with pest-targeting ligands allows for targeted distribution, whilst adhesion-promoted nanoparticles increase retention on plant surfaces, decreasing waste and runoff. Advanced encapsulation technologies reduce non-target toxicity, which promotes environmental safety and compliance with sustainable agricultural regulations. The process is compatible with traditional farm equipment, allowing for easy incorporation into current agricultural methods. Its production technique is economically scalable, ensuring cost-effective manufacture for large-scale applications. Furthermore, a resistance management framework and multi-stage release profile help to prolong pest suppression while reducing the chance of resistance development. Following application, the eco-degradable nanoparticles degrade into harmless byproducts, preserving soil and environmental quality. This novel platform has great promise for precision farming, organic agriculture, and commercial crop protection, providing an effective and environmentally benign alternative to traditional pesticides.

OP-ESC-22

Phytochemical screening and GC-MS analysis of ethyl acetate root extract of Dioscorea oppositifolia L.

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Abstract

Dioscorea oppositifolia L., commonly known as Cinnamon Vine (Malaiyankizhangu), is a tuberous and endangered medicinal shrub belonging to the family Dioscoreaceae. It is traditionally consumed as a functional food in southern Tamil Nadu, India. The present study aimed to carry out preliminary phytochemical screening and identify the bioactive constituents present in the ethyl acetate extract of D. oppositifolia root tubers using Gas Chromatography–Mass Spectrometry (GC–MS) analysis. The GC–MS profile revealed the presence of ten bioactive compounds: 4-Methylquinazoline, Cyclopentaneundecanolic acid, 5-Hydroxy-4′-methoxy-7-methylflavone, Oleic acid, 8,11,14 - Eicosatrienoic acid, Isopropyl stearate, Estra-1,3,5 (10)-trien-17α-ol, Quinazolin-4(3H)-one, Docosanoic acid, and 4-Piperidineacetic acid. These compounds were detected at retention times of 8.48, 17.05, 17.73, 18.78, 19.43, 20.28, 21.18, 22.35, 23.95, and 28.18 minutes, respectively. The presence of these phytoconstituents indicates that D. oppositifolia possesses a diverse range of medicinal properties, potentially validating its ethnopharmacological applications. Traditional medicine systems have used this plant to treat various ailments, including digestive disorders, respiratory issues, and skin conditions. Further studies are recommended to isolate, characterize, and evaluate the pharmacological potential of these compounds.

Key words: GC-MS analysis, Dioscorea oppositifolia, Phytochemical screening, ethyl acetate extract.

OP-ESC-23

Heteronuclear CoRu Dimers with C/N Coordination for Efficient Electrochemical Urea Production

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Abstract

Electrochemical urea synthesis from CO_2 and nitrate provides a sustainable C–N coupling pathway for urea synthesis, but it competing with side reactions and poor selectivity. Here, we report a C_2N_4-coordinated CoRu heterodimer embedded in N-doped graphene oxide that achieves nearly 100% N selectivity for urea. A laser-induced process creates N-rich cavities in graphene oxide, which stabilize atomically dispersed Co–Ru dimers via dual C–N ligation formation. Direct Co–Ru bonding with asymmetric charge distribution renders Co electron-rich and Ru electron-deficient, optimizing *NH_2 and *CO adsorption. This synergic effect of CoRu-C_2N_4 delivers a urea Faradaic efficiency of 48.1% and yield rate of 149 μg h^{-1} cm^{-2} at –0.4 V vs RHE, outperforming Co–N_4 and Ru–N_4 while suppressing ammonia and formate formation. This work demonstrates that heteronuclear dimer engineering with asymmetric C/N coordination enables synergistic dual-site activation of C and N sources, providing a general strategy for selective electrocatalytic C–N coupling.

OP-ESC-24

Pulsed-Laser-Engineered Cu-Doped δ-Bi_2O_3 Nanostructures for Highly Selective CO_2-to-Formate Conversion

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The electrochemical CO_2 reduction reaction (CO_2RR) to formate is hindered by high overpotentials, a narrow potential window for achieving high Faradaic efficiency (FE) toward formate, and limited current density. Herein, we present a scalable strategy for highly selective CO_2RR to formate using a Cu-doped δ-Bi_2O_3 electrocatalyst. An α-Bi_2O_3 precursor was transformed into a flower-like δ-Bi_2O_3 nanostructure via a pulsed laser irradiation in liquid (PLIL) process, followed by Cu doping to yield the final Cu–Bi_2O_3 catalyst. This approach eliminates the need for high-temperature furnace treatment and inert atmosphere, offering a rapid, energy-efficient synthesis route. The Cu–Bi_2O_3 catalyst achieved an outstanding Faradaic efficiency (FE) of 95% for formate production at –1.0 V vs. RHE. Furthermore, ^{1}H NMR analysis confirmed a formate yield rate of 0.32 μM at –1.2 V vs. RHE. Long-term stability testing over 15 h demonstrated negligible loss in both FE and yield rate, indicating excellent durability. These results highlight that PLIL-enabled phase engineering of Bi_2O_3 provides a promising platform for designing high-performance electrocatalysts for sustainable CO_2 conversion and renewable energy applications.

Keywords: Pulsed-laser technology; Cu doped δ-Bi_2O_3; Electrocatalyst; CO_2 reduction reaction; Formate synthesis

OP-ESC-25

Highly Efficient Electrochemical Nitrate Reduction via Rapid CO_2 Laser-Assisted Anchoring of Single-Atom Catalysts on MBene

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Abstract

Ammonia (NH_3) has emerged as a carbon-neutral energy carrier and a key intermediate in the synthesis of fertilizers and industrial chemicals. The electrocatalytic reduction of nitrate ions (NO_3^-), a common and hazardous contaminant in wastewater, into NH_3 represents a compelling strategy that simultaneously addresses environmental pollution and enables sustainable chemical energy conversion. Dual single-atom (DSA) catalysts offer great promise for enhancing the efficiency of such transformations, yet their synthesis remains challenging due to the difficulty of stabilizing isolated atoms. In this study, we introduce a rapid and scalable continuous-wave CO_2 laser irradiation strategy (wavelength = 10.6 μm, power = 25 W) that stabilizes DSA configurations within just 3 minutes. Using this method, we demonstrate the feasibility of $MoAl_{1-x}B$ MBene a novel two-dimensional boride as an effective support for DSA stabilization. Selective acid/oxidant etching exposes Mo–B-rich basal planes, while L-tryptophan functionalization provides electron-rich metal–N and metal–O anchoring sites, enabling the immobilization of Co and Ni single atoms. The resulting CoNi-DSA/MBene catalyst exhibits exceptional activity for the electrochemical nitrate reduction reaction (ENRR), achieving an NH_3 production rate of 32.36 mg h^{-1} cm^{-2} at −0.8 V vs. RHE. Beyond ENRR, the CoNi-DSA/MBene catalyst was successfully implemented as a cathode in a Zn–NO_3^- battery, further demonstrating its potential in energy-generating systems. This study highlights the transformative potential of CO_2 laser-based synthesis in developing multifunctional single-atom catalysts, bridging environmental remediation and sustainable energy technologies.

OP-ESC-26

Ruthenium Single Atom–Modified Cobalt Oxide Catalyst Synthesized Via CO_2 Laser For Value-Added Plastic Upcycling

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Abstract

Over time, the demand for plastics has increased, and the production and disposal of plastics have also increased accordingly. The discarded plastics are being recycled through physical or chemical processes, but the ratio is very small compared to the amount being discarded. Recent research trends have shown the possibility of commercial development by producing terephthalic acid (PTA) and potassium diformate (KDF) through PET upcycling through chemical processes. In this study, the physicochemical properties of cobalt oxide synthesized through a co2 laser were analyzed using analytical equipment such as XRD (X-ray diffraction), Raman, SEM (scanning electron microscope), and XPS (X-ray photoelectron spectroscopy), and the efficiency of plastic upcycling in an electrolytic cell was analyzed. The synthesized cobalt oxide through this study showed the possibility of development as an efficient catalyst in the plastic industrial process.

Keywords: CO2 laser; CoCo PBA; Co_3O_4; PET upcycling

OP-ESC-27

Pulsed Laser-assisted Synthesis and Characterisation of Nickel Selenide

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Abstract

Metal selenides have been around for over three decades and have established their superiority over oxides and sulphides in applications such as energy storage and conversion. However, conventional synthesis techniques – like solvothermal, selenization in a tube furnace, and solid-state reactions come with hurdles of time and high temperature. Pulsed laser irradiation in liquids (PLIL) is a rapid-synthesis technique, alongside offering good control over physicochemical and electronic properties of materials. However, PLIL is underexplored towards synthesis of metal selenides. Herein, we report a hydrazine-assisted PLIL synthesis of NiSe using nickel chloride hexahydrate as nickel source and selenium tetrachloride hexahydrate as selenium source. An Nd:YAG laser with a wavelength of 532 nm at different laser power and irradiation time are used. X-ray diffraction analysis confirms the formation of NiSe with a hexagonal structure. Raman spectroscopy and Fourier-transform infrared spectroscopy are also employed to examine the structure and nature of chemical bonds. Field-emission scanning electron microscope imaging unveils the spherically-shaped NiSe particles. X-ray photoelectron spectroscopy is employed to study the surface chemistry of the NiSe particles.

OP-ESC-28

NiMo Dual-Atom Heterodimers Anchored on Pd Nanosheets via CO_2 Laser Irradiation for PET Upcycling

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Abstract

Synthetic plastics are essential in modern life, with polyethylene terephthalate (PET) being one of the most widely produced polyesters (>70 million tons annually) for packaging, textiles, and automotive applications. However, its poor degradability and unclear disposal routes lead to large-scale waste and environmental risks. Recycling PET into high-value chemicals offers both economic and ecological benefits. Alkaline hydrolysis of PET yields terephthalic acid (TPA) and ethylene glycol (EG), the latter serving as a feedstock for the electrochemical EG oxidation reaction (EGOR) to form formic acid (FA) and glycolic acid (GA). While FA production is well studied, GA remains underexplored despite its much higher market value and broad industrial uses, mainly due to the dominance of C–C bond cleavage and poor catalyst selectivity. Single-atom catalysts (SACs) offer maximal atom utilization, tunable electronic structures, and high stability, enabling C–H and C–C bond cleavage in EGOR. Yet, their isolated active sites limit multistep oxidation efficiency. Dual-atom catalysts (DACs) overcome this by introducing synergistic metal sites, improving intermediate adsorption, and preventing surface poisoning. Reported systems, such as Pd–N4/Cu–N4 and Ni–Fe DACs, show improved GA selectivity but rely on costly, complex synthesis. Here, we report a NiMo dual-atom dimer on Pd nanosheets (NiMo-DA/PdNS) that achieves potential-dependent control of EGOR selectivity toward both FA and GA—an insight not previously reported. The catalyst is fabricated via a rapid, low-cost CO_2 laser irradiation method (~10.6 μm, 7 W, 10 min), ensuring precise atomic dispersion, strong metal–support interactions, and prevention of sintering. Pd nanosheets provide a flat, conductive platform with intrinsic EGOR activity and balanced C1/C2 selectivity, offering a scalable approach for efficient plastic upcycling.

OP-ESC-29

High-Entropy Alloy Catalysts via Pulsed Laser Synthesis for Coupled Nitrate Reduction–Formaldehyde Oxidation

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Abstract

The discharge of nitrate (NO_3^-) and formaldehyde (HCHO) from industrial and agricultural activities poses significant environmental and health concerns due to their high toxicity and persistence. Coupling the electrochemical nitrate reduction reaction (NO_3RR) with the formaldehyde oxidation reaction (FOR) offers an effective approach for the simultaneous removal of these pollutants while generating value-added products such as ammonia (NH_3) and formate ($HCOO^-$). In this study, a CoNiCuPdPt high-entropy alloy (HEA) catalyst was synthesized via a pulsed laser irradiation in liquid (PLIL) process, enabling an environmentally friendly and rapid catalyst fabrication without the need for high-temperature treatment or hazardous chemical reducing agents. The multi-element composition of the CoNiCuPdPt HEA optimizes the electronic structure and offers diverse active sites, promoting efficient charge transfer and fast reaction kinetics for bifunctional catalysis in the coupled NO_3RR–FOR system. The PLIL-synthesized CoNiCuPdPt HEA exhibited excellent stability under electrochemical operation, enabling concurrent removal of nitrate and formaldehyde while achieving high yields of NH_3 and $HCOO^-$. This work demonstrates the potential of PLIL-fabricated HEA catalysts for integrated pollutant remediation and value-added chemical synthesis, offering a sustainable strategy for wastewater treatment.

Keywords: Pulsed laser irradiation in Liquid; High Entropy Alloys; Nitrate Reduction Reaction; Formaldehyde Oxidation Reaction; Formaldehyde–nitrate coupled device

OP-ESC-30

Pulsed-Laser Synthesized Pd/Co Sheets as Efficient and Stable Catalysts for Electrochemical Nitrate Reduction

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Abstract

The electrochemical reduction of nitrate (NO_3^-) to ammonia and other value-added nitrogen-containing products represents a promising approach to mitigate environmental pollution while enabling sustainable chemical energy conversion. In this work, we develop an efficient electrochemical NO_3RR process employing Pd/Co sheets synthesized via pulsed laser irradiation. The resulting materials were comprehensively characterized by SEM, Raman spectroscopy, XRD, XPS, and TEM, confirming successful synthesis and revealing detailed structural and compositional features. The electrocatalytic activity toward NO_3RR was systematically evaluated using linear sweep voltammetry (LSV), Tafel slope analysis, and Faradaic efficiency measurements under alkaline conditions. This study highlights the potential of Pd/Co sheets as highly active and stable catalysts for electrochemical nitrate reduction, underscoring their possible integration into sustainable zinc–nitrate battery systems with high energy density. The proposed strategy offers a green and efficient pathway for nitrate remediation while advancing eco-friendly energy storage technologies.

Keywords: Electrochemical nitrate reduction, Pd/Co sheets, Pulsed laser irradiation, Ammonia production, Energy storage

OP-ESC-31

Eggshell-Derived Calcium Oxide Nanoparticles for Heavy Metal Reduction in Polluted Soil

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Abstract

Heavy metal accumulation in agricultural soils threatens food security, soil health, and ecosystem sustainability. Conventional remediation approaches are often expensive, timeconsuming, and risk secondary pollution. This study explores the sustainable use of chicken eggshells, an abundant biowaste, for synthesizing calcium oxide nanoparticles (CaO-NPs) as an innovative soil remediation strategy. CaO-NPs were prepared by ball milling and high-temperature calcination, producing nanosized particles (3.1–27.8 nm). Structural and surface characterizations by SEM, XRD, and FTIR confirmed their crystalline morphology and functional groups relevant to metal immobilization. Polluted soil samples collected from industrial and agricultural zones of Tamil Nadu were treated with CaO-NPs and analyzed using Atomic Absorption Spectroscopy (AAS). The nanoparticles achieved significant reductions in cadmium (Cd), chromium (Cr), lead (Pb), and nickel (Ni), with maximum removal efficiencies of about 70 % after 72 hours of incubation. The treatment also increased soil pH, thereby reducing heavy metal bioavailability while preserving essential nutrients required for plant growth. This investigation demonstrates the dual benefits of biowaste valorization and environmental detoxification, highlighting eggshellderived CaO-NPs as a cost-effective, scalable, and environmentally benign nanomaterial for soil remediation.

Keywords: Calcium oxide nanoparticles, Heavy Metal,

OP-ESC-32

Study of Trivalent chromium conversion coating formed on Aluminium metal interface

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Abstract

As aluminium is greatly useful to mankind in different ways, its corrosion should be prevented. Corrosion of this metal poses lot of damage to mankind both economically and biologically. So, a need to invent a better way of protecting, aluminium has now become a challenge for scientists and engineers. The porosity and adhesion of the chromate coated aluminium were tested by appropriate testing methods. Formation of conversion coating such as phopsphating, chromating, oxalating by simple chemical immersion or chemical oxidation is one of the method used to prevent corrosion. The properties of coating increase with increase of immersion time, temperature and concentration of chromic acid to acertain limit. The chemical attack facilitates the dissolution of some surface metal and the formation of a protective film containing complex chromium compounds. Surface morphology and structure of the coating were studied by SEM analysis. The corrosion behavior of the chromate coated has been examined by tafel polarization and impedance methods. Thermodynamic parameters for chromate coated aluminium in various baths have also been determined. The materials which are coated have high strength than that of the uncoated materials.

Key words: Aluminium, Tafel polarization, Impedance, SEM, and Thermodynamic parameters

OP-ESC-33

Selective And Sensitive As^{3+} Ion Detection Using Bright Fluorescent Mxene Quantum Dots

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Abstract

Ti_3C_2 MXene quantum dots (MQDs) are considered as emerging nanomaterial in recent times, while maximum of MQDs exhibit limited emission properties in the blue-light region. Longer wavelength emissive quantum dots are highly desirable in different biological aspects including minimal effect of autofluorescence, signal-to-noise ratio improvement, etc. In this study, bright yellow fluorescent nitrogen-doped MQDs (N-MQDs) were successfully prepared using one-pot hydrothermal method. The synthesized N-MQDs showed maximum emission at 570 nm upon excitation wavelength of 420 nm with an optimum fluorescence quantum yield of 13.8 %. Interestingly, the emission of N-MQDs could be significantly quenched upon the addition of As^{3+} ion. Mechanism investigation revealed that static quenching were involved behind the fluorescence decrement via the formation of non-fluorescent complex due to the interaction of N-MQDs' functional groups and As^{3+}. The quenched fluorescence was surprisingly recovered upon the treatment of 2-amino-6-methoxybenzothiazole (MBTZ) in the complex. Strong interaction of MBTZ with As^{3+} lead to the detachment of quencher from N-MQDs resulted in fluorescence recovery. The re-appearance of N-MQDs' functional groups after the addition of MBTZ was confirmed from spectroscopic study. Thus, fluorescence "on/off/on" phenomenon was utilised from N-MQDs nanoprobe for instantaneous detection of As^{3+} and MBTZ. The values for limit of detection were calculated as 30 nM and 0.44 μM with a good linearity for respective As^{3+} and MBTZ. In addition, solid sensor has been fabricated to recognize As^{3+} in wastewater revealing its potentiality towards on-site application in near future.

OP-ESC-34

Facile Synthesis Of Magnetic Fe_2O_3/Activated Carbon Composite for the Removal of Cationic Dye From Synthetic Wastewater

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Abstract

Activated carbon derived from *Prosopis juliflora* seeds (PJAC) was synthesized, magnetized, and utilized for the removal of methylene blue (MB) from aqueous solutions. Magnetization was achieved by treating PJAC with a diluted Fe_2O_3 solution, forming Fe_2O_3/AC (MPJAC). The structural and surface properties of both PJAC and MPJAC were characterized using X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FT-IR), scanning electron microscopy (SEM), Brunauer-Emmett-Teller (BET) surface area analysis, energy-dispersive X-ray spectroscopy (EDAX), X-ray photoelectron spectroscopy (XPS), vibrating sample magnetometry (VSM), and zero-point charge (pHpzc) measurements. The BET surface areas of PJAC and MPJAC were 850.55 m2/g and 720.33 m2/g, respectively. Batch adsorption experiments were conducted to evaluate the effects of pH, contact time, and initial MB concentration. Adsorption data for both PJAC and MPJAC fit well with the Langmuir isotherm model, yielding maximum adsorption capacities (qmax) of 333.3 mg/g for PJAC and 500 mg/g for MPJAC. Kinetic studies revealed that adsorption followed a pseudo-second-order model. The presence of magnetite nanoparticles on MPJAC significantly enhanced its separation efficiency, allowing for easier recovery of the solid phase from the aqueous solution after dye removal.

Keywords: Activated Carbon; Magnetization; Adsorption; Methylene Blue Removal; Langmuir Isotherm.

OP-ESC-35

HPTLC Phytochemical Profiling And Free Radical Scavenging Activity Of Novel Polyherbal Formulation

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Abstract

The present study investigates the phytochemical composition and free radical scavenging potential of a novel polyherbal formulation comprising *Trigonella foenum-graecum* (Fenugreek), *Carum copticum* (Ajwain), *Zingiber officinale* (Ginger), *Chrysanthemum coronarium* (Garland Chrysanthemum), *Curcuma aromatica* (Wild Turmeric), *Cuminum cyminum* (Cumin), and *Nigella sativa* (Black Jeera). Ethanolic extracts of the formulation were obtained using Soxhlet extraction and evaluated through preliminary phytochemical screening, total phenolic content (TPC), total flavonoid content (TFC), DPPH radical scavenging assay, and High-Performance Thin-Layer Chromatography (HPTLC) analysis.Phytochemical screening confirmed the presence of flavonoids, alkaloids, steroids, terpenoids, tannins, phenols, saponins, and proteins. The extract demonstrated strong antioxidant activity with 83% DPPH inhibition at 100 µg/mL, along with significant levels of phenolic and flavonoid compounds. HPTLC fingerprinting revealed a characteristic flavonoid band at Rf 0.18, closely comparable to quercetin. These results indicate that the polyherbal formulation possesses notable antioxidant and free radical scavenging properties, supporting its potential application in natural product research and phytopharmaceutical development.

Keywords: Polyherbal formulation, Phytochemical profiling, HPTLC fingerprinting, Antioxidant activity, Free radical scavenging

OP-ESC-36

Synthesis, Characterization and Photocatalytic study of Al Doped CeO_2

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Abstract

Water pollution due to pharmaceutical products is a major concern to society. Al doped CeO_2 has been synthesized using co-precipitation method and characterized by various techniques like XRD, IR, SEM-EDAX, DRS etc. The photocatalytic performance was evaluated by degradation of pharmaceutical product under visible light. The presence of Al in CeO_2 decreases the band gap thereby extending the absorption in visible region. CeO_2 has negligible photoactivity whereas $Ce_{0.9}Al_{0.1}O_2$ show enhanced activity for the degradation of Oxcarbazepine. The degradation products were validated by HPLC technique.

Keywords: Doped, Photocatalytic, Degradation, pollutant, light

OP-ESC-37

Thermal Studies on the Influence Of Copper/Cobalt Nanoparticles in the Bis (4-Propargyloxyphenyl)Sulfone Matrix Resin System

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Abstract

The material bis(4-propargyloxyphenyl)sulfone (SPE) was prepared using phase transfer catalyst. The synthesized bis(4-propargyloxyphenyl)sulfone was blended with copper and cobalt nanoparticles (3%) separately by wt% ratio. The structural characterization of these materials were done using Fourier-Transform Infrared Spectrophotometer (FTIR). FTIR studies indicated that the blending of copper/cobalt nanoparticles did not show any interaction with pure matrix resin. The curing characteristics of synthesised pure and its blends were investigated using Differential Scanning Calorimetry (DSC). From DSC studies the presence of the copper nanoparticle in SPE shifts the curing temperature to lower temperature region and cobalt nanoparticle shifts the curing temperature to higher temperature region. The nature of the DSC curves obtained provides sufficient information regarding the interaction existing between SPE and nanoparticles. The copper nanoparticle incorporated SPE shows bimodal exotherm. Thermal properties of pure and blends were investigated using Thermogravimetric Analyzer (TGA). From TGA studies the presence of both nanoparticles in SPE increases the thermal stability of the pure material around 15°C and also increases the char residue around 25% at 800°C. From the TG data, it is reasonable to conclude that blending of copper and cobalt nanoparticles with propargyl resin definitely alters the nature of the TG curve indicating reasonable interaction between these two materials. The synthesized materials of bis(4-propargyloxyphenyl)sulfone are used in aerospace structures, electrical and electronic components.

Key words: Propargyl ether, Nanoparticles effect, DSC, TGA

OP-ESC-38

Sustainable Fluorescent Inks for Tamper-Proof Credentials

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Abstract

Counterfeit credentials compromise institutional integrity and consumer trust. This study explores the development of fluorescent security inks using Carbon Quantum Dots (CQDs) synthesized from biomass precursors like orange peel and sugarcane bagasse. The CQDs exhibit strong blue-green fluorescence under UV light (365 nm), with quantum yields of 12–18%. These inks were formulated into printable matrices and applied to paper substrates, producing ornamental motifs and QR-style codes that remain invisible under ambient light but glow vividly under UV. The inks demonstrated long-term stability, tamper-resistance, and eco-safety, offering a scalable green solution for secure authentication. Biomass (bananna bract peel) processed via hydrothermal treatment at 180 °C for 6 h. It was characterized using UV-Vis, PL spectroscopy, TEM (2–6 nm spherical dots), FTIR for surface groups.CQDs blended with biodegradable polymer matrix and glycerol for viscosity. It was printed using Inkjet and screen printing on paper substrates. It was tested using Fluorescence under UV (365 nm), aging stability (6 months), tamper-resistance (solvent and abrasion tests), cytotoxicity (MTT assay on HEK293 cells). CQDs showed stable fluorescence with emission peaks at 450–520 nm. Printed patterns remained invisible in daylight but revealed high-contrast motifs under UV. Fluorescence intensity retained >90% after 6 months. Tampering attempts led to irreversible fluorescence loss, confirming security efficacy. MTT assay showed >95% cell viability, confirming non-toxicity. The ornamental designs enhanced visual appeal while embedding secure verification. EcoFlare ID demonstrates a sustainable, secure, and visually engaging approach to credential authentication. CQD-based inks offer a green alternative to conventional security materials, with strong potential for academic, governmental, and commercial applications.

Keywords: Carbon Quantum Dots, Fluorescent Ink, Biomass, Tamper-Proof

OP-ESC-39

Biogenic Fabrication of Lead Oxide Nanoparticles from Lawsonia inermis and Their Impact on Seed Germination

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Abstract

Green synthesis has attracted considerable attention as a reliable, sustainable, and eco-friendly approach for producing a wide variety of nanomaterials, including metal oxide nanoparticles, hybrid materials, and bio-inspired structures. This method is increasingly recognized as a vital alternative to conventional synthesis techniques, which often involve hazardous chemicals and generate harmful byproducts. In particular, the biological synthesis of lead oxide (PbO) nanoparticles has emerged as a promising substitute for traditional chemical methods, effectively minimizing associated environmental and health risks.In this study, Lawsonia inermis (henna) extract was employed to synthesize PbO nanoparticles via the sol-gel method. The resulting nanoparticles were subsequently evaluated for their impact on mung bean (Vigna radiata) seed germination, demonstrating notable effects on both germination rates and early plant growth.

Keywords: Lawsonia inermis, Lead oxide nanoparticles, Green synthesis, Eco-friendly method

OP-ESC-40

Glow Safe Pack: Smart Packaging with CQD-Based Spoilage Indicators

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Abstract

Food spoilage and pharmaceutical contamination are major public health concerns, often exacerbated by packaging that lacks real-time freshness indicators. This project explores the development of smart packaging materials embedded with Carbon Quantum Dot (CQD)-based fluorescent indicators, synthesized from biomass precursors. These CQDs respond to spoilage-related triggers such as pH shifts, microbial activity, or gas emissions—by changing color or glowing under UV light. Experimental trials confirmed visible fluorescence transitions aligned with spoilage stages, offering a sustainable, intuitive solution for safety assurance and waste reduction. Biomass sources (banana peel, citric acid) were subjected to hydrothermal treatment at 200 °C for 6 h. CQDs were embedded in pH-sensitive polymer matrices and coated onto cellulose-based packaging films. CQDs exhibited strong fluorescence with emission peaks shifting from blue to green as pH dropped from 7 to 4. Packaging films responded to spoilage within 24–48 h, revealing glowing motifs or visible color transitions. Ammonia exposure caused fluorescence quenching, indicating contamination in pharmaceutical vials. The films remained stable under refrigeration and ambient conditions for up to 30 days. MTT assay confirmed >95% cell viability, validating the non-toxic nature of the CQD films. The system offers a scalable, biodegradable solution for intelligent packaging across food and pharma sectors.

Keywords: Carbon Quantum Dots, Smart Packaging, Spoilage Detection.

OP-ESC-41

Eco Friendly Synthesis of Metal Oxide Nanoparticles From Plant Leaves And Their Potential Applications: A Review

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Abstract

The past few years have seen a rise in emphasis on the synthesis of NPs using plant extracts, driven by their eco-friendly nature and low toxicity to humans. MNPs produced through green synthesis methods have attracted global interest due to their distinctive physicochemical properties and wide-ranging applications in biotechnology. As the demand for sustainable green chemistry practices rises, the production of metal and metal oxide nanoparticles has gained significant traction. Biosynthetic approaches to nanoparticle fabrication are particularly favored for their environmental benefits, simplicity, cost-effectiveness, and cleanliness, as they eliminate the need for hazardous chemicals and generate no harmful byproducts. Among various biological sources, plant extracts have emerged as a prominent choice for their dual role in reducing and stabilizing MNPs in a single-step process, thanks to their natural properties. Plants, as biological considered safe and are rich in reducing and capping agents. In addition to reviewing recent developments in plant-mediated synthesis of nanoparticles NPs, such as those of gold, platinum, copper, palladium, silver , titanium dioxide, and zinc oxide, and their various uses, this review delves into the basic ideas of green chemistry.

OP-ESC-42

Modelling and Simulation of Organic (Diketopyrrolopyrrole) Field Effect Transistors (OFETs)

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Abstract

This study investigates the electrical performance of Organic Field Effect Transistors (OFETs) using Diketopyrrolopyrrole (DPP) derivatives as the active organic semiconductor layer. The work focuses on Bottom Gate Top Contact (BGTC) and Bottom Gate Bottom Contact (BGBC) configurations, simulated using the Silvaco Atlas TCAD tool. Key electrical parameters such as field-effect mobility, threshold voltage, subthreshold slope, and on/off current ratio were analyzed to evaluate device efficiency. Simulation results indicate that the BGBC structure exhibits superior charge transport properties compared to BGTC. The hole mobility reached approximately 1.42 $cm^2/V \cdot s$, while the threshold voltage was around –2.1 V, showing stable switching behavior. The on/off current ratio exceeded 10^5, and the subthreshold slope was recorded at 0.65 V/dec, confirming efficient carrier modulation. The enhanced performance is attributed to the strong π–π stacking, planar molecular conformation, and low contact resistance in DPP thin films. These findings demonstrate that DPP-based OFETs combine high charge carrier mobility with robust environmental stability, making them promising candidates for flexible, low-cost, and energy-efficient organic electronic devices.

Keywords: Organic Field-Effect Transistors (OFETs), Diketopyrrolopyrrole (DPP) Derivatives.

OP-ESC-43

Green synthesis and characterization of Cerium oxide Nano particles using Plant leaf extract –A comparative study

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Abstract

The present study focuses on the green synthesis of cerium oxide (CeO_2) nanoparticles using aqueous leaf extracts of *Gloriosa superba L.*, *Artabotrys hexapetalus*, and *Justicia adhatoda*, and compares their physicochemical characteristics and biological activities. The green synthesis approach offers an eco-friendly, cost-effective, and sustainable alternative to conventional methods, utilizing phytochemicals as natural reducing and stabilizing agents. The synthesized CeO_2 nanoparticles were characterized using various techniques, including UV-Vis spectroscopy, FTIR, XRD, SEM, and TEM, to evaluate their optical, structural, and morphological properties. The comparative analysis revealed significant variation in particle size, shape, and crystallinity depending on the plant extract used. Furthermore, the biological activities of the synthesized nanoparticles were assessed through antioxidant, antimicrobial, and cytotoxic assays. Among the three plant-mediated nanoparticles, CeO_2 synthesized using *Gloriosa superba* exhibited superior antioxidant and antibacterial activities, likely due to its unique phytochemical composition and smaller particle size. This study highlights the influence of plant biomolecules on nanoparticle characteristics and bioactivity, underscoring the potential of green-synthesized cerium oxide nanoparticles in biomedical and environmental applications.

Keywords: Green synthesis, Cerium oxide nanoparticles, *Gloriosa superba*.

OP-ESC-44

Lanthanum decorated TiO_2 and upgrade sensitization on Ammonia gas

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Abstract

The effect of the optical, structural, electrical and gas sensor characteristics of pure and lanthanum doped TiO_2:LaNps.The X-ray diffraction pattern indicates the samples have grown in a tetragonal phase with(101) preferential orientation. Optical properties of UV spectra showed that the all samples had high reflectance >80% in the visible spectrum and energy gap was observed to be in the range from 3.49 to3.4eV which increases upto7.5% of La. The PL spectra showed a dominant UV emission peak that slightly shifted to higher wavelength with increasing doping concentrations of the sample. The Raman spectroscopy of the all samples shows the Raman lines around141.2, 406.8, 527.3, and 649.4cm-1 attributed to Eg (High), B1g (LO), A1g (LO), Eg (LO), respectively. The NP size of synthesized TiO2:La was determined by TEM. Images of TEM shows that the size of *particles of TiO2:La nanoparticles with average crystallite size ~7 nm*. *Detect due to oxygen vacancy in the prepared TiO2:La sample were manifested in the PL and Raman spectra characteristics*. Thermal behaviour of the sample showed a weight loss at about 400oC by an exothermic reaction with a maximum weight lose rate of 12% min and complete decomposition of sample was observed within 50 min with heating rate of 10oC/min. The grain boundaries pointedly contributed to the characteristics of the gas sensor are exhibited in parameters that represent the low frequency behavior of the electrochemical system which was analyzed by the impedance spectroscopy .Though the search for a detailed instrument endures, the change in resistance to a definite gas is commonly attributed to transport processes such as adsorption and charge transfer.

Key words: charge carriers, adsorption edges, Titaniumtetraisopropoxide, anatase, crystallite

OP-ESC-45

Nano Fusion for Health: CQD–NiO Composite Sensors from Waste to Wellness

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Abstract

This study presents the green synthesis and application of a Carbon Quantum Dot–Nickel Oxide (CQD–NiO) nanocomposite for electrochemical sensing of biologically significant analytes such as dopamine, uric acid, glucose, and hydrogen peroxide. CQDs were derived from biomass precursors and combined with eco-friendly NiO nanoparticles to form a synergistic sensor material. The composite exhibited enhanced conductivity, redox activity, and surface reactivity. Electrochemical tests confirmed high sensitivity, selectivity, and stability, positioning the sensor as a sustainable platform for real-time biomedical diagnostics. TEM and XRD confirmed uniform CQD dispersion on NiO nanoparticles (5–10 nm). CV and DPV showed distinct redox peaks for dopamine and uric acid with detection limits in the nanomolar range. Glucose and H_2O_2 detection exhibited linear response over wide concentration ranges. EIS revealed reduced charge transfer resistance due to CQD enhancement. Real sample recovery rates ranged from 96–102%, confirming practical applicability. The sensor maintained >90% signal stability over 30 days, demonstrating durability and reproducibility.

Keywords: Carbon Quantum Dots, Nickel Oxide, Electrochemical Sensor, Dopamine Detection.

OP-ESC-46

Development Of Nutrient Rich Herbal Biscuits Using Oats, Almond and Corn Flour: A Fusion Of Health And Taste

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Abstract

The study was conducted to evaluate the quality attributes of biscuits produced from oats, almonds and corn flour. The increasing demand for nutritious snacks has prompted the development of herbal biscuits that combine health benefits with appealing flavors. This study focuses on creating nutrient-rich herbal biscuits using oat, almond, and corn flour as primary ingredients. Oats are known for their high fiber content, which aids digestion and promotes heart health. Almond flour adds essential vitamins and healthy fats, while corn flour provides a gluten-free option and enhances texture. The formulation of the biscuits integrates a blend of natural herbs, including turmeric, ginger, and rosemary, which are recognized for their antioxidant and anti-inflammatory properties. This fusion not only enhances the nutritional profile but also contributes unique flavors and aromas, appealing to health-conscious consumers. A series of experiments were conducted to determine the optimal ratios of the three flours and herbal additions, balancing taste, texture, and nutritional value. Sensory evaluations involving a panel of consumers assessed the acceptability of the biscuits, focusing on attributes such as flavor, aroma, crunchiness, and overall satisfaction. Nutritional analysis indicated that the final product is rich in protein, dietary fiber, and essential nutrients, making it a suitable snack for various dietary needs. The study concludes that these herbal biscuits successfully merge health and taste, providing a viable alternative to traditional snacks. This product not only caters to the growing market for health-oriented food options but also promotes the consumption of functional ingredients. Future research will explore shelf-life stability and potential health benefits through clinical studies, further establishing these biscuits as a nutritious addition to everyday diets.

Key words: Biscuits, Oats, Nutritional Composition, sensory evaluation

OP-ESC-47

Quality Characteristics of Biscuits Produced From Black Rice, Nuts and Seeds in Blended Flour

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Abstract

Biscuits are one of the most popular bakery products made from cereal that are consumed by all peoples in the world. They are snacks produced from unsweetened dough that is changed into an interesting product by baking. The study was conducted to evaluate the quality attributes of biscuits produced from black rice, nuts and seeds blended flours. Three Biscuits samples were made with varying proportion of 100%, 70% and 60% black rice replaced with and defatted seeds flours respectively. The Biscuits samples were baked and analyzed for nutritional compositions and sensory evaluation. The sample had evaluated moisture (2.89), total ash (2.04), fat (34.52), crude fiber (BDL(DL:0.10)), energy (552.88), protein (8.26), carbohydrates (52.29). Incorporation of wall nuts, badam, pista, cashew and sesame seed flours increased the moisture, ash, protein, and fat contents while increasing the composite flours and reduced the carbohydrate content in the biscuits. Sensory assessment revealed a significant difference between the control sample and the composites in terms of colour, flavour, taste, texture and overall acceptability of the biscuits.

Key words: Biscuits, black rice, nutritional composition, sensory evaluation, bakery product

OP-ESC-48

Synthesis And Characterization of Biodegradable Starch-Based Bioplastics from Custard Apple Seeds

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Abstract

The increasing environmental concerns over plastic pollution have driven the development of biodegradable alternatives to conventional plastics. This research focuses on the synthesis and characterization of starch-based bioplastics derived from custard apple (*Annona squamosa*) seeds, an underutilized agro-waste product. Custard apple seeds, rich in starch content, offer a promising renewable resource for bioplastic production. The study involves extracting starch from custard apple seeds and incorporating plasticizers to enhance the mechanical properties of the resulting bioplastic. The synthesized bioplastic is characterized through various analytical techniques, including Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and thermogravimetric analysis (TGA), to evaluate its structural, thermal, and mechanical properties. The biodegradability of the material is also assessed through soil burial tests, comparing its degradation rate with that of conventional plastics.

Keywords: *Annona squamosa,* Bio-based polyester, bioplastics, renewable resources, custard apple seeds.

OP-ESC-49

Bio-Assisted Synthesis and Characterization of Selenium Nanoparticle Using Leaves Extract of *Allmania Nodiflora* And Evaluation of Its Photocatalytic Activity

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Abstract

The present study focuses on the green synthesis, characterization, and antimicrobial evaluation of selenium nanoparticles (Se NPs) synthesized using the leaf extract of *Allmania nodiflora*, a medicinal plant known for its bioactive compounds. This eco-friendly method serves as a sustainable alternative to conventional chemical synthesis, eliminating the need for hazardous reagents and harsh conditions. The synthesized Se NPs were characterized using multiple analytical techniques including UV-Visible spectroscopy (UV-Vis), Fourier Transform Infrared Spectroscopy (FT-IR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM), and Energy Dispersive X-ray Spectroscopy (EDX). The UV-Vis spectrum showed a strong absorption peak around 260 nm, confirming the formation of Se NPs. FT-IR analysis indicated the presence of various functional groups from the plant extract, suggesting their role in the reduction and stabilization of the nanoparticles. XRD patterns revealed that the synthesized Se NPs possess a crystalline structure consistent with hexagonal wurtzite phase. SEM images demonstrated that the nanoparticles were predominantly spherical in shape, while EDX confirmed the elemental composition of selenium. Antibacterial assays showed that the Se NPs exhibited significant inhibitory activity against *Staphylococcus aureus*, a common human pathogen. These findings highlight the potential of *Allmania nodiflora*-mediated Se NPs as promising antibacterial agents for biomedical applications.

Keywords: *Allmania nodiflora,* Bio-assisted Se NPs synthesis, Antibacterial.

OP-ESC-50

Eco-Friendly Synthesis of TiO_2 Nanocomposite Using Medicinal Plant Extract: Photocatalytic and Antimicrobial Application

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Abstract

A TiO_2 nanocomposite was successfully synthesized using an eco-friendly green synthesis approach with *Nilgirianthus ciliates* plant extract. The structural and morphological properties of synthesized green TiO2 nanocomposite were characterized using FT-IR, powder-XRD, and SEM to confirm its structural, optical, and morphological properties. FTIR confirmed Ti-O-Ti and Ti-O stretching vibrations, while XRD analysis identified the anatase phase. SEM analysis represented the surface morphology of synthesized green TiO_2 particles, and it confirmed that the plant extract reduces particle agglomeration compared to pure TiO_2. Additionally, EDX and elemental mapping verified the presence of essential elements in the composite. Photocatalytic studies exhibited efficient ciprofloxacin mineralization under UV light, with an optimal catalyst dosage of 100mg, along with good sustainability. Furthermore, the synthesised green-TiO2 particles exhibited satisfactory antimicrobial activity against the tested human pathogens, particularly at higher concentrations. These studies highlight the potential of green-synthesized TiO_2 for environmental and biomedical applications.

Keywords: Green synthesis, *Nilgirianthus ciliates,* TiO_2, Photodegradation, Antimicrobial studies.

OP-ESC-51

Green Synthesis Of Zinc Oxide Nanoparticles Using Of *Nilagirianthu Ciliatus* For The Control Of Mosquitoes And Pathogenic Microbes.

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Abstract

The investigation highlights the significance of managing mosquito vectors to control arbovirus diseases worldwide, and their main vectors, *Aedes aegypti* is essential for assessing disease transmission risk and for better planning of control interventions. The main objective of this study is to utilize nanoparticles for control of the mosquitoes. The intention of this study was also to synthesis cost-effective, non-toxic and green routed metal nanoparticles (NPs) using *Nilagirianthu ciliatus* plant extract as reducing and capping agents without any hazardous material. Zinc oxide (ZnO) nanoparticles were synthesized in the present study using aqueous leaf extract of *N. ciliatus* and characterized using UV–visible spectroscopy, FT-IR, XRD, SEM and DLS analyses. Furthermore, the nanoparticles were used as insecticidal agent against the dengue vector, *Ae. aegypti* and the grain storage pest, *Sitophilus oryzea.* The mechanistic action of the nanoparticles on the dengue vector was revealed through histopathological analysis that showed severe tissue damage in the epithelial and goblet cells in the larval midgut region. In addition, the antimicrobial study showed efficiency of nanoparticles in controlling bacteria and fungi. ZnO nanoparticles also inhibited the biofilm formation by *Staphylococcus aureus* and *Escherichia coli*. The antioxidant activity demonstrated the potential ability of free radical scavenging by ZnO nanoparticles. Finally, ZnO nanoparticles proved to exhibit photocatalytic degradation of crystal violet (CV). The results of the present study suggest that *N. ciliatus* mediated ZnO nanoparticles has a wide range of biomedical applications.

Keywords: *N. ciliates, Zinc* oxide (ZnO) nanoparticles, *Ae. aegypti, Sitophilus oryzea*

OP-ESC-52

Extraction Of Oil From *Acalypha Indica* Seeds And Its Application In Cosmetic Product Development

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Abstract

The present study investigates the extraction, characterization, and cosmetic application of seed oil derived from *Acalypha indica Linn.*, a traditionally valued yet underexplored medicinal plant. Seeds were collected, authenticated, and subjected to Soxhlet extraction using ethanol and n-hexane as solvents. The purified oil was characterized through FTIR, GC–MS, and HPLC analyses, confirming the presence of key bioactive compounds such as linoleic acid, oleic acid, tocopherols, and β-sitosterol. Physicochemical evaluation revealed favorable properties including suitable viscosity, pH, and high antioxidant potential. Antimicrobial assays demonstrated broad-spectrum activity against *Escherichia coli*, *Staphylococcus aureus*, *Corynebacterium diphtheriae*, and *Candida albicans*. The extracted oil was utilized in the formulation of herbal soap and shampoo, both of which exhibited desirable quality attributes—soap with high total fatty matter (70%), good hardness, stable foaming (>6 minutes), and low moisture (7.1%), and shampoo with scalp-friendly pH (6.0 ± 0.2), high foaming capacity (165 ± 4 mL), optimum viscosity (2,280 cP), low surface tension (33.1 dynes/cm), and effective antimicrobial activity. Sensory evaluation confirmed smoothness, shine, and user acceptability. Overall, *Acalypha indica* seed oil demonstrates significant potential as a sustainable, multifunctional ingredient in cosmetic formulations, combining cleansing efficiency with antimicrobial, moisturizing, and conditioning benefits.

OP-ESC-53

Synthesis of Novel Bio-Active 2,3,5,6-tetrafluro phenyl substituted Bis-Chalcones

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Abstract

In this study, four novel bis-chalcone compounds (BC 1-4) were successfully synthesized in yields exceeding 90% via Claisen-Schmidt condensation reaction of 2,3,5,6-tetrafluoroterephthaldehyde with four different acetophenones, utilizing sodium hydroxide as a catalyst. The synthesized compounds were characterized and confirmed using physical properties and spectral techniques like FT-IR, UV-Visible, and HR-MS to confirm their structure. The FT-IR analysis revealed the presence characteristic functional groups, while UV-Visible spectra results represent strong absorbance by the active carbonyl groups around 350 to 385nm. Additionally, HR-MS data validated the formation of the synthesized compounds (BC 1-4) based on the accurate molecular masses. The synthesized compounds exhibited satisfactory antimicrobial activity against the tested human pathogens, with BC 3 showing particularly strong activity at higher concentrations compared to the standard drug. These results suggest that the synthesized compounds have significant potential to effectively inhibit microbial strains.

Keywords: Bis-Chalcones, Claisen Schmidt reaction, FT-IR, UV-Visible spectroscopy, antimicrobial study.

OP-ESC-54

Extraction of Oil from Passiflora foetida Seeds and Its Application in Cosmetic Product Development

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Abstract

The present research focused on the extraction, characterization, and evaluation of the biological potential of Passiflora foetida seed oil with specific applications in cosmetic formulations such as soap and shampoo. Seeds were collected from rural regions of Tamil Nadu and authenticated botanically before solvent extraction using Soxhlet apparatus and distillation methods. The extracted oil was subjected to advanced analytical characterization techniques, including Fourier Transform Infrared Spectroscopy (FTIR), Gas Chromatography–Mass Spectrometry (GC–MS), and High-Performance Liquid Chromatography (HPLC), to identify its fatty acids, sterols, tocopherols, and phenolic content. Results revealed a predominance of unsaturated fatty acids, particularly linoleic acid, oleic acid, and palmitic acid, along with the presence of phytosterols and natural antioxidants. Biological evaluation demonstrated significant antibacterial activity of the oil against pathogenic bacterial strains such as Escherichia coli, Proteus mirabilis, Staphylococcus pyogenes, and Corynebacterium diphtheriae, with zones of inhibition confirming its therapeutic relevance. Furthermore, soap and shampoo formulations incorporating P. foetida seed oil were prepared and characterized using standard parameters, including pH, foaming ability, viscosity, total fatty matter, and surface tension. Results indicated that the formulations exhibited desirable physicochemical properties, superior moisturizing effects, and antimicrobial protection compared to conventional formulations. This study establishes P. foetida seed oil as a sustainable, underutilized plant-based resource with promising applications in pharmaceutical, nutraceutical, and cosmetic industries,traditional knowledge with modern scientific validation.

OP-ESC-55

Production Of Aloe Vera Cocount Jaggery Balls

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Abstract

This research was designed to produce a nourishing peanut energy bar and jaggery balls with commercial value especially for malnourished children to meet their body development requirements. Among the Various possible approaches to tackle the problem of malnutrition, food based approach is considered the most sustainable one, despite being a long term strategy. Hence, exploring the possibility of value addition to traditional products like energy bars, laddo, mathari and biscuits could be a better option to enhance the intake of micro-nutrients. Nutrition bars are supplemental bars containing high energy foods. . The test parameters of the best product, Moisture content is 5.59 g, Ash content is 0.57 g ,Fat conent is 1.45 g,Crude fibre content is 4.47 g , protein content is 1.16 g , Carbohydrate Content is 86.76g and Energy364.73 (kcal). Jaggery ball should be recommended for all age groups as it helps to boost immunity and also improves physical growth and good memory.

Key Words: Aloe vera, Jaggery,Coconut, Honey,Lemon and

OP-ESC-56

Green Synthesis and Characterization of Silver Nanoparticles Using *Carica papaya* Extract and Evaluation of Their Anti-atherosclerotic Activity

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Abstract

This study aims to biosynthesize silver AgNPs employing *Carica papaya* leaf extract, characterize the physicochemical properties and explore their anti-atherosclerotic potential. Fresh *C. papaya* leaves were macerated to extract bioactive polyphenol compounds. Total phenolic content was determined by the Folin–Ciocalteu method. AgNPs were synthesized using green reduction, and their properties were characterized by UV–visible spectroscopy, scanning electron microscopy (SEM), X-ray diffraction (XRD), zeta potential analysis, and Fourier-transform infrared spectroscopy (FTIR). In vitro cell line models were used to evaluate cytotoxicity and antiatherosclerotic activity (e.g., assessments of lipid uptake, oxidative stress, or endothelial function). UV–visible spectra displayed the characteristic surface plasmon resonance peak at ~ 480 nm, confirming AgNP formation. SEM imaging showed well-dispersed, predominantly spherical nanoparticles. The XRD patterns revealed distinct crystalline phases corresponding to silver. In cell line studies, AgNPs exhibited acceptable biocompatibility and showed significant antiatherosclerotic effects (e.g., reduced lipid peroxidation, improved endothelial cell markers). Biogenically synthesized AgNPs using *C. papaya* leaf extract exhibit favourable physicochemical properties, stability, biocompatibility, and promising *in vitro* antiatherosclerotic efficacy.

Keywords: Green synthesis; *Carica papaya*; silver nanoparticles; antiatherosclerosis; nanobiotechnology.

OP-ESC-57

Computational Studies And Hirshfeld Surface Analysis On The Crystal Structure of Bis-Dimethyl Ammonium 4-Nitrobenzoate

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Abstract

The single crystal of dimethylammonium 4-nitrobenzoate is synthesized by slow evaporation technique using Tetrahydrofuran (THF) as a solvent. The single crystal X-ray diffraction studies manifest the crystallinity of the crystal in monoclinic crystal system with space group C2/c and it shows supramolecular architectures composing of twelve membered ring with R44(12) motif. Computational studies have been performed using DFT calculations at 3LYP/6-311G(d,p) level of theory to comprehend the crystal structure with optimized geometry, molecular electrostatic potential (MEP), Mulliken atomic charges and first order hyperpolarizability. The intermolecular interactions of the crystal are determined by Hirshfeld surface analysis.

Key Words: Single crystal, Hirshfeld analysis, Slow evaporation, Optimized geometry

OP-ESC-58

Measurement Techniques for Aerosol in Air Pollution Studies: Advances And Challenging

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Abstract

As aerosols play a complicated role in atmospheric chemistry, climate forcing, and public health, measuring them has become an important part of air pollution research. Improvements in aerosol measurement methods, such as ground-based monitoring tools and remote sensing technologies, have made it easier to accurately measure the size, shape, and chemical makeup of particulate matter over time. Researchers have been able to capture fine-scale changes in aerosol size distribution, composition, and sources thanks to techniques like aerosol mass spectrometry, lidar-based remote sensing, and real-time monitoring. Even with these improvements, there are still big problems to solve, such as calibrating instruments, finding ultrafine and semi-volatile particles, aerosols' spatial heterogeneity, and high operational costs in places with few resources. To get around these problems, we need to use a combination of traditional monitoring, advanced analytical tools, and modelling frameworks to learn more about how aerosols behave and what that means for climate research and air quality management.

Keywords: Aerosol measurement, Air pollution, Remote sensing, Mass spectrometry, Monitoring challenges

OP-ESC-59

Catalytic Degradation of Malachite Green via Biodegradable MnO_2-Sodium Alginate Nanocomposite Hydrogels

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Abstract

This study presents the green synthesis, characterization, and application of a biodegradable MnO2-Sodium Alginate (MnO2-SA) nanocomposite hydrogel for the catalytic degradation of Malachite Green dye and removal of Cd(II) ions from aqueous solutions. The nanocomposite was fabricated via a facile ionic gelation technique using sodium alginate as a biopolymer matrix and MnO_2 nanoparticles as the catalytic core, offering structural stability and eco-friendly processing. Batch catalytic degradation experiments demonstrated that the MnO2-SA nanocomposite efficiently degraded Malachite Green under ambient conditions. Removal efficiency exceeded ~94.0% within 90.0 minutes at optimal pH and temperature conditions, indicating strong catalytic activity attributed to MnO2 redox properties and high surface functional group availability. Similarly, batch adsorption studies for Cd(II) ions revealed ~91.0% removal efficiency under optimized conditions, with adsorption following the Langmuir isotherm and pseudo-second-order kinetics, confirming monolayer chemisorption. Mechanistic investigations suggested that Malachite Green degradation occurred via a catalytic oxidation process mediated by Mn-O active sites, while Cd(II) removal was dominated by electrostatic interaction and ion exchange. Furthermore, the MnO2-SA hydrogel exhibited high stability and reusability, retaining over 85.0% efficiency after five cycles. These findings highlight the potential of MnO2-SA nanocomposite hydrogels as sustainable, efficient, and reusable catalysts for simultaneous organic dye degradation and heavy metal removal in wastewater treatment applications.

PP-ESC-01

Base Mediated Regioselective Ring-Opening Reaction Of Donor–Acceptor Cyclopropanes Using Tryptophan Esters

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Abstract

Donor–acceptor cyclopropanes (DACs) are versatile synthetic intermediates that undergo regioselective ring-opening reactions in the presence of nucleophiles. In this study, we investigate the base-mediated reactivity of DACs with tryptophan esters, leveraging the nucleophilicity of the indole ring and the activated amine moiety under mild basic conditions. The reactions proceed smoothly in the presence of organic bases, promoting selective cleavage of the strained cyclopropane ring to enabling the formation of C–C bonds adjacent to the indole core. The use of a base medium avoids the need for metal catalysts and acidic conditions, offering a more sustainable pathway. Preliminary mechanistic insights suggest a nucleophilic ring-opening pathway initiated by deprotonation and subsequent attack at the electron-deficient carbon of the cyclopropane. This methodology provides an efficient route to access structurally complex tryptophan-based building blocks with potential applications in medicinal chemistry and peptide modification.

Keywords: Donor-acceptor cyclopropanes, Tryptophan ester, Base-mediated ring-opening, Indole nucleophile

PP-ESC-02

Nickel And Cobalt Schiff Base Complexes as Effective Sensors for Selective Pesticides

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Over the past century, pesticides and agrochemicals in general have grown to be a significant part of global agricultural systems, enabling a discernible rise in crop yields and food production. At the same time, we have come to understand that agrochemical residues have spread in the environment, leading to considerable contamination of land ecosystems and poisoning human food. Hence there is a global need to sense the residual pesticide in green manner with short time thereby we can avoid consuming food contaminated by pesticide. Synthesize the schiff base from 2-hydroxy-1-naphthaldehyde and 2-amino pyridine by means of green synthesis. Equal mol of 0.5g of O- hydroxy naphthaldehyde and 0.2g of 2-amino pyridine was dissolved in 20ml of orange peel extract and stirred for 5 hours. The change in the color of reaction mixture from orange color to reddish brown color was observed during the course of the reaction. The TLC was checked at one-hour intervals. Equal amount of Schiff base and salt of Cobalt ($CoCl_2.6H_2O$) were dissolved in orange peel extract and stirred for 2 hours. Similarly, salt of Nickel ($NiCl_2.6H_2O$) taken to prepare Nickel complex. TLC was checked at particular time intervals. From the spectral and analytical data formation of Schiff base & complexes were confirmed. All the prepared Schiff base & complexes quenches the fluorescence on adding pesticides while subjected to the UV detector. From results obtained from UV visible spectroscopy and Photoluminescence Nickel complex with Cypermethrin shows noticeable quenching rather than with Cobalt complex. Hence, the residual Cymermethrin pesticide in vegetables and fruits were identified using Schiff base complex of Nickel (OSBN) through quenching mechanism. Real time analysis with Grapes showed fluorescence. Synthesized Schiff base, Cobalt complex and Nickel complex of naphthaldehyde aminopyridine Schiff base, which were subjected to sense the pesticides viz., Cypermethrin, Monocrotopos. It was found that the Ni complex acts as an effective sensor towards Cypermethrin.

Keywords: Schiff base, Cobalt & Nickel complexes, sensor for pesticide.

PP-ESC-03

From Macro To Nano: Advancing Frontiers In Adhesive Dentistry

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Abstract

Nanotechnology has opened new horizons in conservative dentistry by providing restorative materials with superior aesthetics, strength, and longevity. Secondary caries at the tooth–restoration interface remains one of the leading causes of composite restoration failure and continues to present a major challenge in restorative dentistry. To address this problem, researchers have explored the use of nanoparticles as pretreatment agents or as components of adhesive systems, aiming to combine enhanced adhesion with antibacterial and anticariogenic effects. Among the different nanoparticles investigated, including zinc oxide, titanium dioxide, hydroxyapatite, amorphous calcium phosphate, and bioactive glass, silver nanoparticles have consistently shown the most promising outcomes on enhancing the adhesion of composite restoration. Experimental studies show that silver nanoparticles significantly improve dentin shear bond strength compared with zinc oxide and titanium dioxide, without affecting enamel adhesion. When applied before acid etching, silver nanoparticles improved bond strength in both etch-and-rinse and self-etch systems and provide sustained antibacterial activity against cariogenic bacteria. Other nanoparticles such as titanium dioxide, amorphous calcium phosphate, and bioactive glass have been reported to preserve bond strength while promoting remineralization of tooth enamel and microbial resistance. Collectively, these findings emphasize that nanoparticle pretreatment not only enhances enamel and dentin bond strength but also imparts anticariogenic benefits. This poster highlights the clinical potential of nanoparticle pretreatment, emphasizing that integrating nanoparticles — particularly silver — into adhesive protocols can improve restoration longevity, reduce secondary caries, and advance restorative dentistry toward a nano-based future.

PP-ESC-04

Facile Synthesis of Zno/Cuo/$Ce_2(WO_4)_3$ Ternary Heterostructure with Improved Charge Separation for Visible-Light Driven Degradation of Congo Red Dye

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Abstract

An encouraging strategy to enhance light absorption, charge carrier dynamics, and stability for wastewater treatment is the design of ternary heterostructure photocatalysts. This study synthesized and used a ZnO/CuO/$Ce_2(WO_4)_3$ nanocomposite for the photocatalytic degradation of Congo red (CR), a benzidine-based anionic diazo dye with sulfonate groups and -N=N- azo linkages that provide high water solubility and structural stability. It is widely used in the leather, paper, and textile industries because of its vibrant coloring. It is also used in the textile industry and is known to be highly toxic, carcinogenic, and persistent in watery environments. CuO, a p-type semiconductor that forms a p-n junction and promotes charge carrier migration across the interface, was coupled with ZnO, a wide band-gap semiconductor with high oxidative potential. The addition of $Ce_2(WO_4)_3$ improved light harvesting even more and served as a redox-active element that sped up interfacial charge transfer. The three phases were successfully integrated, as demonstrated by structural and optical analyses, which also showed evidence of strong interfacial contact and inhibited recombination. The ZnO/CuO/$Ce_2(WO_4)_3$ system demonstrated significantly higher activity toward CR degradation, achieving almost total removal under visible-light irradiation, according to photocatalytic experiments. Synergistic heterojunction formation, effective photoinduced carrier separation, and better incident photon utilization are credited with the improved performance. These results imply that ZnO/CuO/$Ce_2(WO_4)_3$ ternary heterostructures have a great deal of potential for advanced oxidation procedures and the remediation of wastewater contaminated with dyes.

PP-ESC-05

Moringa Gum And Pectin-Based Hydrogel in Wastewater Treatment

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Abstract

In recent years, the progress in novel hydrogel represents a promising solution in challenges addressing wastewater treatment globally. Nowadays, natural materials are of great interest in the synthesis of hydrogels. In this study a novel hydrogel made through a hydrogel formulation approach with incorporation of natural polysaccharides Moringa gum and Pectin with synthetic polymeric cross linker system made via environmentally sustainable conditions. Different optimization conditions are employed such as backbone ratio, amount of initiator, concentration and pH. Recyclability test showed consistent sorption desorption behavior after multiple rounds of testing suggesting durability in use. Hydrogel features facilitate effective sorption of dyes and organic matter. This unique method allows us to minimize or eliminate the use of toxic reagents and was directed at room temperature for general applicability. This approach to hydrogel in this work is presented as an environmentally friendly and reusable, multifunctional material with significant efficacy for emerging water purification uses and an alternative to more traditional adsorbents.

Keywords: Hydrogels; Gum; polysaccharides; Adsorption; dye removal; environment friendly.

PP-ESC-06

Confiscation of Synthetic Dye by the Utilization of Eco-Gels

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Abstract

Growing water pollution from synthetic dyes necessitates sustainable adsorbents. A novel eco-gel was synthesized using flaxseed gum, almond gum, and PVA, crosslinked with citric acid and formaldehyde. Characterization (SEM, XRD, FTIR, TGA, swelling) confirmed porous structure and enhanced thermal stability. Adsorption showed high efficiency, fitting the pseudo-second-order kinetic model and suggesting chemisorption. The developed eco-gel is a promising, cost-effective material for sustainable wastewater treatment. Synthetic dyes are persistent water contaminants that require efficient and eco-friendly remediation. This study addresses this environmental challenge by developing a novel, sustainable bio-polymeric eco-gel derived from natural gums for highly efficient dye adsorption from industrial effluents. Synthesis utilized flaxseed gum, almond gum, PVA, and citric acid/formaldehyde crosslinkers. Characterization included SEM, XRD, TG-DTA, UV-Vis, and FTIR. Adsorption performance was assessed using synthetic dye solutions, applying isotherms (Langmuir, Freundlich, D-R, Temkin) and pseudo-second-order kinetic models. Characterization confirmed porous morphology (SEM), excellent swelling, and enhanced thermal stability (TGA). Adsorption showed high efficiency and capacity. Kinetic analysis adhered best to the pseudo-second-order model, indicating a chemisorption mechanism. The developed bio-polymeric eco-gel, utilizing almond gum and flax seed gums, are highly suited for applications where thermal stability and swelling are crucial. Its superior adsorption capacity makes it the preferred choice for cost-effective wastewater treatment and industrial effluent removal.

Key Words: Gum; Dyes; Gels; Adsorption

PP-ESC-07

Analytical Method Validation for New Materials: Compliance with ICH Q2(R1) Guidelines

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Abstract

Reliable characterization of new materials requires validated analytical methods to ensure accuracy, reproducibility, and regulatory compliance. The ICH Q2(R1) guideline provides a structured framework for validation, complemented by USP <1225> and ICH Q14 for method development. This study aimed to validate spectroscopy- and chromatography-based analytical methods for new material characterization in compliance with ICH Q2(R1), assessing their suitability for research and industrial applications. Validation experiments were performed to evaluate accuracy (recovery studies), precision (repeatability and intermediate precision), specificity (absence of interference), linearity (calibration curve correlation), and robustness (deliberate variations). Protocols followed ICH Q2(R1) and were cross-referenced with USP and EMA guidelines. The validated methods demonstrated accuracy within 98–102%, precision with relative standard deviation <2%, and strong linearity ($r^2 > 0.999$). Specificity studies confirmed no matrix interference, while robustness testing showed method resilience to small experimental changes. Analytical methods validated under ICH Q2(R1) were accurate, precise, specific, linear, and robust. These results confirm their reliability for regulatory compliance, ensuring high-quality data for both research and industrial applications in new materials.

Keywords: Analytical method validation; ICH Q2(R1); spectroscopy; chromatography; new materials; quality assurance

PP-ESC-08

Stress Meter: Skin Conductance To Measure Stress

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Abstract

Currently available human stress monitoring devices are either very inaccurate or rely on a strictly controlled laboratory environment. The purpose of stress meter is to assess the emotional pain of human being. The stress can cause hair to fall, acne to break out and many other problems. These manifestations of stress can cause even more anxiety. In this paper, we present the novel concept of a skin conductance to measure stress by using multimeter.The basic principle to measure stress by finding conduction of skin which changes due to sweat production. When stressed, the body responds by going into fight mode, while fight mode activates sweat production this produced sweat conducts current/electricity. A multimeter device can be used to measure this change in electrical conductivity of the skin, with higher conductivity indicating higher stress levels. Probes are attached to two different points on the skin; typically, the palm has high density of sweat glands.Multimeter device measures the resistance of the skin. Since conductivity is directly proportional to sweat production. Resistance varies inverse proportional to the stress. If the stress level is high the skin offers less resistance, and if relaxed resistance is high. The low resistance of the skin during high stress is due to an increase in the blood supply to the skin. This increases the permeability of the skin and hence the conductivity for electric current. The main advantage is that this multimeter device provides a way to monitor and potentially reduce stress by offering real-time feedback, allowing users to identify high-stress situations and take actions, such as deep breathing or relaxation techniques, to lower their stress levels. Stress meter can be further developed to design equipment like skin response meters; skin resistance meters. Stress is the very common condition of every human being socially. Finally, this stress meter allows assessing the emotional pain.

Keywords: Stress meter, resistance, conductivity, blood supply.

PP-ESC-09

Sealing ability and depth of penetration of chitosan nanoparticle incorporated in two different endodontic sealer using CSLM

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Abstract

Endodontic re-infections primarily occur due to the ingress of bacteria and their toxins through an incomplete seal following obturation. A variety of sealers have been developed to achieve effective integration with the different obturation materials and dentinal tubules. The root canal sealer should provide a “Monoblock effect”. Root canal sealers that penetrate deep into the dentinal tubules help to prevent microleakage and reinfection. Evaluate apical microleakage and depth of penetration of chitosan nanoparticle incorporated Mineral Trioxide Aggregate and ZOE, using CLSM. Twenty freshly extracted single rooted teeth were used and divided into 2 Groups Group I (N=10) SUBGROUP IA (N=5)- MTA Fillapex, SUBGROUP IB (N=5)- ZOE, Group II (N=10) SUBGROUP IIA (N=5)- MTA Fillapex+ CNP, SUBGROUP IIB (N=5)- ZOE+CNP. The root canals were prepared using rotary files and obturated. All samples were immersed in rhodamine B dye to assess both penetration depth into dentinal tubules and interfacial adaptation. All groups exhibited different apical dye leakage and depth of penetration of sealers. Lowest mean leakage and highest sealer penetration was observed in Sub group IIA while the maximum mean leakage and minimum depth of penetration of sealers was observed in Sub group 1B was observed. All the chitosan nanoparticles incorporated sealers exhibit varying degrees of sealing, with enhanced sealing ability. CNP-incorporated Mineral Trioxide Aggregate exhibit superior sealing ability and deeper penetration compared to ZOE.

PP-ESC-10

Indian Jujube Seed–Derived Carbon Dots: Fluorescence Properties And Potential Applications

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Abstract

The utilization of biomass as a renewable and sustainable resource has received a lot of attention all over the world, according to the researchers. In this study, for the first time, the Indian jujube seeds were utilized as a green precursor for the synthesis of fluorescent carbon nanomaterials by the one-step hydrothermal method, and their applications were explored. The morphology and spectral characteristics of carbon dots are studied using microscopic and spectroscopic techniques such as scanning electron microscopy (SEM) and high-resolution transmission electron microscopy (HR-TEM), UV-Vis absorption spectroscopy, fluorescence spectroscopy, Raman spectroscopy, and Fourier transform infrared spectroscopy (FTIR). As synthesized carbon dots show a typical excitation-dependent emissive character due to the presence of multiple functional groups, they are studied for the application in drug delivery, bio-imaging, and ion detection. Their performance in the application is validated by photophysical parameters for effective optimization. To summarize, this study highlights the efficiency, reproducibility and greener method of synthesizing carbon dots from Indian jujube seeds for potential applications.

Keywords: Indian jujube seeds, Carbon Dots, Fluorescence, Sensors, Nanomaterials.

PP-ESC-11

Enhanced Photocatalytic Performance of La-Doped $ZnIn_2S_4$ for Degradation of malachite green dye under direct sunlight

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Abstract

Zinc indium sulfide ($ZnIn_2S_4$), a layered ternary metal chalcogenide, has emerged as a promising visible-light-responsive photocatalyst for applications in energy conversion. Its tunable bandgap, broad light absorption, high stability, and eco-friendly nature make it an attractive candidate for sustainable photocatalysis. Elemental doping has proven to be an effective strategy to optimize the electronic structure and facilitate charge separation. In this study, Lanthanum(La) doped $ZnIn_2S_4$ was synthesized via hydrothermal method. Systematic characterizations, including UV–vis diffuse reflectance spectroscopy, Raman spectroscopy, and high-resolution transmission electron microscopy (HRTEM), demonstrated that La-doping slightly broadened and strengthened visible-light absorption and increased the specific surface area. Electrochemical measurements further revealed improved photocurrent response, with the maximum photocurrent density achieved at a La content of 1.5 wt%. Consistently, La-doped $ZnIn_2S_4$ exhibited superior photocatalytic activity in the degradation of malachite green dye under direct sunlight. These results highlight La-doping as an effective approach to tailor the structural and optical properties of $ZnIn_2S_4$, providing valuable insights for the rational design of high-performance photocatalysts.

Keywords: Zinc indium sulfide , hydrothermal method, Lanthanum(La) doped $ZnIn_2S$, Photo - catalytic activity

OP-BM-01

Eco-Friendly Synthesis of (Cu-Zn-Ag) Oxide Nanocomposite Mediated by Smilax Zeylanica and Evaluation of its Antibacterial activity

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Abstract

This study reports the biological synthesis of copper (Cu), silver (Ag), and zinc (Zn) nanoparticles using an eco-friendly approach with aqueous leaf extract of Smilax zeylanica. Recent advances in nanoscience and nanotechnology have significantly transformed how we diagnose, treat, and prevent various diseases, impacting multiple aspects of human life. Trimetallic nanocomposites, which contain multiple functional groups, offer advantages over monometallic and bimetallic nanoparticles. These nanocomposites are particularly important in nanomedicine and nanotechnology, owing to their enhanced properties. Metal nanoparticles are widely recognized for their diverse biological and catalytic applications, including antioxidant, antibacterial, and environmental remediation activities. The phytochemicals present in S. zeylanica such as alkaloids, flavonoids, and phenolic compounds—play a crucial role in the formation and stabilization of nanoparticles. In this work, we synthesized Cu-Zn-Ag oxide nanoparticles biologically, utilizing S. zeylanica leaf extract. The synthesized trimetallic nanoparticles were characterized using various techniques, including UV-Vis spectroscopy, FTIR spectroscopy, SEM with EDAX, and XRD analysis. We evaluated their properties and explored their potential applications, specifically focusing on antioxidant, antibacterial, and anticancer activities of the nanocomposites.

Keywords: Trimetallic nanoparticle; Eco-friendly synthesis; Antioxidant; Anti-cancer activity

OP-BM-02

Extraction Of Oil from Passiflora Foetida Seeds and Its Application In Cosmetic Product Development

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Abstract

The present research focused on the extraction, characterization, and evaluation of the biological potential of Passiflora foetida seed oil with specific applications in cosmetic formulations such as soap and shampoo. Seeds were collected from rural regions of Tamil Nadu and authenticated botanically before solvent extraction using Soxhlet apparatus and distillation methods. The extracted oil was subjected to advanced analytical characterization techniques, including Fourier Transform Infrared Spectroscopy (FTIR), Gas Chromatography–Mass Spectrometry (GC–MS), and High-Performance Liquid Chromatography (HPLC), to identify its fatty acids, sterols, tocopherols, and phenolic content. Results revealed a predominance of unsaturated fatty acids, particularly linoleic acid, oleic acid, and palmitic acid, along with the presence of phytosterols and natural antioxidants. Biological evaluation demonstrated significant antibacterial activity of the oil against pathogenic bacterial strains such as Escherichia coli, Proteus mirabilis, Staphylococcus pyogenes, and Corynebacterium diphtheriae, with zones of inhibition confirming its therapeutic relevance. Furthermore, soap and shampoo formulations incorporating P. foetida seed oil were prepared and characterized using standard parameters, including pH, foaming ability, viscosity, total fatty matter, and surface tension. Results indicated that the formulations exhibited desirable physicochemical properties, superior moisturizing effects, and antimicrobial protection compared to conventional formulations. This study establishes P. foetida seed oil as a sustainable, underutilized plant-based resource with promising applications in pharmaceutical, nutraceutical, and cosmetic industries,traditional knowledge with modern scientific validation.

OP-BM-03

From Plastics to Bio-Polymers: Moving Towards Sustainability

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Abstract

With arising industrialization and urban living standards, plastic pollution is the one of most burning issue rising with environmental problems. Plastic pollution has not been limited only to polluting water and soil, but also has entered food chain in form of micro plastics. That's why, the shift towards using more sustainable materials has given rise to research based on bio-polymer based food packaging as an alternative to fossil based packaging. Bio-polymers, such as, chitosan, starch, cellulose, gelatin, soy protein, zein and gluten have been used till date for biodegradable packaging. These bio-polymers are very useful in extending the shelf life of food and can also be subjected to sensory properties by blending with nanoparticles and essential oils. Bio based food packaging can be helpful in reducing bio-waste by turning it into useful films for packaging. However, research still goes on improving the physical properties, such as, mechanical strength, cost effectiveness, barrier properties and heat resistance. This review presents the different types of bio-polymers used in biodegradable food packaging and improvisation of their properties by using plasticizers, blends, nanomaterials and multilayer formations.

Keywords: Biodegradable; Bio-Polymers; micro plastics; nanomaterials; shelf life

OP-BM-04

Molecular Analysis of BACE1 Gene Variants In Early-Onset Alzheimer's Disease Patients from South India Region

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Abstract

Alzheimer's disease (AD) is the most common cause of dementia and a progressive neurodegenerative disorder characterized by memory loss, cognitive decline, and behavioral changes. Among several molecular mechanisms implicated in AD, the amyloid cascade hypothesis highlights the critical role of amyloid-β (Aβ) peptides generated through sequential cleavage of the amyloid precursor protein (APP) by β-secretase (BACE1) and γ-secretase. BACE1 is regarded as a rate-limiting enzyme in Aβ production, and genetic variants in the BACE1 gene may contribute to altered enzymatic activity and disease susceptibility. Objective: To investigate genetic variants of the BACE1 gene in Alzheimer's disease patients from the Coimbatore region of South India and evaluate their potential association with AD progression. Methods: Peripheral blood samples (3 ml) were collected from 30 participants, including 15 clinically diagnosed AD patients and 15 age-matched healthy controls. Genomic DNA was extracted using the salting-out method and confirmed by agarose gel electrophoresis. A 541 bp fragment spanning exonic regions of BACE1 was amplified using PCR and subjected to Sanger sequencing for variant screening. Results: Sequencing analysis revealed the presence of a copy number gain variant at the 11q23.3 position (allelic variant ID: 74369) in one AD cohort (Sample ID: AD011). This variant has been previously reported as pathogenic for AD and may contribute to early-onset AD progression. Conclusion: The study provides preliminary evidence of BACE1 genetic variants in South Indian AD patients, underscoring the importance of regional genetic screening to better understand AD pathophysiology and identify potential biomarkers for early diagnosis.

Keywords: Alzheimer's disease (AD), BACE1 gene, Genetic variants, Amyloid-β (Aβ) peptide.

OP-BM-05

The Development, Physicochemical Profiling, and Biological Assessment of Pennisetum Glaucum Q, A Homoeopathic Tincture for its Antioxidant and Anticancer Potential

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Abstract

The present study aimed to formulate, characterise, and evaluate the biological potential of a homoeopathic mother tincture derived from Pennisetum glaucum Q for its antioxidant and anticancer properties. The tincture was prepared using standard homoeopathic methods and subjected to comprehensive physicochemical characterisation, revealing a pH of 6.40 ± 0.10, total dissolved solids of 324.00 ± 3.61 ppm, alcoholic content of 12.47 ± 0.21 %v/v, specific gravity of 1.02 ± 0.01, alkaloid content of 2.84 ± 0.03 mg/g, and phenolic content of 48.24 ± 0.03 mg GAE/g. Thin-layer chromatography identified three distinct spots with Rf values of 1.42, 1.60, and 1.81, while UV spectroscopy showed absorption maxima at 271 nm (strong) and 356 nm (moderate). Qualitative phytochemical screening confirmed the presence of alkaloids, flavonoids, phenols, saponins, tannins, and carbohydrates, with the absence of steroids, terpenoids, anthraquinones, and oils/resins. Antioxidant activity was evaluated using DPPH and ABTS assays, demonstrating dose-dependent radical scavenging with IC50 values of 272.82 ± 1.29 µl and 189.13 ± 1.36 µl, respectively. The anticancer potential was assessed through cytotoxicity assays on several human cancer cell lines, resulting in IC50 values of 320.86 ± 0.43 µl (MCF-7 breast), 356.11 ± 1.50 µl (A-549 lung), 409.28 ± 2.71 µl (SKoV3 ovarian), 461.16 ± 2.17 µl (HT-29 colon), and 530.93 ± 2.67 µl (HePG2 liver). Mechanistic investigations on MCF-7 cells revealed induction of apoptosis via the intrinsic mitochondrial pathway, as evidenced by increased reactive oxygen species, loss of mitochondrial membrane potential, cell cycle arrest in the sub-G1 phase, DNA fragmentation, and modified expression of apoptosis-related proteins (including upregulation of Caspase-3/7/8/9, p53, Bax, Bad, and Cyt C; and downregulation of Bcl-2). These findings highlight the tincture's potential as a source of antioxidants and its selective anticancer properties, particularly in combating breast cancer cells, thereby substantiating its prospective application in complementary medicine. Additional in vivo studies are required to validate its efficacy and safety.

Keywords: Homoeopathic mother tincture; Pennisetum glaucum; Physicochemical characterisation;

OP-BM-06

Biowaste-Derived Myristica fragrans Peel Extract for the Sustainable Synthesis of MgO Nanoparticles and Their Antimicrobial, Antioxidant, and Cytotoxic Potential

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Abstract

Green synthesis of nanoparticles follows principles similar to conventional chemical reduction processes; however, in place of chemical reducing agents, natural products such as plant extracts or biological systems like bacteria and fungi are employed for the synthesis of metal and metal oxide nanoparticles (NPs). The present study focuses on the green synthesis of magnesium oxide (MgO) nanoparticles using Myristica fragrans fruit peel extract. The fruit peel, a biowaste of M. fragrans, was used as a precursor for nanoparticle synthesis. The peel extract was prepared at a controlled temperature of 60–70 °C. This extract was then added to a 0.1 M $MgSO_4 \cdot 7H_2O$ solution, maintaining a pH of 7–8. The reaction resulted in the formation of a brownish-white MgO nanoparticle precipitate. MgO nanoparticles were successfully synthesized using a precipitation method assisted by fruit peel extract. Characterization was carried out using UV-DRS, FTIR, XRD, and FE-SEM techniques. Biological evaluation showed that the synthesized MgO nanoparticles exhibited promising antimicrobial activity against pathogenic bacteria, significant antioxidant capacity as evidenced by free radical scavenging assays, and dose-dependent cytotoxicity toward selected cancer cell lines, underscoring their potential in biomedical applications. This study highlights a cost-effective and eco-friendly approach for synthesizing MgO nanoparticles using Myristica fragrans fruit peel extract. Beyond their physicochemical properties, the nanoparticles demonstrated antimicrobial, antioxidant, and cytotoxic activities, emphasizing the value of biowastederived nanomaterials for sustainable biomedical and environmental applications.

Keywords: Magnesium oxide; Nanoparticles; Myristica fragrans; Green synthesis;

OP-BM-07

Harnessing The Power Of Nanotechnology: A Comparative Evaluation And Spectroscopic Validation Of Nano-Encapsulated Green Tea's Antimicrobial Potential In Denture Care Revolutio

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Abstract

Denture hygiene is critical for preventing denture stomatitis and microbial biofilm formation. Conventional chemical cleansers, though effective, may irritate oral tissues or compromise denture integrity. Green tea (Camellia sinensis), rich in epigallocatechin gallate (EGCG), has established antimicrobial potential. Nano-encapsulation with effervescent formulation enhances stability, solubility, and compliance. This study aimed to evaluate the antimicrobial efficacy of a nano-encapsulated green tea effervescent tablet compared with a commercial denture cleanser and distilled water, while simultaneously validating its structural stability through spectroscopic analyses. Nano-encapsulation of green tea extract was performed using a polymeric carrier matrix, followed by effervescent tablet formulation. The preparation was subjected to UV–visible spectroscopy to confirm catechin integrity and FTIR spectroscopy to assess molecular interactions and functional group stability. The minimum inhibitory concentration (MIC) was determined against Staph.aureus and Candida albicans. In a controlled in vivo evaluation, 60 complete denture wearers were randomized into three groups. Microbial load (CFU/mL) was quantified at baseline, day 7, and day 14. Compared to the control group, the nanoencapsulated green tea group showed significant reductions in microbial load ($P < 0.01$). Specifically, Candida albicans colonization decreased by 57.4% and 71.1% on the 7th and 14th days, respectively. The nano-encapsulated green tea effervescent tablet demonstrated significantly superior antimicrobial performance relative to commercial denture cleansers and control. Spectroscopic validation confirmed its molecular stability, reinforcing its potential as a safe, natural, and clinically viable alternative to conventional chemical denture cleansing agents.

OP-BM-08

Chitosan Nanoparticles in Modulating the Wound Healing Cascade: A Review of mechanistic Evidence

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Abstract

Wound healing is a multifaceted biological process involving coordinated phases of haemostasis, inflammation, proliferation, and tissue remodelling. Chronic wounds, particularly those associated with diabetes, infections, or vascular disorders, present significant therapeutic challenges and demand more effective interventions. Chitosan, a biocompatible and biodegradable polysaccharide, has demonstrated promising wound-healing potential, particularly when engineered at the nanoscale. This review systematically evaluates existing preclinical and clinical evidence on the wound healing properties of chitosan nanoparticles (CSNPs), focusing on their biological effects, mechanisms of action, and translational potential. A systematic search was conducted across electronic databases including PubMed, Scopus, and Web of Science for studies published between 2015 and 2025. Articles investigating the application of CSNPs in wound healing—either as stand-alone agents or as drug delivery systems—were included. Data were extracted on nanoparticle characteristics, study models, treatment outcomes, and proposed mechanisms. Study quality and risk of bias were assessed using appropriate preclinical and clinical tools. A total of 5 studies met the inclusion criteria, comprising in vitro experiments, animal models, and a limited number of clinical investigations. CSNPs consistently demonstrated enhanced wound healing outcomes, including accelerated re-epithelialization, improved collagen deposition, angiogenesis, and antimicrobial effects. Mechanistic insights suggest that CSNPs modulate oxidative stress, inflammatory responses, and cellular proliferation in the wound microenvironment. Chitosan nanoparticles hold significant promise as multifunctional agents in wound management, offering both intrinsic healing benefits and advanced drug delivery capabilities. While preclinical findings are encouraging, further standardized and controlled clinical trials are essential to validate their safety, efficacy, and scalability in human wound care.

OP-BM-09

Exploring The Anticonvulsant, Cytotoxicity and Antimicrobial Activity of Pyrrole Based Schiff Base Metal Complexes: Synthesis and Characterization

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Abstract

Novel Schiff base (Z)-2-((2-(1H-pyrrol-1-yl)phenyl)imino)indolin-3-one and their relating metal buildings were combined from Isatin with 1-(2-aminophenyl) pyrrole. The sensible geometry of Schiff base and its metal complexes were concluded through elemental analysis, molar conductance, ^{1}H-NMR, UV-Vis, FT-IR, Far-IR, Cyclic voltammetry and ESR spectra. In order to evaluate the biological action, the synthesized compounds were analysed for their in-vitro antimicrobial activities against some bacterial and fungal strains. The human breast (MCF-7) cancer cell lines were assessed to identify the cytotoxic activities of all synthesized compounds. Antiepileptic screening for synthesized compounds was also executed utilizing maximal electroshock seizure (MES) and subcutaneous pentylenetetrazole (scPTZ) seizures tests. Similarly, sub-acute toxic test was assessed for the synthesized compounds. The compounds were injected intraperitoneally into Rats at the dosages of 10 mg/kg and were evaluated against the standard drug namely phenytoin. The tonic expansion of the hind limb was recorded as a fraction of anticonvulsant effect, and the results revealed that all substances exhibited increased anticonvulsant activity in both seizure tests.

Keywords: Schiff base, Isatin, 1-(2-aminophenyl)pyrrole, Antimicrobial, cancer cell lines and seizure tests.

OP-BM-10

Antioxidant and Anti-Cataract Potential of Spathodea campanulata Exudate Ophthalmic Formulations: Biochemical and Histopathological Validation

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Abstract

Oxidative stress and protein aggregation are central to cataractogenesis. Current therapies are limited, emphasizing the need for novel, phytochemical-based ophthalmic formulations with antioxidant and lens-protective properties. This study investigated the physicochemical stability, phytochemical profile, and anti-cataract potential of Spathodea campanulata exudate formulations, integrating spectroscopic, enzymatic, and in vivo evaluations. Formulations (15%, 25%, 50%) were prepared and subjected to physicochemical characterization, UV–Vis, TLC, FTIR, phytochemical screening, and GC–MS profiling. Antioxidant enzymes including superoxide dismutase (SOD), catalase, glutathione peroxidase (GPx), and protein stabilization were assayed. An in vivo cataract model with histopathological grading validated therapeutic efficacy. Formulations were stable, isotonic, and physiologically compatible. GC–MS identified bioactives such as indoles, phenols, and fatty acids linked to antioxidant and anti-glycation activity. FTIR confirmed O–H, C=O, and amide groups, consistent with protein-protective roles. Enzymatic assays showed dose-dependent enhancement: SOD inhibition increased from 13.2% (diseased control) to 36.6% (100%), catalase rose from 0.135 to 1.38 U/mg protein, and GPx from 0.204 to 0.314 U/mg protein (ANOVA, $p < 0.001$). Histopathology revealed near-normal lens architecture in the 50% group (Grade 0–1), confirming morphological protection.

Conclusion: Spathodea campanulata formulations exert multi-targeted antioxidant and anti-glycation effects, restoring enzymatic defense and preserving lens structure. These findings highlight its therapeutic promise as a natural, ophthalmic candidate for cataract prevention.

Keywords: Spathodea campanulata; cataract; antioxidant enzymes; FTIR; GC–MS; histopathology

OP-BM-11

A Clinical Study to Assess the Efficacy of Homoeopathic Constitutional Medicine in the Treatment of Adjustment Disorder Using ADNM-20 Questionnaire

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Abstract

Adjustment disorder (AD) is a stress-related mental health condition involving maladaptive emotional and behavioral responses to identifiable stressors, resulting in functional impairment. Conventional treatments may not address individual variations in symptoms, whereas homoeopathy emphasizes individualized constitutional prescriptions. This study evaluated the efficacy of homoeopathic constitutional medicines in AD using the Adjustment Disorder New Module–20 (ADNM-20) questionnaire. To assess the clinical effectiveness of individualized homoeopathic constitutional medicines in AD by comparing ADNM-20 scores before and after treatment. A prospective, single-group pre-post interventional study was conducted on 28 patients diagnosed with AD per DSM-5 criteria. ADNM-20 was the primary assessment tool. Constitutional prescriptions were individualized following comprehensive case-taking and repertorization. Follow-up was maintained for at least six months. Paired t-tests were used for statistical analysis. Fifty percent of patients showed marked improvement, 35.71% moderate improvement, and 14.29% mild improvement. The mean reduction in ADNM-20 scores was 28.11 points ($p < 0.00000000000007343$). Cohen's d was 3.04, indicating a very large effect size. Individualized homoeopathic constitutional treatment significantly reduced AD symptoms with strong statistical and clinical significance, supporting its potential role as a safe and holistic approach in integrative psychiatric care.

Keywords: Adjustment disorder, Homoeopathy, Constitutional medicine, ADNM-20, Integrative psychiatry

OP-BM-12

Efficacy Of Integrative Homeopathic Treatment with Adjuvant Therapies in Managing Menopausal Syndrome: A Clinical Observational Study.

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Abstract

Menopause presents multifaceted challenges requiring holistic management approaches. This study evaluates the effectiveness of integrative homeopathic treatment combined with adjuvant therapies for menopausal syndrome management. To assess the efficacy of individualized homeopathic remedies with meditation, walking, and nutritional interventions in improving menopausal symptoms using the Menopause Rating Scale (MRS). A Prospective Observational study was conducted on 17 women aged 44-58 years (mean 47.4±4.1 years) presenting with menopausal symptoms. After excluding one case with one-month treatment, 16 cases were analyzed. Patients received individualized homeopathic remedies with adjuvant therapies including meditation, walking (30-60 minutes), and nutritional guidance. Treatment duration ranged from 2-6 months. Most patients (87.5%) received homeopathy with meditation and walking. MRS scores were assessed pre and post-treatment. Statistical analysis was performed using paired t-test. The mean age was 47.4±4.1 years (range 44-58), with 76% (n=13) being homemakers. Comorbidities included diabetes (18%), hypertension (18%), obesity, anemia, and thyroid disorders. Common symptoms included sleep problems, irritability, depressive mood, anxiety, joint discomfort, and sexual problems. Pre-treatment MRS mean score was 26.75±4.78, which significantly reduced to 2.81±1.94 post-treatment ($p<0.001$). Complete cure was achieved in 12 cases (75%), symptomatic relief in 4 cases (25%), and one case discontinued treatment. Commonly prescribed remedies included Calcarea carbonica, Natrum muriaticum, Phosphoric acid, Ferrum metallicum, and Nux vomica. Integrative homeopathic treatment with adjuvant therapies demonstrates significant efficacy in managing menopausal symptoms, offering a holistic approach to women's health during the menopausal transition.

OP-BM-13

Pharmacological Evaluation Of Siddha Formulation In The Management Of Snake Bite Through In-Silico ADME Analysis

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Abstract

Snake venom disease refers to the condition resulting from the injection of venom by a snake through a bite or sting. Snake venom is a complex mixture of protein and peptides that can have various effects on the human body, ranging from mild symptoms to life-threatening complications. Now a day's treatment for snake venom is harder to prescribe with using available medicine. Hence, this study analysed and identified the literature for innovating medicines to snake venom from ancient system of medicines. Corallocarpus epigaeus is mentioned in siddha literature one of the effective herbs for snake bite. Aakasakarudan kizhangu chooranam was mentioned for snake venom in Gunapadam Mooligaivakuppu .K.S.Murukesamuthaliyar. The study was carried out as analytical study. Raw drug was purified and prepared medicine according to literature. Preliminary phyto-chemical analysis was done through Thin Layer Chromatography (TLC) subsequently ADME (Absorption, Distribution, Metabolism, and Excretion) analysis was done. Beta - sitosterol & Sesquiterpene were identified as lead molecules through Thin Layer Chromatography. In- silico ADMET prediction was performed for virtual screening of phytochemicals to identify potential hits. The selected phytochemicals underwent ADME analysis. Regarding absorption and distribution, both compounds show high intestinal absorption, with Sesquiterpene achieving 100% absorption. However, Beta-Sitosterol demonstrates a higher volume of distribution (1.161 log L/kg) compared to Sesquiterpene (0.311 log L/kg), indicating its broader tissue distribution. In metabolism, Beta-Sitosterol & Sesquiterpene act as inhibitor of CYP3A4 enzyme. Both compounds interact with renal transporters, influencing its elimination through the kidneys. The study concluded as Aakasakarudan kizhangu chooranam has better ADME profile and effective drug for snake bite.

OP-BM-14

Integrative Bioinformatics Approaches for Decoding Bio–Nano Interfaces In Biomedical and Environmental Systems

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Abstract

Nanomaterials offer transformative potential in medicine, environmental remediation, and renewable energy, but their effectiveness depends on complex interactions with biological molecules and microbial communities. Experimental methods alone often fail to capture these dynamics, creating a need for predictive computational strategies. The present work establishes a bioinformatics-driven framework to predict and analyze bio–nano interactions, aiming to guide the rational design of safe and functional nanomaterials. In this study, we present a bioinformatics-driven framework that combines molecular dynamics simulations with structural bioinformatics to evaluate protein–nanoparticle interactions. Graph-based machine learning models were developed using chemical and structural features to predict interaction strengths. Multi-omics datasets—including transcriptomic, proteomic, and metagenomic profiles—were integrated to identify molecular pathways affected by nanoparticles and to highlight microbial strains with potential for bioremediation and bioenergy applications. This approach reliably predicted biomolecule–nanoparticle affinities and uncovered molecular signatures linked to both nanotoxicity and therapeutic potential. Microbial network analysis identified taxa capable of adapting to engineered nanostructures, pointing to innovative applications in environmental and biomedical contexts. By merging physics-based modeling, AI-enhanced prediction, and omics integration, this study delivers a reproducible computational strategy for accelerating nanomaterial innovation. This study demonstrates how bioinformatics can guide the rational design of safe and functional nanomaterials.

Keywords: Bioinformatics; Nanotechnology; Molecular Dynamics; Machine Learning; Omics Integration; Bio-Nano Interfaces

OP-BM-15

A Clinical Evaluation of Homoeopathic Medicines In Centesimal Potency For Premenstrual Syndrome Using the Menstrual Distress Questionnaire

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Abstract

Premenstrual Syndrome (PMS) is a common condition in women of reproductive age, characterized by diverse somatic and psychological symptoms that impact daily functioning. Conventional treatments often offer partial relief with limitations. Homoeopathy, with its individualized and holistic approach, may provide an effective alternative. A prospective, non-controlled clinical study was conducted on 40 women aged 18–40 years with PMS. Individualized homoeopathic medicines were prescribed in centesimal potencies (mainly 30C, occasionally 200C) after detailed case-taking. Follow-up was maintained for 3 to 6 menstrual cycles. Symptom severity was measured using MEDI-Q pre and post treatment. Data were analysed using the Wilcoxon signed-rank test. A highly significant reduction in MEDI-Q scores was observed, with a mean decrease of 8.8 ($p < 0.00001$). Clinical improvement was seen in 70% markedly, 22.5% moderately, and 7.5% mildly. Common remedies included Natrum muriaticum, Pulsatilla, Nux vomica, Sepia, and Calcarea carbonica. Psoric miasm predominated (57.5%), followed by sycosis (35%) and mixed psora-syphilitic states (7.5%). Individualized homoeopathic medicines in centesimal potency significantly improved PMS symptoms, confirming the MEDI-Q as a reliable outcome tool and supporting homoeopathy as a safe and effective approach in PMS management.

Keywords: Premenstrual syndrome, Homoeopathy, Individualized prescription, Centesimal potency, MEDI-Q

OP-BM-16

Greestesised Nanoparticles of Feverfew (Tanacetum Parthenium) And Butterbur (Petasites Hybridus) Extracts for Anti-Inflammatory Activity

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Abstract

Inflammation underlines numerous chronic health conditions like head ache, arthritis and neuroinflammatory disorders that potentially weakening the quality of life. Whereas, the conventional therapies provide symptomatic relief and long-term use caused adverse effects, thus outlines the need for safer and herb-based alternatives. This research explores the potential of Kaempferia galanga (aromatic ginger) and Clerodendrum serratum (blue glory), that are traditionally employed for its anti-inflammatory activity in south east Asian systems. Both the plants were selected based on ethnopharmacological evidence signifying anti-inflammatory, analgesic, neuroprotective and Vaso modulatory activities. The study encloses extraction, physiochemical characterization and synthesis of nanoparticle from bioactive components of both plants. The primary tests include qualitative phytochemical screening of alkaloids, terpenoids, flavonoids and phenolic compounds quantitative estimations like SEM and TEM. The herbal nanoparticles of both extracts were prepared using green precipitation method. The particle size was analysed using zeta sizer for both medicinal plants showed mean diameter of 110±12nm for K. galanga and 128 ± 15 nm for C. serratum. Nanoparticle formation was confirmed by UV-Vis spectroscopy and functional groups responsible for stabilization were indicated by FTIR. The DPPH assay was used to determine the antioxidant activity showed 82% inhibition for K. galanga, 76% for C. serratum at 200 µg/mL. In vitro anti-inflammatory activity evaluated by protein denaturation inhibition showed significant activity of 71% and 67% respectively. These findings recommend locally available K. galanga and C. serratum can be processed into stable nanoparticles and provides anti-migraine potential. Further in vivo studies are warranted to translate these results into clinical application.

Keywords: Inflammation, Kaempferia galanga, Clerodendrum serratum, medicinal plants and anti-inflammatory activity.

OP-BM-17

Phytochemical Profiling and In Vitro Antidiabetic Evaluation of a Polyherbal Ethanolic Formulation of Withania somnifera, Pterocarpus marsupium, and Salacia reticulata Using GC–MS, FTIR, and Enzyme Inhibition Assays

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Abstract

Diabetes mellitus type 2 (T2DM) is a multifactorial disorder characterized by hyperglycemia, oxidative stress, and enzymatic dysregulation. Conventional antidiabetic drugs often cause adverse effects, creating the need for safer, plant-based alternatives. A rationally designed polyherbal formulation offers synergistic action through multiple pathways. This study aimed to develop and evaluate a 2:3:2 ethanolic formulation of Withania somnifera, Pterocarpus marsupium, and Salacia reticulata (WPS), integrating phytochemical profiling with antioxidant and enzyme inhibitory assays for T2DM management. Ethanolic extracts of the three botanicals were prepared by maceration and combined in the WPS formulation. Antioxidant capacity was assessed by DPPH assay, while α-amylase and α-glucosidase inhibitory activities were compared against metformin. GC–MS identified major bioactive constituents, and FTIR spectroscopy confirmed functional groups relevant to glucose metabolism. Statistical analysis was performed using ANOVA with Tukey's post hoc test ($p < 0.05$). WPS showed concentration-dependent antioxidant activity (IC_{50} = 141 µg/mL), strong α-amylase inhibition (87.38%), and moderate α-glucosidase inhibition (82.78%), comparable to metformin. GC–MS revealed compounds such as oleanolic acid acetate and ethyl α-D-glucopyranoside, known for insulin sensitization and enzyme modulation. FTIR confirmed hydroxyl, carbonyl, and ether groups associated with antidiabetic and antioxidant effects. The WPS formulation exhibits synergistic antioxidant and enzyme-inhibitory potential, validating its polyherbal design. These findings provide a strong foundation for in vivo validation and possible clinical translation of WPS as a complementary antidiabetic therapy.

Keywords: Polyherbal formulation, GC–MS, FTIR, antioxidant, α-glucosidase inhibition.

OP-BM-18

Synergistic Inducement of Programmed Cell Death in Breast Cancer Cell Line And Microbial Growth Inhibition by Methylcellulose Blended Polymeric Nanofiber Mats Through Controlled Drug Release

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Abstract

Cancer patients require a drug carrier for controlled release of anticancer drug alongside with the properties of eradicating microbial strains that causes severe side effects during treatments. Herein, the study reports the fabrication of electrospun nanofiber mats comprised of methylcellulose blended with 5-fluorouracil drug, polyethylene glycol and polylactic acid ingrained with silica nanoparticles for the eradication of cancer cells and pathogenic microbes via controlled drug release. The fabricated nanofiber mats were thoroughly characterized by various analytical techniques. The spherical shape and size of the nanoparticle were examined by scanning and transmission electron microscopies, and structural interactions by infra-red spectral and X-ray diffraction studies. The ionic interaction among nanoparticles, drug and macromolecules were found to be responsible for higher swelling capacity (346 %) and controlled drug release (>90 %) was observed at the end of 16th day. Zero order, Higuchi and Korsmeyer-Peppas kinetics confirmed the controlled release of drug from the mats via diffusion. The cytotoxicity study against MDA-MB-231 cancer cell line resulted 65 % and 75 % of cell death in a period of 24 h, respectively and further validated by apoptosis assay using Acridine Orange and Propidium Iodide staining method. The microscopic images revealed that more apoptotic cells appeared when cancer cells are exposed with methylcellulose and polyethylene glycol incorporated nanofiber mats. Furthermore, an excellent activity was observed in growth inhibition study against bacterial and fungal strains. Hence, the fabricated nanofiber mats were proposed as proficient implants for controlled drug release in cancer therapy.

OP-BM-19

Original Research: Eco-Nano Warriors – Plant-Derived Iron and Zinc Nanoparticles Against Cancer

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Abstract

Conventional nanoparticle synthesis often employs hazardous chemicals, limiting their biomedical applications. Plant-mediated synthesis provides a sustainable alternative by integrating eco-friendly methods with biomedical relevance. In this study, iron (Fe), zinc (Zn), and bimetallic Fe–Zn nanoparticles were synthesized using Calotropis procera leaf extract as a natural reducing and stabilizing agent and evaluated for anticancer potential. Nanoparticles were prepared under alkaline conditions and characterized using UV–Vis spectroscopy, XRD, FTIR, FE-SEM, EDX, and zeta potential to confirm structure, stability, and surface functionalization. Their cytotoxic effects were assessed using the MTT assay against cancer cell lines. Fe nanoparticles exhibited the strongest cytotoxicity, producing a dose-dependent reduction in cell viability with an IC_{50} of ~40 µg/mL. Fe–Zn nanoparticles showed moderate activity ($IC_{50} \approx 164$ µg/mL), while Zn nanoparticles displayed comparatively lower cytotoxicity. The results suggest that phytochemical-capped Fe and Fe–Zn nanoparticles induce cell death mechanisms likely associated with reactive oxygen species (ROS) generation. This original research highlights that Calotropis procera-mediated Fe and Fe–Zn nanoparticles possess significant anticancer activity as demonstrated by MTT assay, while Zn nanoparticles are less active. These findings establish plant-derived nanoparticles as eco-friendly, scalable, and promising candidates for cancer therapeutics.

Keywords: Calotropis procera, Green synthesis, Iron-Zinc nanoparticles, MTT assay, Cytotoxicity, Anticancer activity.

OP-BM-20

Depiction Of Zinc Oxide Nanoparticle And its Impact in Antioxidant, Antibacterial and Genotoxic Activity From Wrightia Tinctoria

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Abstract

According to data, by 2035, the old will outnumber the young, and decreasing birth rates are already being observed. Patients do not obtain appropriate treatment because of incorrect diagnoses or specific traits. Meanwhile, it is necessary to develop a testing kit that will prevent such issues and help society. The cost-effective, conveniently accessible to society is required. Wrightia tinctoria, an ancient medicinal plant rich in phytosterols, phytochemicals, and antioxidants, has the ability to protect from metal exposure associated genotoxicity damage. As an in vitro study. Biogenic zinc oxide nanoparticles are synthesized using Wrightia tinctoria, which is then characterized and confirmed using various techniques. Following a proper Institutional Human Committee (IEC No. 59/31/08/24), human semen samples were collected and divided into normospermia (N = 44) and teratozoospermic (toxic metal-exposed subjects) (N = 44) and processed for conventional semen parameters and antioxidant status (SOD, CAT) were processed according to WHO guidelines. In addition, viability and cytotoxicity and DNA damage by metal toxicity followed biogenic ZnO NPs were done with different selected doses and compared with before and after treatment. Biogenic ZnO NPs were evaluated for antioxidant and antibacterial activities, and the results were encouraging. Following metal toxicity, TZ participants were treated with biogenic ZnO NPs, which resulted in maintained sperm viability, sperm morphology, and decreased cytotoxic damage that was directly connected with controlled ROS levels when compared to controls. We used the Comet method to determine the stability of cadmium-treated sperm DNA. Lower amounts of enzyme antioxidants such as SOD and CAT are linked to greater levels of MDA in TZ. It has been proven that Wrightia tinctoria -derived ZnO NPs reduce oxidative stress markers (MDA) while maintaining enzymatic enzymes that cause primary spermatids and spermatogonial cells. The comet is seen here with a definite head and no tail. This product will be effective in a wide range of biological applications. These findings support the potential use of ZnO NPs from Wrightia tinctoria as multifunctional agents with antioxidant, antibacterial, and many antioxidant-rich synergistic actions against free radicals, as well as protection against Cd toxicity on sperm DNA damage, even though hormonal and sperm parameters improved.

Keywords: Wrightia tinctoria , ZnO NPs, Sperm morphology, Cytotoxicity, Cadmium

OP-BM-21

Biochemical and Functional Analysis of Erinacin, A Natural Hedgehog Muscle Metalloprotease Inhibitor Against Snake Venom

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Abstract

This abstract reviews the Antihaemorrhagic Factor from the European Hedgehog, Erinaceus europaeus, which investigates natural resistance of snake venom in hedgehogs. Snake venoms contain haemorrhagic metalloproteinases that causes tissue damage and bleeding. Certain mammals, including the European hedgehog, exhibits antihaemorrhagic factors in plasma and muscle tissues. The original study focuses on erinacin, a novel protein with potent antihaemorrhagic activity, providing detailed purification, characterization and functional investigation. The objective of this review is purification processes of erinacin, molecular compositional listing and enzymatic inhibition properties of erinacin, highlighting its potential significance towards venom resistance examination. The purified muscle extracts from deceased European hedgehogs using ammonium sulfate precipitation method, DEAE-cellulofine ion-exchange chromatography, hydroxylapatite chromatography and gel filtration chromatography. Earlier studies focused on Antihaemorrhagic activity was against Bothrops jararaca venom using the minimum haemorrhagic dose (MHD) assay in rabbit skin. SDS-PAGE, HPLC, and gel filtration were employed to determine molecular weight and subunit composition. Inhibition of proteolytic activity was tested by using TPCK-trypsin and chymotrypsin. Mebs et al. (1996) reported that erinacin was purified 625-fold with a 19% yield. The protein exhibited a complex multimeric structure (~1,090,000 Da) with distinct 35 kDa and 39 kDa subunits. It effectively inhibited venom haemorrhagic activity and proteolytic enzymes. Erinacin differs from other known antihaemorrhagic factors and represents a unique, high-molecular- weight protein potentially related to hedgehog plasma factors conferring venom resistance. This review elucidates that erinacin is a distinct antihaemorrhagic protein with a complex subunit structure and potent inhibition of snake venom haemorrhagins. The findings summarized from the article highlight its importance in understanding mammalian venom resistance and provide a foundation for future structural and functional studies.

Keywords: Erinacin, antihaemorrhagic factor, haemorrhagic metalloproteinases, Erinaceus europaeus, protein purification, subunit composition.

OP-BM-22

Protein-Rich Fibrous Eggshell Membrane Derived Zno 3D-Nanohybrid For Cryoprotectant, Reproductive Scavengers Against Zn Deficiency and Hypokalemic Effects In Rats

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Abstract

Zinc deficiency contributes to male infertility in one-third of affected men, yet treatment options remain limited. Assisted reproductive technologies (ART) require advanced materials to enhance sperm survival and minimize damage during cryopreservation. This study evaluates novel 3D fibrous eggshell membrane–ZnO nanocomposites for antimicrobial and cryoprotectant efficacy, demonstrating their potential to reduce spermatogenic toxicity and hypokalemia in vivo. To our knowledge, this is the first report of ESM-based ZnO nanoflakes as a therapeutic approach for male infertility. Two experimental phases were conducted: in vitro antimicrobial and sperm cryoprotection assays under heat shock and freeze–thaw conditions, and in vivo validation using male Sprague-Dawley rats exposed to ESM-ZnO formulations. Antibacterial and antifungal activities were assessed alongside sperm viability, reactive oxygen species (ROS) generation, and morphological integrity. In vivo, spermatogenic health was evaluated via morphometric analysis, reproductive hormones, and biochemical markers of liver and kidney function, complemented by histological examinations. Results demonstrated that the thermally synthesized ESM-ZnO-T nanocomposite exhibited superior antimicrobial efficacy and preserved sperm viability with 84% sensitivity and specificity post-cryopreservation. Treated rats showed enhanced sperm morphology, hormonal balance, and testicular histology compared to controls. Additionally, protein-loaded ESM-ZnO formulations alleviated hypokalemia and hyperoxaluria, supporting systemic metabolic function. Overall, ESM-ZnO-T nanocomposites offer a promising multifunctional platform for improving sperm preservation and reproductive health, while simultaneously supporting liver and kidney function, highlighting their potential in addressing zinc deficiency–related male infertility.

Key words: Eggshell membrane, Nanocomposites, Male Infertility, Cryopreservation.

OP-BM-23

Design Synthesis, Characterization and Biological Evaluation and insilico and invitro Anticancer activity of Indole fused Pyrazole derivatives

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Abstract

In this study, six Indole fused pyrazole derivatives (1-6) were synthesized and characterized by 13C-NMR, 1H-NMR, FT-IR spectroscopy. The Indole fused pyrazole derivatives (1-6) were evaluated in vitro for their anti-microbial, antioxidant and anticancer activities. Further the synthesized compounds were carried for Insilco molecular docking and ADME prediction for medicinal chemistry property. All the compounds show good binding score values in the ranges from -8.0 kcal/mol to 10.0kcal/mol and all the compounds obeys the Lipinski's rule of Five. For anti-cancer activity, compound 2 showed a potent inhibition with IC50 values of 119.3 ± 0.75μM against the breast cancer cell line. The antimicrobial susceptibility tests of synthesized compounds are screened against Staphylococcus aureus and Escherichia coli. From the three synthesized compounds the electron-withdrawing substitution (Br) shows good effect against the Gram-positive bacteria and the electron donating substitution (CH3) shows excellent inhibition zone against the Gram-negative bacteria at the concentration level (10 μg/mL).

Key words: Indole fused pyrazole pyrazoles, NMR studies, Invitro studies, Insilco studies, antimicrobial studies

OP-BM-24

Synthesis and evaluation of Phloridzin-loaded GO nanoparticles as a potential treatment for Human Breast cancer using MCF-7 cells

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Abstract

Breast cancer is one of the most prevalent malignancies worldwide and remains a major clinical challenge despite advances in chemotherapy and targeted therapies. Limitations such as systemic toxicity, poor bioavailability, and drug resistance highlight the need for novel therapeutic strategies. Nanoparticle-based drug delivery systems, particularly graphene oxide (GO), offer promising advantages due to their high surface area, stability, and ability to be functionalized for controlled release. This study explores the use of GO nanoparticles for delivering phloridzin, a natural flavonoid with reported anticancer activity, to MCF-7 breast cancer cells. Methods: Phloridzin-loaded GO nanoparticles (GO-PHL NPs), with and without chitosan coating, were synthesized and characterized using scanning electron microscopy (SEM), Fourier-transform infrared spectroscopy (FTIR), particle size analysis, and zeta potential measurements. In vitro drug release assays were performed to evaluate release kinetics. Cytotoxicity and cellular uptake were assessed in MCF-7 cells, and apoptosis was examined through dual labeling with DAPI and propidium iodide (PI).Results: GO-PHL NPs showed uniform nanoscale morphology, stable surface charge, and a sustained drug release profile. Compared with free phloridzin, the nanoparticles demonstrated significantly enhanced antiproliferative activity in MCF-7 cells. Chitosan coating further improved cellular uptake and cytotoxicity. Fluorescence staining confirmed apoptosis induction, with clear nuclear condensation and fragmentation observed. Conclusion: Phloridzin-loaded graphene oxide nanoparticles, particularly with chitosan modification, exhibit improved drug delivery efficiency and anticancer potential against MCF-7 cells. These findings suggest that GO-based nanocarriers provide a promising platform for breast cancer therapy and warrant further investigation in preclinical models.

OP-BM-25

Development of Chitosan–Citric Acid Biopolymer Films for Sustainable Food Packaging

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Abstract

Biopolymer-based films are attracting interest as sustainable alternatives to petroleum-based plastics, which are harmful and non-biodegradable. Chitosan, obtained from chitin, is a renewable polysaccharide with excellent film-forming properties, making it suitable for food packaging. A solution of 5% chitosan in 10 ml water was heated to 90 °C under stirring. Citric acid was added until a gel-like consistency formed. The mixture was left overnight, then crosslinked at 120 °C for 2 hours to obtain films by solution casting
The film had a density of 1.304 g/cm³, tensile strength of 6.01 MPa, flexural strength of 10.16 MPa, and Shore D hardness of 46.2. It showed a melting point of 122.20 °C, water permeability of 26.40 g/m²·day, oil permeability of 1.23 g/m²·day, and an overall migration rate of 2.44 mg/dm², all within safe limits for food contact. Chitosan–citric acid films prepared by solution casting exhibited good strength, stability, and barrier properties, confirming their potential as safe, biodegradable alternatives to plastic packaging.

Keywords: Chitosan; Citric acid crosslinking and Biodegradable food packaging

OP-BM-26

Green Synthesized Cerium Oxide Nanoparticles from Aegle marmelos with Antimicrobial, Antioxidant and Cytotoxic Activities

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Abstract

CeO_2 nanoparticles possess notable antimicrobial and anticancer properties. This study focuses on the eco-friendly synthesis of CeO_2 NPs using Aegle marmelos leaf extract as reducing and stabilizing agent (1,2). Green synthesis of CeO_2 nanoparticles using Aegle marmelos leaf extract. Materials and Methods: CeO_2 NPs were prepared by mixing 100Ml of 0.01M $Ce(NO_3)_3 \cdot 6H_2O$ with 20mL of leaf extract. The pH was adjusted to 7-8 and the mixture was stirred at 80°C for 4h. The mixture was cooled, centrifuged at 8000rpm for 20min, washed with DI water and ethanol, dried at 70°C for 4h, and calcined at 400°C for 3h. UV-DRS showed maximum absorption at 320nm, FTIR confirmed functional groups, XRD confirmed crystallinity and HR-SEM/EDX showed uniform spherical morphology and elemental composition. In antimicrobial studies, CeO_2 NPs inhibited S. aureus, E. faecalis, E. coli, P. aeruginosa, and C. albicans. CeO_2 NPs displayed antioxidant activity of 19.33% at 1000µg/mL and 11.50% at 500µg/mL. Cytotoxicity against SF-268 cells was dose-dependent, with an IC_{50} of 162µg/mL.

Conclusion: CeO_2 nanoparticles synthesized using Aegle marmelos extract are crystalline, stable and spherical, exhibiting significant antimicrobial, antioxidant and anticancer activities, highlighting their potential in biomedical applications.

Keywords: Aegle marmelos; Green synthesis; Cerium oxide; cytotoxicity.

OP-BM-27

Advanced Preclinical Evaluation of Polyherbal Ointment For Wound Healing: In-Vitro, In-Vivo, Toxicological And Stability Assessment

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Abstract

Polyherbal formulation provides a promising alterative for wound and burn management because of their multifaceted therapeutic efficiency and minimal adverse effect. This research gives an advanced evaluation of a previously formulated polyherbal ointment containing Kalmegh (Andrographis paniculata), Neem (Azadirachta indica) and Turmeric (Curcuma longa). In-vitro assays were used such as Enhanced cell migration was demonstrated by using HaCaT keratinocytes and fibroblast cultures showed 1.6-fold increase in collagen deposition compared to controls. Mitigation of oxidative stress were indicated by elevated antioxidant enzyme activity (SOD and catalase). In-vivo studies in Wister rats revealed accelerated wound contraction of 94.5% by day 14 and faster epithelialization in 16 ± 1.2 days compared to control group and standard silver sulfadiazine treatment. Histological analysis showed increased collagen organization, decreased inflammation and neovascularisation. Furthermore, acute dermal toxicity tests highlight no erythema, oedema or systemic side effects at dose up to 2000mg/kg. Pharmacokinetic studies showed negligible systemic absorption of active constituents, supporting localised therapeutic action. The physicochemical properties, antimicrobial activity and microbial safety were maintained under accelerated and real-time conditions indicating the stability over 6 months period. These results validate the polyherbal ointment as a safe, stable and efficacious candidate for burn and wound therapy that permits further clinical evaluation in human subjects.

Key words: Polyherbal ointment, Wound healing, Burn therapy, In-vivo evaluation, Stability and Toxicology

OP-BM-28

Silver-Based Nanocomposite Coatings for Enhanced Antibacterial

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Abstract

In orthopaedic surgery, bacterial infections on titanium implants are typically challenging to treat and may require medication or implant removal. Orthopedic implant surface coating with metal oxide and metal NPs or nanopolymers has the potential to transform metallic implants antibacterial capabilities. Numerous biocompatible substances with antibacterial properties have been researched for endophyte surface coating. Developing nanocomposite coatings with both enhanced osseointegration and antibacterial action is essentia. Niobium pentoxide (Nb2O5) is a very promising transition metal oxide (TMO) and is well known for their exceptional biocompatibility and potential for biological applications, Nb2O5 have garnered more interest recently [Matsuno et al., 2001]. The incorporation of Nb2O5 can provide osteoconductive and osteoinductive properties, promoting bone growth and integration with the titanium substrate. In biological contexts, Nb2O5 is a stable, non-reactive substance. Due to its inertness, Nb2O5 reduces the possibility of harmful immunological responses, inflammation, and toxic reactions, making it safe for use in medical applications. Nb2O5 is well recognized for its capacity to promote osteointegration, which is the process by which osteoblasts, or bone cells, proliferate and fuse with the implants surface. To improve cell adhesion and proliferation, Nb2O5 surface chemistry and topography can be adjusted. Indeed, materials based on niobium have demonstrated positive interactions with bone cells, promoting the growth of bone surrounding the implant. Silver (Ag) NPs have a wide range of antimicrobial actions and has long been recognized for its potent bactericidal and inhibitory effects [Zhao et al., 2005]. Ag NPs are important for covering orthopedic implants because it can increase biocompatibility, lower the risk of infection, and prolong the life of the implant. Ag can be added to coatings, including those composed of metal oxide to enhance bone cell adherence and encourage osteointegration. These coatings bioactivity can be increased by Ag ions, promoting the body's natural bone-healing process. Due to its adaptability for complicated implant geometries, simplicity of processing control, and controllable coating composition, PED has become a common coating. Adding Ag nanopowder to the electrolyte allowed Liu et al., to create composite coatings using ECD. The current experiment was conducted using a well-designed aqueous acidic electrolytic solution, thin coating of Nb2O5 was electrodeposited and then Ag NPs are codeposited from this solution. Ag NPs may kill germs and Nb2O5 can prevent bacterial adherence, resulting in a dual-action antibacterial mechanism when combined with Nb2O5.

OP-BM-29

Development, Phytochemical Characterization, And Bioanalytical Evaluation Of Drynaria Quercifolia Mother Tincture: Integrating GC–MS, FTIR, And In Vitro Anti-Inflammatory Assays

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Abstract

Rheumatoid arthritis (RA) and osteoarthritis (OA) are debilitating joint disorders characterized by persistent inflammation, oxidative stress, and progressive cartilage degradation. While conventional drugs such as NSAIDs offer symptomatic relief, their long-term use is limited by adverse effects, highlighting the need for plant-derived therapeutic alternatives. This study aimed to evaluate the anti-inflammatory potential of Drynaria quercifolia ethanolic extract by integrating phytochemical profiling with functional bioassays relevant to RA and OA pathology.

Materials and Methods: Rhizomes of D. quercifolia were extracted using hydroethanolic maceration and analyzed by GC–MS and FTIR to identify phytoconstituents and functional groups. Anti-inflammatory activity was investigated through albumin denaturation inhibition, proteinase inhibition, and HRBC membrane stabilization assays, with Diclofenac serving as a standard. GC–MS identified bioactive compounds including hydroquinone, maltol derivatives, and resorcinol, while FTIR confirmed hydroxyl, carbonyl, and ether functional groups. The extract demonstrated concentration-dependent activity with 44.5% albumin denaturation inhibition (IC_{50} = 407.6 µg/L), 78.5% proteinase inhibition (IC_{50} = 361.0 µg/L), and 14.7% hemolysis protection in HRBC stabilization (IC_{50} = 708.4 µg/L). Results were statistically comparable to Diclofenac ($p > 0.05$). Drynaria quercifolia ethanolic extract exhibits significant in vitro anti-inflammatory efficacy, likely mediated by phenolic constituents that stabilize proteins, inhibit proteolysis, and protect cell membranes. These findings support its potential as a natural therapeutic candidate for RA and OA management.

OP-BM-30

Comparative Analysis of Green Synthesis of Zinc Nanoparticles, Characterization, Qualitative and Quantitative Analysis of Phytoconstituents and Its Antibacterial, Antioxidant and Antidiabetic Activity of Corollocarpus Epigaeus And Withania Somnifera

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Abstract

The present study focuses on the green synthesis of ZnO nanoparticles of rhizome of Corollocarpus epigaeus and Withania somnifera its characterization, qualitative and quantitative phytochemical analysis and their antibacterial activity, its anti-oxidant activity and its anti-diabetic assay. The properties of absorbance peak observed by UV spectrophotometer, the organic compounds were identified through FTIR and the morphology of ZnO nanoparticles were observed and confirmed through SEM. The active components were analysed by various phytochemical studies in methanolic and chloroform extract to describe the presence of Glucose, proteins, phenols, flavonoids, terpenes and saponins. To screen for antibacterial activity and antioxidant activity by well diffusion method and DPPH assay respectively. Screening of antidiabetic activity by alpha amylase and alpha glucosidase inhibition assay. The results of assays were analysed statistically and compared. The results observed through UV spectrophotometer, FTIR and SEM analysis confirmed the presence of ZnO nanoparticles. The phytochemical analysis showed the presence of carbohydrates, saponins, terpenoids and proteins. The ZnO nanoparticles of Corollocorpus epigaeus and Withania somnifera proved to have the antibacterial activity against both gram-positive and gram-negative organisms such as Staphylococcus sp., Enterococcus sp., Escherichia coli, Klebsiella sp., and Proteus sp. Radical scavenging property of nanoparticles were found to be at 100 µg/ml of concentration of both plants. The anti-diabetic inhibition assay determines the IC50 value of α-amylase and α-glucosidase activity under assay condition. Comparative analysis was done to rule out the better therapeutic option for certain conditions.

OP-BM-31

Correlation of Urinary Nephrin And Clinical Markers of Nephropathy In Type 2 Diabetes Mellitus

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Abstract

Nephrin has 1241amino acids with 180 kDa molecular weight transmembrane glycoprotein of the immunoglobulin is an important component of the slit diaphragm located between foot process of podocytes together with endothelial cells and the basement form calyx of glomerular filtration barrier. If any alterations occurs in the podocytes and glomerulus basement membrane and also mutation of this proteins can cause foot process effacement and massive proteinuria. Hence urinary nephrin measurement is a potential important biomarker for detection of early glomerular injury and diagnostic or prognostic marker of nephropathy in T2DM. This cross-sectional study comprised 150 subjects with type 2 diabetes mellitus with and without chronic kidney disease and albuminuria who had results for urinary nephrin. Additionally, seventy-five (75) age, gender and BMI matched healthy controls are also included. The urinary nephrin and nephropathy factors were analyzed. Urinary nephrin significantly elevated in all the groups of T2DM patients when compared to healthy controls (P=0.001**). These levels were significantly correlated with kidney disease factors in patients with T2DM. The receivers operating curve analysis also the urinary nephrin shown very high significant at area under curve with sensitivity (73) and specificity (82) respectively P-value is 0.001**.

Conclusion: Based on the study findings, we concluded determination of urinary nephrin might be useful for early detectable and diagnostic marker for nephropathy in patients with type 2 diabetes mellitus.

Keywords: Urinary Nephrin, Type 2 Diabetes Mellitus, Nephropathy.

OP-BM-32

Enzyme-Sensitive and Biofilm-Cue–Responsive Biomaterials: Designing "Bacteria-Tracking" Systems for Precision Infection Control

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Abstract

Chronic biofilm infections resist treatment because conventional carriers act as passive depots, releasing antimicrobials irrespective of infection status. This indiscriminate release reduces efficacy, harms healthy tissue, and accelerates resistance. A novel paradigm is emerging: engineering non-living biomaterials that behave like "bacteria trackers", activated by bacterial enzymes and biofilm-derived cues. To review enzyme- and biofilm-responsive design strategies that enable site-specific activation of antimicrobial systems and to evaluate their translational potential across wound and implant-associated infections. Scopus-indexed studies (2015–2025) were examined on: (i) enzyme-sensitive crosslinkers (protease-, collagenase-, and β-lactamase-degradable motifs); (ii) biofilm-cue responsiveness targeting extracellular DNA, polysaccharides, and quorum-sensing signals; and (iii) responsive material formats such as injectable matrices, dressings, and implant coatings. Outcomes assessed included trigger specificity, release control, biofilm penetration, cytocompatibility, and in vivo efficacy. Enzyme-responsive systems demonstrated precise drug release in protease-rich or resistant bacterial environments. DNase and Dispersin B incorporation enhanced penetration and eradication of biofilm-protected colonies. β-lactamase-sensitive motifs restricted antibiotic release to resistant strains. Early-stage designs responsive to quorum-sensing molecules represent a highly novel but less mature avenue. Collectively, these systems outperformed passive matrices in controlling bacterial load, preserving host tissue, and reducing resistance pressure.

Conclusion: By converting bacterial virulence factors into therapeutic triggers, "bacteria-tracking" biomaterials represent a unique and innovative approach for managing fistula-like tracts, diabetic ulcers, surgical wounds, and implant infections.

Keywords: bacteria-tracking biomaterials; enzyme-sensitive crosslinkers; biofilm cues; infection-responsive systems.

OP-BM-33

Experimental And Computational Analysis of Gallic Acid for Antimicrobial Activity

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Abstract

A polyphenolic molecule, Gallic acid (3,4,5-trihydroxybenzoic acid) ($C_7H_6O_5$) is an antioxidant provides antimicrobial activity. The DFT calculations have been performed using Gaussian ’09 software package. The study reveals the structural analysis and energy calculations provide the optimized structure. The FTIR and FT-Raman frequencies explain the complete vibrational modes of the compound providing the structure stability with the absence of imaginary wavenumber. The redistribution of electron density in various bonding, antibonding orbitals had been calculated by natural bond orbital (NBO) analysis to give clear evidence of stabilization originating from the hyper conjugation of various intra – molecular interactions. The HOMO-LUMO analysis is to elucidate information about the charge transfer within the molecule. Further in vitro analysis of antimicrobial activity against *E.coli* and *Staphyalococcus aureus* revealed the maximum zone of inhibition exhibited by gallic acid 19 and 17 mm respectively when compared with standard antibiotic ampicillin 22 and 21mm. Experimental and computational analysis of gallic acid providing more insights in finding out novel drug candidate for multidrug resistance microbial infections.

Key Words: DFT calculations; HOMO-LUMO; Gaussian ’09; NBO Analysis

OP-BM-34

Development Of Optimized Plant-Based Bioactive Compounds For Cervical Cancer Treatment: A Comprehensive Study On Extraction, Characterization And Therapeutic Efficacy

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Abstract

This study aimed to optimize polyphenol extraction from *Anethum graveolens* leaves for potential cervical cancer therapy. Microwave-Assisted Extraction (MAE) was employed under controlled conditions of microwave power, irradiation time and liquid–solid ratio. OVAT, RSM, and ANN were applied for process optimization and predictive modeling. Total polyphenol content was quantified, and antioxidant potential was assessed using DPPH and LOX–COX assays. GC–MS analysis identified bioactive compounds including Umbelliferone, Gallic Acid and Sinapic Acid. Plant-derived polyphenols are promising therapeutic agents due to their antioxidant and anti-inflammatory activities. Efficient extraction and optimization are essential for maximizing yield and bioactivity. This study integrates Microwave-Assisted Extraction with computational modeling to extract and characterize bioactive compounds from *A. graveolens*. Shade-dried *A. graveolens* leaves were powdered and subjected to Microwave-Assisted Extraction. Extraction conditions were optimized via OVAT, RSM, and ANN. Total polyphenols were measured by Folin–Ciocalteu assay. GC–MS was used for phytochemical profiling, and antioxidant activity was evaluated using DPPH and LOX–COX inhibition assays. MAE enhanced polyphenol recovery compared to conventional methods. RSM and ANN accurately predicted optimal conditions. GC–MS confirmed Umbelliferone, Gallic Acid and Sinapic Acid as major bioactive compounds. Extracts showed strong antioxidant and anti-inflammatory activity, validating therapeutic potential. MAE combined with OVAT, RSM, and ANN provides an efficient strategy for polyphenol extraction. Bioactive compounds exhibit antioxidant and anti-inflammatory properties, supporting their use in nutraceutical and pharmaceutical formulations for cervical cancer.

OP-BM-35

To synthesis and characterization of modified Coenzyme q -10 for lipid-soluble antioxidants: case studies on coenzyme granules

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Abstract

Coenzyme Q-10 (CoQ10), also known as ubiquinone, is a lipid-soluble benzoquinone compound that plays a pivotal role in cellular energy production and antioxidant defense. The development of Coenzyme Q10 (CoQ10) represents a complex yet promising endeavor, aiming to enhance the bioavailability and improve the solubility of coenzyme Q10. Its dual functionality as both an electron carrier and a potent antioxidant allows it to protect membrane lipids, proteins, and DNA from reactive oxygen species (ROS) while regenerating essential antioxidants such as vitamin E. Clinically, CoQ10 supplementation exhibits therapeutic benefits in cardiac failure, hypertension, Parkinson's disease, male infertility, metabolic disorders, and skin aging. Furthermore, it helps mitigate statin-induced myopathy by replenishing depleted CoQ10 levels. However, its poor water solubility and limited oral bioavailability have necessitated the development of advanced nanocarrier-based formulations such as liposomes, nanoemulsions, micelles, and solid lipid nanoparticles. These systems enhance its absorption, stability, and pharmacokinetic performance. Recent research emphasizes CoQ10's role in mitochondrial medicine, anti-aging therapy, and biopharmaceutical innovation. Ongoing studies focus on improving its bioavailability, targeted delivery, and synergistic action with other antioxidants. Thus, CoQ10 represents a multifunctional therapeutic agent with promising potential in preventive and regenerative medicine.

Keywords: Coenzyme Q-10; ubiquinone; solubility; antioxidant; bioavailability; nanotechnology; nanoemulsions; cardiovascular health; neuroprotection.

OP-BM-36

Schiff Base Nanoparticles As Potential Anticancer Agents: Combined Experimental, DFT, And Molecular Docking Analysis

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Abstract

The present study explores the design, synthesis, and evaluation of novel Schiff base ligand-functionalized nanoparticles with potential anticancer activity. These nanoparticles were characterized using advanced physicochemical techniques to confirm their size, morphology, and surface properties, which enhance cellular uptake and selective cytotoxicity against cancer cells. Density Functional Theory (DFT) calculations were employed to investigate the electronic structure, stability, and reactivity of the Schiff base-ligand-nanoparticle systems, providing insight into their interaction potential at the molecular level. Furthermore, molecular docking studies were conducted to predict the binding affinity and interaction modes of the nanoparticles with key oncogenic proteins, revealing favorable interactions that could inhibit cancer cell proliferation. The combined experimental and computational analyses demonstrate that these Schiff base-functionalized nanoparticles possess significant anticancer potential, paving the way for the development of targeted nanomedicine strategies.

Keywords: Schiff-base ligand, DFT, Molecular docking, anticancer.

OP-BM-37

From Surface to Stability: Plasma Treated Hydroxyapatite/ Polymer Coatings for 316L Stainless Steel Implants

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Abstract

Metal-based biomaterials such as titanium, titanium alloys, zirconia, and stainless steels are widely used in load-bearing orthopedic implants due to their excellent mechanical strength and structural reliability. Among these, 316L stainless steel (316L SS) is particularly favored for its corrosion resistance, biocompatibility, and cost-effectiveness. However, the unwanted release of Fe, Cr, and Ni ions poses biological risks. To address this challenge, plasma surface treatment was employed to enhance surface activation, thereby improving hydrophilicity and coating adhesion. Building on this, a multifunctional composite coating was designed using hydroxyapatite (HAP), mineral substitutions, a marine biopolymer, and a synthetic polymer. The samples were maintained at a Ca/P ratio of 1.67, closely mimicking stoichiometric HAP to ensure chemical stability and biological relevance. X-ray photoelectron spectroscopy (XPS) confirmed successful mineral substitution at Ca^{2+} sites within the HAP lattice. Electrochemical analyses demonstrated a noble shift in E_{corr} and a reduction in i_{corr} in simulated body fluid (SBF), signifying superior corrosion resistance. In addition, the coating exhibited remarkable hydrophilicity (~51.8°), supporting favorable cell interactions and long-term implant stability. Overall, this study presents an advanced surface engineering strategy that enhances corrosion resistance, chemical integrity, and bioactivity of 316L SS, offering significant promise for orthopedic implant applications.

Keywords: 316L Stainless steel; Mineral substitution; Simulated body fluid (SBF); Long-term stability; Bioactive implant.

OP-BM-38

Fabrication Of Naturally Derived Substituted Hydroxyapatite/Biopolymer Nanocomposite for Biomedical Applications

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Abstract

In the present work, magnesium substituted HA (M-HA) is synthesized by using calcium sources from the fresh water sea shell and also reacts with the phosphate obtained from diammonium hydrogen phosphate and magnesium nitrate. To the biogenic derived Leucas aspera (L. Aspera) methanolic crude extract is added which is used to improve the antibacterial activity of as-synthesized M-HA/LA. The synthesis of HA and L. Aspera composite is evaluated for the physicochemical, antibacterial and mechanical strength using X-ray diffraction (XRD), Fourier Transform Infra Red (FTIR) Spectroscopy, Scanning Electron Microscopy (SEM) and young's modulus. The morphological SEM results demonstrated a M-HA/LA composite which was homogeneous structure revealed that the small sphere like morphology of composite material is favorable for the adhesion and proliferation of cells and the elemental mapping evidenced for the homogenous distribution of mineral ions and the LA composite material. Also the composite materials exhibited improved cytocompatibility and bioactivity due to the coeffect of substitution of minerals and reinforcement of LA into the HA. Thus, the naturally derived M-HA/LA biocomposite can serve as a prospective biomedical for tissue engineering applications.

OP-BM-39

ADMET Profiling and Molecular Docking of Selected Phytochemicals for Transdermal Wound Healing and Anti-Inflammatory Applications

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Abstract

Transdermal patches offer controlled release and enhanced bioavailability for wound-healing phytochemicals. Six compounds—Bacoside A, Picroside I, Mangiferin, Chrysin, Vitexin, and Curculigoside—were screened using molecular docking and ADMET profiling. Docking results showed strong protein–ligand interactions, with Picroside I binding NF-κB (−10.44 kcal/mol), Vitexin exhibiting high affinity for COX-2, iNOS, and IL-6, and Mangiferin displaying consistent multi-target modulation. ADMET analysis revealed Vitexin (MW 432.38 g/mol, log Kp −8.79 cm/s) and Mangiferin (MW 422.34 g/mol, log Kp −9.14 cm/s) as optimal for skin permeation and safety, with minimal drug-likeness violations. Chrysin exhibited high permeability but limited binding strength, whereas Bacoside A was hindered by its low permeability. These findings suggest Vitexin and Mangiferin as promising lead molecules for transdermal patch formulations. Future validation will include in vitro release studies, ex vivo skin permeation, and in vivo wound-healing efficacy. Vitexin and Mangiferin emerged as lead candidates for cost-effective transdermal wound-healing applications, supported by favorable docking and ADMET profiles, with future in vitro, ex vivo, and in vivo validation to support clinical application.

Key Words: Phytochemicals; Wound healing; Docking; ADMET; Transdermal delivery

OP-BM-40

Crystallinity-Tuned HAP Multicomponent Composite with Enhanced Strength for Bioactive Implant Coatings

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Abstract

The inherent drawbacks of conventional hydroxyapatite (HAP)-based coatings such as poor mechanical strength, weak interfacial adhesion, and limited biological functionality highlight the need for advanced composite materials for next-generation implant applications. In this work, a multifunctional composite was developed by integrating HAP with 5-amino-4-imidazolecarboxamide (AICA) to promote bioactivity and molecular-level interactions, Sodium alginate (SA) to provide a biocompatible hydrogel-like framework, and polyacrylonitrile (PAN) to reinforce mechanical toughness and coating stability. FTIR and UV-Vis analyses verified the molecular interactions among the composite components. Structural refinement resulted in a reduced crystallite size (~22.7 nm) and an optimized Ca/P ratio (~1.67), closely resembling that of natural bone. The composite exhibited a dense, uniform morphology and enhanced hydrophilicity (contact angle ~58°), supporting favorable cell adhesion and proliferation. Thermal analysis demonstrated high stability up to ~670 °C, confirming its suitability for biomedical processing. Mechanical evaluation revealed a markedly improved Vickers hardness (~281 HV at 9.8067 N load) and strong pull-off adhesion (~3.28 MPa), indicative of excellent load-bearing capacity and robust interfacial bonding. Collectively, these results demonstrate that the HAP/AICA/SA/PAN composite is a highly promising biocompatible coating material with superior structural integrity and biological performance, making it an excellent candidate for advanced implant applications.

Keywords: Hydroxyapatite composite; Organic-inorganic interactions; Hybrid coatings; Microstructure; osteointegration; Surface hydrophilicity.

OP-BM-41

Prescription Pattern Analysis and Economic Evaluation of Different Dermatological Formulations Across Multiple Skin Disorders in teritary care hospital

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Abstract

Dermatological disorders are most common and highly prevalence around worldwide and account for a significant proportion of outpatient visits in tertiary care hospitals. The choice of dosage form and prescription pattern analysis plays a crucial role in ensuring therapeutic efficacy, patient compliance and evaluating trends. A prospective observational study was conducted in the dermatological department of a teriary care hospital over six months from the period of Jan 2025-july 2025. Prescription was collected systematically and analysed to determine the frequency of various dosage forms such as topical preparations (creams, ointments, gels, and lotions), oral formulations (tablets, capsules, and syrups), and parenteral routes. Cost minimization analysis involved economic evaluation between different brands and generic medications to assess cost variation and their impact on overall treatment cost. A total of 100 sample were analyzed. The most prescribed classes were antihistamines (49%), Corticosteroids (34%), antifungals (9%), antibacterials (8%). Its reveal's tablet formulation (50%) was more predominant, followed by ointments (46%), creams (20%). Significant variations are observed among different brands, with some exhibitinh more than a three folf price difference. Therpaeutic equivalent but more affordable alternatives were identified, highlighting potential for cost-effective prescribing.

Keywords: Prescribing patterns, Drug utilization, Dosage forms, Dermatology, Cost-minization analysis (CMA), Rational drug use,

OP-BM-42

Medical Association

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Abstract

Medical associations play a pivotal role in advancing healthcare standards, promoting medical education, and ensuring ethical practices among healthcare professionals. These organizations serve as a unifying body for physicians and medical practitioners, fostering collaboration, research, and policy advocacy. By organizing conferences, publishing journals, and offering continuing medical education (CME) programs, medical associations contribute significantly to professional development and the dissemination of medical knowledge. Additionally, they act as a liaison between the medical community, government agencies, and the public, influencing health policy and improving patient care outcomes. In an era of rapidly evolving medical science, the role of medical associations remains essential in maintaining clinical excellence, promoting evidence-based practice, and addressing emerging healthcare challenges through collective action and leadership.

OP-BM-43

Synergistic Wound Healing Activity of Manganese Oxide Nanoparticles from *Citrus hystrix* and Encapsulated Arbutin in a Topical Gel Formulation

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Abstract

Wound healing requires effective therapies that enhance tissue repair and minimize complications. This study focused on the biosynthesis of manganese oxide nanoparticles (MnO_2 NPs) using *Citrus hystrix* extract as a natural reducing and stabilizing agent. The nanoparticles were incorporated with Arbutin, a bioactive compound possessing antioxidant and anti-inflammatory properties, into a topical gel formulation. The MnO_2-Arbutin gel was designed to promote cell proliferation, collagen deposition, and reduce oxidative stress at the wound site. Physicochemical characterization, biocompatibility, and wound healing assessments demonstrated enhanced therapeutic potential, indicating its promise as a safe and effective treatment for acute and chronic wounds. Citrus hystrix peels from Kolli Hills, Namakkal, were dried and extracted by hot plate evaporation. Manganese oxide nanoparticles were green-synthesized and characterized (UV-Vis, PSA, FTIR, SEM, EDX). Their antibacterial, anti-inflammatory, and antioxidant activities were evaluated to explore wound healing potential. The study achieved eco-friendly synthesis of MnO_2 nanoparticles using *Citrus hystrix* peel extract. Characterization confirmed their structure, while biological tests showed synergistic wound healing MnO_2provided antimicrobial and antioxidant effects, and Arbutin acted as an antioxidant and tyrosinase inhibitor. The gel enabled sustained Arbutin release, enhancing therapeutic efficacy. The MnO2-Arbutin topical gel formulation demonstrated synergistic wound healing potential, controlled release, and biocompatibility. This novel nanotechnology-based approach shows promise for developing safe and effective therapies for acute and chronic wound management.

Key Words: Manganese oxide nanoparticles, *Citrus hystrix*, Arbutin, topical gel,

OP-BM-44

Development and Performance Assessment of M-HAP/Chitosan Composite Coatings on Titanium Alloys for Biomedical Applications

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Abstract

The long-term success of biomedical implants largely depends on their corrosion resistance, bioactivity, and ability to promote osseointegration. Titanium alloys, though widely used, often require surface modification to enhance their biological performance and durability in physiological environments. In this study, M-HAP/Chitosan/Polycaprolactone (PCL) composite coatings were developed on Ti–6Al–4V alloys using a multi-layer deposition strategy. The incorporation of metal-doped hydroxyapatite (M-HAP) provided superior bioactivity and structural similarity to bone mineral, while chitosan contributed antibacterial functionality and improved adhesion at the coating substrate interface. PCL was employed as a protective outer layer to impart mechanical stability, controlled degradation, and enhanced corrosion resistance. The coatings were systematically characterized through X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and scanning electron microscopy (SEM) to confirm phase composition, chemical interactions, and surface morphology. Electrochemical impedance spectroscopy (EIS) and Tafel polarization studies revealed significantly improved corrosion resistance of the coated alloys compared to bare Ti–6Al–4V. Furthermore, antibacterial activity against representative Gram-positive and Gram-negative strains was assessed to validate the coatings' ability to mitigate bacterial adhesion and proliferation. The findings demonstrate that the incorporation of M-HAP with chitosan and PCL not only improves corrosion resistance but also provides antibacterial functionality, highlighting the potential of the developed composite coatings for next-generation biomedical implants.

Keywords: Surface modification, Multifunctional nanocomposite coatings, Corrosion resistance.

OP-BM-45

Quality control in pharmaceuticals

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Abstract

Quality control (QC) in pharmaceuticals is a systematic process designed to ensure that the drug products consistently meet predefined safety, efficacy, and quality standards. It involves rigorous testing of raw materials, in-process intermediates and finished products to prevent substandard or contaminated medicines from reaching patients. Through processes such as assay tests, dissolution studies, and microbial testing, QC safeguards public health and ensures compliance with international regulatory frameworks including Good Manufacturing Practices (GMP) and International Council for Harmonization (ICH) guidelines. By distinguishing between quality control and quality assurance (QA), this paper highlights QC's role as a critical backbone of pharmaceutical manufacturing, ensuring drug stability, potency and uniformity across production batches. Ultimately, strong QC practices not only protect patients but also reinforce industry credibility, regulatory compliance and long-term sustainability of pharmaceutical companies.

OP-BM-46

Diamond coated ZnO 3D-nanohybrid for cryoprotectant and invitro fertilization scavengers against Zn deficiency effects in rats

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Abstract

Zinc deficiency is a major contributor to male infertility, affecting nearly one-third of infertile men worldwide, yet effective therapeutic strategies remain limited. This study aimed to develop and evaluate a novel three-dimensional (3D) diamond-coated zinc oxide (ZnO) nanohybrid as a multifunctional cryoprotectant and antimicrobial agent to mitigate zinc deficiency–induced spermatogenic toxicity. The investigation was conducted in two phases: (1) *in vitro* evaluation of antimicrobial activity and sperm cryoprotection under heat shock and freeze–thaw conditions, and (2) *in vivo* validation using male Sprague–Dawley rats treated with Diamond–ZnO formulations. Antibacterial and antifungal activities were assessed alongside sperm viability, reactive oxygen species (ROS) generation, and morphological integrity. In vivo analyses included reproductive hormone profiling, testicular morphometry, and biochemical markers of hepatic and renal function, complemented by histopathological examination. The thermally synthesized Diamond–ZnO nanocomposite demonstrated superior antimicrobial efficacy and significantly preserved sperm viability (84% sensitivity and specificity) following cryopreservation. Treated rats exhibited improved sperm morphology, balanced reproductive hormones, and restored testicular histoarchitecture compared with controls. Moreover, protein-loaded Diamond–ZnO formulations alleviated hypokalemia and hyperoxaluria, indicating systemic metabolic support.

Key words: Diamond particles, Nanocomposites, Male Infertility, Cryopreservation,

OP-BM-47

Biopharmaceuticals

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Abstract:

Biopharmaceuticals, also known as biologics, are therapeutic products derived from living organisms or produced using biotechnology. Unlike traditional chemically synthesized drugs, biopharmaceuticals are primarily composed of proteins, nucleic acids, or living cells and tissues, making them highly specific and effective in targeting diseases. They include a wide range of products such as monoclonal antibodies, vaccines, recombinant proteins, hormones (like insulin), gene therapies, and cell-based therapies. Biopharmaceuticals have revolutionized the treatment of chronic and life-threatening conditions such as cancer, autoimmune disorders, diabetes, and genetic diseases by offering targeted mechanisms of action with reduced side effects. Their production involves advanced techniques like recombinant DNA technology, hybridoma technology, and cell culture methods to ensure high purity and efficacy. Despite their advantages, biopharmaceuticals face challenges including high production costs, complex manufacturing processes, stringent regulatory requirements, and stability issues. Continuous research and innovation in biotechnology, genetic engineering, and bio-manufacturing are driving the rapid growth of the biopharmaceutical industry, paving the way for more personalized and effective medical treatments in the future.

OP-BM-48

Green-Synthesized Phytochemical Nanoparticles from *Hypericum perforatum*, *Leucas aspera* and *Vitex negundo* Extracts for Management of Post-Menopausal Syndrome: A Preliminary Evaluation

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Abstract

Post-Menopausal Syndrome (PMS) is a multifactorial condition associated with deficiency of oestrogen, oxidative stress and alterations in mood. Even though hormone replacement therapy (HRT) remains conventional therapy, its long-term adverse reactions necessitate the exploration of safer, plant-based alternatives. The current research explores the extraction and preliminary evaluation of bioactive nanoparticles synthesised from *Hypericum perforatum, Leucas aspera* and *Vitex negundo* for their well-known activity in alleviating PMS-related symptoms. The ethanolic extracts of the selected herbs were prepared and subjected to nanoparticle extraction through green synthesis techniques. The characterization for particle size, morphology, and stability of synthesized nanoparticles was done using dynamic light scattering (DLS) and scanning electron microscopy (SEM). The phytochemical screening proves the presence of flavonoids, phenolics and terpenoids- compounds known for their phytoestrogenic and antioxidant properties. The nanoparticle showed a mean particle size of 152.4 ± 3.1 nm with a zeta potential of +31.6 mV, indicating good stability. *In-vitro* evaluation proved significant antioxidant activity of DPPH IC_{50} = 34.2 µg/mL and anti-inflammatory activities with moderate estrogenic potential in MCF-7 cell assays, highlighting their utility in treatment of PMS symptoms. The research concludes that the derived nanoparticles from herbal plants possess promising therapeutic potential. The future study will focus on formulation and optimization of these nanoparticles into suitable dosage forms for enhanced delivery, stability and clinical application for post-menopausal care.

Keywords: Post-menopausal syndrome, *Hypericum perforatum, Leucas aspera, Vitex negundo.*

OP-BM-49

Formulation and Evaluation and optimization of Metformin and Curcumin-Loaded Nanostructured Lipid Carriers for Enhanced diabetic Wound Healing

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Abstract

Diabetic wounds remain a significant clinical challenge due to impaired angiogenesis, prolonged inflammation, oxidative stress, and frequent infections, often resulting in delayed healing. This study aims to develop and evaluate a dual-drug nanostructured lipid carrier (NLC) gel encapsulating Metformin and Curcumin for enhanced diabetic wound management. Curcumin is known for its antioxidant, anti-inflammatory, and antimicrobial activities but is limited by poor solubility and bioavailability, whereas Metformin has shown potential in modulating inflammatory and vascular pathways to support tissue regeneration. NLCs were selected as the delivery platform to improve drug solubility, stability, and controlled release, while promoting deeper skin penetration. The optimized NLCs will be prepared using solvent emulsification diffusion, characterized for particle size, polydispersity index, zeta potential, entrapment efficiency, and morphology, and subsequently incorporated into a gel. The final formulation will be evaluated for physicochemical properties, antioxidant potential, antimicrobial activity, and stability under accelerated conditions. This novel combination approach is expected to provide a synergistic therapeutic effect, ensuring localized, sustained drug delivery and reduced dosing frequency. The proposed NLC-based gel holds promise as an effective, patient-compliant topical therapy for chronic diabetic wounds.

Keywords: Diabetic wound healing; Nanostructured Lipid Carriers (NLCs); Metformin

OP-BM-50

Formulating A B-Cyclodextrin–Dasatinib Inclusion Complex By Kneading To Boost Dissolution Performance

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Abstract

Dasatinib (DAS) is a class II BCS tyrosine-kinase inhibitor whose clinical efficacy is hindered by limited aqueous solubility. We formulated a simple β-cyclodextrin (β-CD) inclusion complex to improve pre-absorptive performance. Ingredients were DAS and β-CD (97%); the complex was formulated at the optimum molar ratio of 2:1 β-CD: DAS in ethanol: water (1:1), kneaded 45 min, air-dried for 24 h, and size-reduced (#65). Solution behavior was also assessed using UV spectrophotometry (λ_max 321 nm), saturation solubility, Higuchi–Connors phase-solubility, and Job's continuous-variation analysis; solid-state verification utilized FTIR, DSC, XRD, SEM, and ^{1}H NMR. The complex enhanced aqueous solubility from ~14 µg/mL (neat DAS) to ~40.15 µg/mL (~3-fold). Phase-solubility profiling indicated an AL-type response; combined with a Job's plot maximum at R ≈ 0.7, evidence favored a suitable 2:1 β-CD: DAS stoichiometry with moderate affinity consistent with fast release. In USP-II dissolution (pH 6.8, 37 °C), the complex delivered ~76.90% drug release at 120 min compared to ~35.9% for DAS. FTIR band overlap/attenuation (N–H, C=O, O–H/C–O–C), loss of the DAS melting endotherm on DSC, reduced/broadened XRD reflections, and SEM-documented loss of crystalline habit, along with ^{1}H NMR chemical-shift perturbations (β-CD H-3/H-5; DAS protons), confirmed true inclusion in place of physical admixture. Overall, kneaded β-CD complexation forms a strong, cost-effective pathway to convert DAS into a dispersion- and dissolution-capable product with evident promise to enhance oral availability.

Key words: Dasatinib; β-Cyclodextrin; Inclusion complex; Kneading method; Phase-solubility.

OP-BM-51

Pharmaceutical Manufacturing & Quality

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Abstract

Pharmaceutical Manufacturing is the industrial process of producing medicines from raw materials into final dosage forms like tablets, capsules, or injections. It includes formulation, processing, packaging, and labeling under strict regulatory guidelines. Pharmaceutical Quality ensures that every medicine produced is safe, effective, pure, and consistent. It is maintained through quality assurance, quality control, and compliance with Good Manufacturing Practices.

Keywords : Pharmaceutical manufacturing : it is the large-scale process of producing medicines.

OP-BM-52

Study On Conjunctival Microbial Flora And Its Variation In Normal, Pre-, And Post-Operated Cataract Eyes

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Abstract

Cataract is the leading cause of preventable blindness worldwide, and surgery remains the most effective treatment. However, the risk of postoperative infection due to microbial flora in the conjunctival sac remains a significant concern. Understanding the microbial pattern in operated and non-operated eyes helps in formulating better infection control and antibiotic prophylaxis strategies. A prospective observational study was conducted for six months in a tertiary care hospital, Salem, including 30 cataract patients of both genders. Conjunctival swabs were collected from normal, pre-operative, and post-operative eyes and cultured on blood agar. The microbial isolates were identified and analysed statistically using SPSS software version 28.0. Among the 90 conjunctival samples, microbial growth was found in 70% of normal eyes, 66.7% of pre-operative samples, and 36.7% of post-operative samples. Coagulase-negative *Staphylococci* were the most common isolates, followed by *Diphtheroid*, *Streptococcus* and *Cutibacterium* . A significant reduction in microbial growth post-surgery was observed due to the use of prophylactic antibiotics such as Moxifloxacin and Ciprofloxacin combined with Dexamethasone.

Keywords: Cataract, Conjunctival flora, Microbial growth, Antibiotic prophylaxis, Infection control.

OP-BM-53

ADMET Profiling and Molecular Docking of Selected Phytochemicals for Phytochemical-Infused Band-Aid Preparation in Wound Healing Applications

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Abstract

Phytochemical-loaded band-aids represent a novel therapeutic approach that combines wound protection with localized drug delivery. Six phytochemicals—Bacoside A, Picroside I, Mangiferin, Chrysin, Vitexin, and Curculigoside—were evaluated by molecular docking and ADMET profiling. Docking studies showed Picroside I as a strong NF-κB binder (−10.44 kcal/mol), Vitexin with high affinity for COX-2, iNOS, and IL-6, and Mangiferin as a consistent multi-target agent. ADMET profiling supported Vitexin (MW 432.38 g/mol, log Kp −8.79 cm/s) and Mangiferin (MW 422.34 g/mol, log Kp −9.14 cm/s) as ideal for topical band-aid incorporation due to permeability and safety profiles. Bacoside A exhibited poor penetration, while Chrysin, though highly permeable, displayed weaker binding. Future research will include in vitro antimicrobial and anti-inflammatory assays, ex vivo skin adhesion and permeation studies, and in vivo wound closure models.

Key Words: Phytochemicals; Band-aid; Docking; ADMET; Wound healing; Topical delivery

OP-BM-54

Hptlc Phytochemical Profiling And Free Radical Scavenging Activity of Novel Polyherbal Formulation

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Abstract

The present study investigates the phytochemical composition and free radical scavenging potential of a novel polyherbal formulation comprising *Trigonella foenum-graecum* (Fenugreek), *Carum copticum* (Ajwain), *Zingiber officinale* (Ginger), *Chrysanthemum coronarium* (Garland Chrysanthemum), *Curcuma aromatica* (Wild Turmeric), *Cuminum cyminum* (Cumin), and *Nigella sativa* (Black Jeera). Ethanolic extracts of the formulation were obtained using Soxhlet extraction and evaluated through preliminary phytochemical screening, total phenolic content (TPC), total flavonoid content (TFC), DPPH radical scavenging assay, and High-Performance Thin-Layer Chromatography (HPTLC) analysis.Phytochemical screening confirmed the presence of flavonoids, alkaloids, steroids, terpenoids, tannins, phenols, saponins, and proteins. The extract demonstrated strong antioxidant activity with 83% DPPH inhibition at 100 µg/mL, along with significant levels of phenolic and flavonoid compounds. HPTLC fingerprinting revealed a characteristic flavonoid band at Rf 0.18, closely comparable to quercetin. These results indicate that the polyherbal formulation possesses notable antioxidant and free radical scavenging properties, supporting its potential application in natural product research and phytopharmaceutical development.

Keywords: Polyherbal formulation, Phytochemical profiling, HPTLC fingerprinting, Antioxidant activity, Free radical scavenging

OP-BM-55

Enhanced Osseointegration and Bioactivity of Composite HAp Coatings on Titanium for Bone Regeneration

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Abstract

With the increasing demand for effective bone implant therapies, titanium (Ti) has become a preferred material for load-bearing orthopedic applications due to its excellent mechanical properties and biocompatibility. However, challenges such as implant failure and insufficient integration with surrounding bone tissue particularly in patients with low bone density continue to hinder clinical outcomes. To overcome these limitations, porous bioactive coatings have emerged as a promising strategy to enhance osseointegration and implant performance. Among various ceramic biomaterials, hydroxyapatite is considered ideal for coating metallic implants due to its chemical resemblance to natural bone mineral and its superior biocompatibility. The sol-gel technique offers a versatile and cost-effective method for depositing HAp coatings, providing advantages such as low processing temperatures, uniform composition, and strong interfacial bonding. To further improve the corrosion resistance and biological functionality of titanium implants, a series of composite coatings comprising mineral-substituted hydroxyapatite (MHAp, where M = Zn or Mg), polylactic acid-MHAp (PLA-MHAp), halloysite nanotube-MHAp (HNT-MHAp), HNT-PLA-MHAp, were successfully developed on anodized titanium substrates via electrodeposition. The structural and functional characteristics of the composite coatings were analyzed using Fourier-transform infrared spectroscopy (FT-IR), X-ray diffraction (XRD), and scanning electron microscopy (SEM). Electrochemical techniques such as potentiodynamic polarization and electrochemical impedance spectroscopy (EIS) were employed to assess the corrosion behavior of the coatings. Additionally, the study addresses the critical challenges in developing HAp-based coatings on titanium for biomedical applications, including optimization of physical and mechanical properties, corrosion resistance, in vitro bioactivity in simulated body fluid (SBF), and antibacterial performance.

Keywords: Titanium implants, Hydroxyapatite coating, Electrodeposition, Corrosion resistance.

OP-BM-56

Packing Of Pharmaceutical Products

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Abstract

Packaging of pharmaceutical products plays a critical role in ensuring the safety, stability, and efficacy of medicines from the point of manufacture until their use by the patients. It serves multiple purposes such as protecting drugs from environmental factors like moisture, light, oxygen, and microbial contamination, while also preventing mechanical damage during storage and transportation. Modern pharmaceutical packaging integrates innovative materials and technologies to provide tamper resistance, patient convenience, and regulatory compliance. Additionally, packaging fulfils an essential communicative function by delivering accurate product information, usage instructions, and legal labelling requirements. With the increasing demand for patient safety and quality assurance, sustainable and smart packaging solutions are also gaining prominence in the industry. Thus, pharmaceutical packaging is not merely a protective layer but an integral part of drug development, distribution, and patient care.

OP-BM-57

TLC (Thin Layer Chromatography) Fingerprinting and Bioautography of *Gymnema Sylvestre*

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Abstract

Gymnema sylvestre (family: Asclepiadaceae), commonly known as "Gurmar" is an herb found in central and western India, tropical Africa, and Australia. Different parts of the plant are used to treat Anti-inflammatory activity, Anti-Diabetic Effects, Antimicrobial Properties, and obesity. In this work, the methanol extract of *Gymnema sylvestre* leaves was collected and extracted. TLC analysed the extract. The retention factor result of TLC analysis of the crude extract of *Gymnema sylvestre* confirmed the presence of triterpenoid saponin. Performed comprehensive phytochemical screening (both qualitative and quantitative). Performed twelve qualitative tests of *Gymnema sylvestre* extract. Performed quantitative analysis by estimation of phenol. Performed multienzyme bioautography on TLC-separated extracts to identify and localise enzyme-inhibiting phytocompounds for key metabolic marker enzymes. A completed molecular docking study of gymnemic acid and IL-6 receptor subunit beta was conducted to determine their binding affinity. Finally got -8.1 best docking score of gymnemic acid with IL-6 pro-inflammatory cytokines. Optimal recovery of bioactive metabolites has been successfully done using maceration techniques of *Gymnema sylvestre* leaves. Phytochemical screening (12 qualitative and 2 quantitative) has been successfully done to estimate the total phytochemical content to evaluate antioxidant potential. Thin-layer chromatography fingerprinting profile has successfully been used for comparative analysis of solvent extracts using (Chloroform: Methanol: Water) mobile phase and FeCl3 visualising agent. The bioaugmentation process has been successfully done for the identification of the bacterial growth inhibition properties of *Gymnema sylvestre*. Molecular docking has been successfully done for the validation of phytocompounds against

OP-BM-58

Molecular Profiling of Drug-Resistant Gram-Negative Bacteria and Evaluation of Herbal Phytocompounds: Development and Validation of a Stable Anti-MDR Herbal Prototype

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Abstract

The emergence of multidrug-resistant (MDR) Gram-negative bacteria represents a critical global health concern, as these pathogens significantly limit available therapeutic options and contribute to increased morbidity, mortality, and healthcare costs. This study aims to perform molecular profiling of MDR Gram-negative pathogens to identify resistance genes, mutational hotspots, and virulence factors that facilitate their survival and adaptability. By integrating genomic and proteomic characterization, the research seeks to elucidate the molecular basis of antimicrobial resistance. In parallel, phytocompounds derived from selected medicinal plants are evaluated for their antibacterial potential through a combination of in silico molecular docking, in vitro antimicrobial assays, and in silico toxicity prediction. The most promising candidates demonstrating strong binding affinity and antibacterial activity are developed into stable herbal prototypes such as sprays, washes, or surface coatings. These formulations incorporate natural stabilizers and preservatives to enhance their shelf-life and usability. Comprehensive evaluation of the prototypes includes physicochemical stability testing, antibacterial efficacy assays, and cytotoxicity analysis to ensure safety and performance. This integrative framework bridges molecular characterization of resistant pathogens with the discovery and development of plant-based therapeutics. Ultimately, the study aims to produce a safe, effective, and sustainable herbal formulation capable of combating MDR Gram-negative bacteria. The outcomes are expected to support the development of eco-friendly antimicrobial alternatives, contributing to the global effort to mitigate antibiotic resistance and reduce dependency on conventional synthetic drugs.

Keywords: Phytochemicals, Antibacterial activity, Molecular docking, Herbal-derived phytocompounds

OP-BM-59

Medical Association

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Abstract

A medical association is a professional organization that unites healthcare practitioners, researchers, and medical students to promote excellence in medical practice, education, and research. Its primary objectives include setting ethical and professional standards, facilitating continuing medical education, advancing healthcare policies, and fostering collaboration among medical professionals. Medical associations play a vital role in advocating for patient safety, public health awareness, and evidence-based medical practices. By organizing conferences, publishing journals, and supporting clinical research, they serve as a bridge between medical science and community health needs. Ultimately, medical associations contribute significantly to the improvement of healthcare systems and the professional development of physicians worldwide.

OP-BM-60

Isatin derived Copper(II) Complex for Spectroscopic Investigation, In-Vitro Antibacterial and DNA-Cleavage Activities

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Abstract

Background: Schiff base complexes have been extensively investigated for more than a century and have been employed in areas that include magnetochemistry , non-linear optics photophysical studies , catalysis and materials chemistry Objective: This study was designed to synthesis a potentially active new Schiff base mixed ligands from Isatin (1H-Indole-2, 3- dione), Benzil and p-nitroaniline and then it is allowed to react with the metal salt copper chloride to form a effective mononuclear Schiff base Cu(II) complex.Methods: The Schiff base ligand (L1)was prepared by adding an ethanolic solution (20 ml) of Isatin (1 mM) and an ethanolic solution (20 ml) of p-nitroaniline. The Schiff base ligand (L2) was synthesized by adding an ethanolic solution (20 ml) of benzil (1 mM) and an ethanolic solution (20 ml) of p-nitroaniline (2mM). The ethanolic solution of ligand 1 (1mM) and was added drop wise to an ethanolic solution of ligand 2 (1mM) and the copper chloride salt (1mM) in 20 ml of ethanol were added with continuous stirring, and the mixture were heated under refluxion for 4 ½ hrs to form the mononuclear Schiff base Cu(C38H25N9O8Cl2) complex.Results: Depend upon the spectroscopic studies, the coordinating capability of the Schiff base ligand with Cu(II) ion have been proved via IR Spectral studies. UV-visible and magnetic measurements shows that Cu(C38H25N9O8Cl2) complex have distorted octahedral geometry correspondingly. We also have evaluated in-vitro antibacterial activity and DNA cleavage studies of newly synthesized potentially active Schiff base ligands and its metal complex. Conclusion: In this work, the findings clearly indicates that the Cu(C38H25N9O8Cl2) complex shows good in vitro antibacterial and DNA cleavage activities than the ligands. Keywords: 1H-Indole-2, 3-dione, mixed ligand Schiff base, DNA cleavage activity.

Keywords: 1H-Indole-2, 3-dione, mixed ligand Schiff base, DNA cleavage activity

OP-BM-61

Biosynthesis of Silver Nanoparticles from Bambusa vulgaris Extracts Using Different Solvents and Their Antibacterial Activity

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Abstract

In the present study, green synthesis of silver nanoparticles (AgNPs) is demonstrated using the plant extract of Bambusa vulgaris. The plant extracts through two different solvents, including methanol and ethyl acetate was prepared and further investigated for its antimicrobial activities against various bacterial strains. The phytochemical analysis was performed, where alkaloids, tannins and phenols were detected in methanolic extract. The structural properties and morphology of AgNPs were confirmed by scanning electron microscope (SEM), Fourier transform infrared (FT-IR) and X-ray diffraction (XRD) spectroscopic techniques. Their antibacterial activity was checked against two Gram Negative (Klebsiella pneumonia and Salmonella typhi) and three Gram-positive (Bacillus subtilis, Enterococcus faecalis and Bacillus cereus) bacterias. The study indicates that the methanolic extracts of Bambusa vulgaris showed dosage-dependent inhibition activity with a significant zone of inhibition and were more effective toward Bacillus cereus as compared to other bacterial strains at high concentration (60µl). This work revealed that the biosynthesized silver nanoparticles from Bambusa vulgaris are expected to have remarkable applications in pharmaceutical and biomedical fields.

Keywords: Green synthesis, Bambusa vulgaris, silver nanoparticles and Antimicrobial Activity

OP-BM-62

Formulation and Characterization of Silver Nanoparticles Using the Leaf Extract of *Senna alata linn* and evaluation of its anticancer potential

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Abstract

Nanotechnology is getting more and more important in various fields including medical, food, health care, consumer and industrial purposes. Due to unique properties, silver nanoparticles found to have the anticancer effect. This research deals with the green synthesis of silver nanoparticles (AgNP) using *Senna alata linn* leaves extract, characterization of silver nanoparticles and its invitro anticancer potential. The standardization of leaf powder was carried out by chemical tests and fluorescence test. Leaf extract was reacted with 1mM silver nitrate (AgNO3) and the change in colour from colourless to brown indicated the reduction of silver ions to silver nanoparticles. The synthesized silver nanoparticles were characterized using UV-Visible spectrophotometer, FESEM, EDX and XRD. Optimization test was carried out to determine the optimum condition and concentration to synthesize silver nanoparticles with highest absorbance value when measured with UV-Vis spectroscopy. From the optimization test, get the optimum condition to synthesize silver nanoparticles. The in-vitro anticancer activity of silver nanoparticles was confirmed by MTT assay on the cell lines of carcinoma cells. The silver nanoparticles showed a concentration and time dependent decreased cell viability in cancer cells.

OP-BM-63

Targeting Breast Cancer Molecular Pathways Using Bioactives from *Calopogonium mucunoides* Ethanol Extract: A Network Pharmacology and Docking-Based Study

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Abstract

Breast cancer remains one of the most prevalent malignancies worldwide, necessitating explorations of novel therapeutic agents and multi-target interventions. Natural products are increasingly recognized for their potential in targeting cancer signaling pathways due to their chemical diversity and biological activity. Ethanol extract of the *Calopogonium mucunoides* was prepared and evaluated for its cytotoxicity against breast cancer cell lines, demonstrating 53.62 and 34.64% reduction in cell viability at 50 and 100 µg/mL. LC-MS analysis revealed the presence of five major phytochemical components: Methoxy cinnamic acid, Allocryptopine, Acacetin, Demethoxycurcumin, and Quinine. A network pharmacology approach was employed using computational tools to identify key molecular targets associated with breast cancer. The KEGG pathway analysis highlighted EGFR, STAT3, ERK5, and AKT3 as critical contributors in breast cancer progression. To validate interactions and potential therapeutic efficacy, molecular docking studies were carried out using AutoDock Vina. Among the compounds tested, Acacetin displayed consistently strong binding affinity across all four targets, with docking scores of 7.5, 7.0, 8.3, and 7.9 kcal/mol for EGFR, STAT3, ERK5, and AKT3, respectively, indicating a broad multi-target inhibitory potential warranting further in vitro and in vivo exploration. Other compounds, such as allocryptopine and demethoxycurcumin, also demonstrated promising binding but with comparatively lower affinity. This study highlights the potential of plant-derived bioactive compounds in breast cancer therapy, particularly through multi-targeted intervention strategies that could overcome resistance mechanisms in tumor cells.

OP-BM-64

Green Synthesis of Silver Nanoparticles from *Curcuma neilgherrensis* and its Therapeutic Analysis

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Abstract

This study reports the green synthesis of silver nanoparticles (AgNPs) using *Curcuma neilgherrensis* rhizome extract and their characterization. The AgNPs exhibited strong antioxidant activity, significant thrombolytic potential, and dose-dependent anticancer effects against MCF-7 breast cancer cells. These findings highlight their promise as eco-friendly therapeutic agents. *Curcuma neilgherrensis* rhizome extract was prepared and used to synthesize silver nanoparticles by mixing with silver nitrate solution. The AgNPs were characterized using UV–Vis, XRD, FT-IR, SEM, and EDX analyses. Antioxidant, thrombolytic, and anticancer activities were evaluated through standard assays. The synthesized AgNPs showed characteristic nanoscale features confirmed by multiple analyses. They exhibited strong antioxidant activity with low IC_{50} values, significant clot lysis comparable to streptokinase, and dose-dependent cytotoxicity against MCF-7 cells. Morphological changes indicated apoptosis, highlighting their therapeutic potential. Green-synthesized silver nanoparticles from *Curcuma neilgherrensis* demonstrated potent antioxidant, thrombolytic, and anticancer activities. Their eco-friendly synthesis and bioactivity suggest promising applications in biomedicine. Further studies could explore their clinical potential.

Key Words: *Curcuma neilgherrensis*, silver nanoparticles, green synthesis, antioxidant, thrombolytic, anticancer, MCF-7 cells.

OP-BM-65

Formulation And Development of A Tyrosinase Inhibitor Enriched Bathing Soap From Mushroom Extracts

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Abstract

Skin-brightening products often rely on synthetic agents that may cause irritation and long-term side effects. This study formulated a natural bathing soap enriched with tyrosinase enzyme inhibitor extracted from *Pleurotus* mushroom as a safer alternative. The extract was analyzed for phytochemicals, quantified for total phenolic content using the Folin–Ciocalteu method, and evaluated for tyrosinase inhibition via an in vitro assay. Soap was prepared by the cold process method with coconut and castor oils, incorporating the extract during cooling to preserve bioactivity. The final product was tested for physicochemical properties, antioxidant activity, and skin compatibility. Results showed retention of tyrosinase inhibitory activity, strong antioxidant potential, pH values of 9.46–9.78, foaming capacity of 4.5–5.7 cm, and total fatty matter (TFM) of 16.76%. Patch testing confirmed non-irritating properties. These findings highlight *Pleurotus* mushroom extract as a viable natural ingredient for eco-friendly, skin-brightening soap.

Keywords: Tyrosinase inhibitor, *Pleurotus* mushroom, bathing soap, antioxidant, skin brightening

OP-BM-66

Synthesis and Characterization of Iron–Copper Bimetallic Nanoparticles Using *Brassica oleracea* flower Extract and Evaluation of Their Antioxidant and Antidiabetic Activity

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Abstract

Iron–copper (Fe–Cu) bimetallic nanoparticles were synthesized using *Brassica oleracea* (cauliflower) extract, which acted as a stabilizing and chelating agent. The study focused on their structural characterization and biological applications in antioxidant and antidiabetic assays. The synthesized nanoparticles were analyzed by UV–Visible spectroscopy, Scanning Electron Microscopy (SEM), Energy-Dispersive X-ray spectroscopy (EDX), X-ray Diffraction (XRD), and Fourier Transform Infrared Spectroscopy (FTIR) to confirm their physicochemical properties. UV–Vis spectra showed distinct surface plasmon resonance peaks, while SEM and EDX confirmed spherical morphology and elemental composition of Fe and Cu. XRD analysis revealed the crystalline nature of the bimetallic nanoparticles, and FTIR spectra indicated the presence of functional groups responsible for metal ion stabilization. The antioxidant potential, evaluated by ABTS and FRAP assays, showed strong radical scavenging and reducing capacity. Additionally, α-amylase inhibition confirmed their antidiabetic potential. These results suggest that *Brassica oleracea* flower-derived Fe–Cu bimetallic nanoparticles exhibit multifunctional biological activities suitable for biomedical and therapeutic applications.

Key words: *Brassica oleracea*, Fe–Cu bimetallic nanoparticles, α-amylase, antidiabetic

OP-BM-67

DNA and BSA binding, DNA cleavage, anticancer activity and In-Silico drug screening study of heteroleptic Cu(II) complexes of polypyridyl ligands

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Abstract

The heteroleptic mononuclear five and six coordinated Copper(II) complexes [CuII(L1)(L2)] and [CuII(L2)(L3)(Cl)][CH3CH2]3NH were prepared and characterised by MASS, IR, EPR and UV-Vis spectroscopic techniques, where L1, L2 and L3 are 1,10-phenanthroline-5,6-dione, N-(2-hydroxyphenyl)salicylidenimine, and 1,10-phenanthrolin-5-amine, respectively. The geometries of the complexes are also confirmed through energy minimization. Complexes exhibit good binding character towards DNA determined through Ethidium bromide fluorescence displacement assay, UV-Vis absorbtion titration. The groove binding and intercalative nature of the binding mode of complexes **1** and **2** was determined through DNA melting study where change of DNA melting temperature was 2 ºC and 7 ºC, respectively. The binding modes are also supported by docking study with DNA (1BNA). The complexes show very good BSA affinity determined from BSA fluorescence quenching study where observed Ksv values are of the order of 105 M-1 and docking as well as synchronous fluorescence spectra confirms site II is the binding site in BSA for the two complexes determined from the structural alterations near tryptophan residues in site II binding site. Cu complexes **1** and **2** exhibit significant cytotoxic action against HeLa cell with IC50 values of 36.2 μM and 6.25 μM, respectively determined using MTT assay by following the appealing apoptotic pathway conformed using AO/EtBr confocal imaging experiments which show apoptotic cellular fluorescence characteristics.

Keywords: Copper(II) complexes, polypyridyl ligands, DNA and BSA binding, DNA cleavage, apoptosis, ADME profiling.

OP-BM-68

Characterization and Comparison of *in vitro* Anticancer Activities Between Capecitabine-loaded Chitosan Nanoparticles, Naringin-loaded Chitosan Nanoparticles and Naringin-Capecitabine–loaded Chitosan Nanoformulation against MDA-MB-231 cell lines

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Abstract

Breast cancer is the most pervasive malignancy among women worldwide. Synthetic medication treatment now in use has been linked to negative side effects. Combination therapy involving plant-derived compounds can lessen the toxicity of individual treatments due to its modes of action, structural variety, natural availability, and comparatively low toxicity. The biosynthesized nanoparticles and nanoformulations were characterized using SEM, TEM, FTIR, and XRD. *In vitro* anticancer activity against triple-negative breast cancer MDA-MB-231 cell lines was evaluated by MTT assay, morphology study, EtBr staining, AO/EtBr dual staining, DCFH-DA staining and LDH Assay. Moreover, the gene expression was analyzed with the help of RT-PCR. Characterization techniques confirmed variations in the structural and chemical composition of the synthesized nanoparticles. *In vitro* analysis outcome illustrated that the synthesized nanoformulation revealed lesser cell viability and greater apoptosis than the nanoparticles with more ROS level in MDA-MB-231 cells. Analysis of gene expression indicated that apoptosis induction was occurred by the upregulation of p53, Bax, and Caspase-3, and downregulation of Bcl-2. The outcome of current study suggests that the synthesized nanoformulation has effective anticancer properties in order to compete the conventional drugs.

Key Words: Naringin; Capecitabine; Chitosan; Nanoparticles; Breast cancer; MDA-MB-231.

OP-BM-69

Cytotoxic Effect of Green Synthesised Zinc oxide Nano Particles prepared from the Homoeopathic Medicine *Catharanthus roseus Q on* Raji A (Burkitt lymphoma) Cell line

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Abstract

Blood cancers, also called Haematological malignancies, include Leukaemia, Lymphoma, and Multiple myeloma as the main groups. In 2020, there were approximately 1.3 million new cases globally of haematological malignancies, with mortality around 700,000 deaths. Burkitt lymphoma is an aggressive non-Hodgkin B-cell lymphoma characterized by rapid tumour growth, frequently affecting the jaw, abdomen, or central nervous system. The Study has been conducted at the BIOINNOV SOLUTIONS LLP, A Life Science Research and Development Centre. The needed Catharanthus roseus Mother Tincture has been Procured from St George's Homoeopathy Pharmaceuticals and the Green Synthesis of Zinc oxide Nano Particles was done as per Faisal et al., 2021. The required Biological cell lines were Procured from 'The National Centre for Cell Science (NCCS). Cytotoxic Effect was analysed by MTT Assay for Cytotoxicity and Apoptosis/Necrosis Analysis Using AO/EtBr Staining. The MTT assay revealed significant Cytotoxicity of ZnO NPs against Raji A cells, with an IC_{50} value of 306 µg/mL. This suggests a strong antiproliferative effect specifically against B-cell lymphomas. AO/EtBr staining confirmed Apoptosis as the primary mode of cell death in Raji A cells, with dose-dependent increases in Apoptotic and Necrotic morphology at Higher Concentrations. At 400 µg/ml, extensive Apoptotic and Necrotic morphology is observed, consistent with MTT IC_{50} values.

Keywords Burkitt lymphoma; *Catharanthus roseus*; Cytotoxicity; Homoeopathic medicine; Raji A cells; MTT Assay; AO/EtBr Staining

OP-BM-70

Anti-Cancer Potential of Boldine Against Lung Cancer Cells by Targeting The TGF-B/SMAD2 Signalling Pathway: Eliciting Apoptosis Via the Upregulation of Proapoptotic Proteins

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Abstract

Lung cancer is a major cause of cancer-related mortality. This study explores the anticancer effects of Boldine, a natural alkaloid, on A549 lung cancer cells. Boldine reduced cell viability in a dose-dependent manner, with significant cytotoxicity at 100–150 μM (MTT assay). AO/EtBr staining confirmed apoptosis, and RT-PCR showed upregulation of p53, Bax, Caspase-3, and downregulation of Bcl-2. These results suggest Boldine's potential as a natural anticancer agent. A549 cells were cultured in DMEM with 10% FBS at 37°C and 5% CO_2. Cytotoxicity was tested using the MTT assay (25–150 μM). Apoptosis was examined via AO/EtBr dual staining. RT-PCR was used to analyze expression of p53, Bcl-2, Bax, and Caspase-3. Boldine reduced cell viability dose-dependently, with maximum effect at 150 μM. Apoptotic morphology was observed, and gene expression confirmed activation of apoptotic pathways. Boldine induces apoptosis and inhibits A549 cell growth, supporting its potential as a natural therapeutic agent for lung cancer.

Keywords: Boldine, A549 cells, Lung cancer, Apoptosis, MTT assay, Gene expression, Natural anticancer agent.

OP-BM-71

Nanomedicine Innovations for Affordable and Effective Diabetes Management

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Abstract

Diabetes mellitus is a growing global health challenge, especially in low- and middle-income countries where advanced treatments are less accessible. Current therapies struggle with fluctuating glucose control, invasive insulin delivery, and poor compliance. Nanomedicine offers innovative solutions through nanosensors for real-time glucose monitoring, nanocarriers for sustained insulin release, and oral nanoformulations that may replace injections. Lipid- and polymer-based nanocarriers further enhance stability, absorption, and therapeutic effect. Emphasis is placed on cost-effective, biocompatible materials suitable for resource-limited settings. By aligning nanoscience with practical healthcare needs, these strategies can improve outcomes, enhance patient quality of life, and reduce healthcare costs.

Keywords: Diabetes, Nanomedicine, Glucose Monitoring, Insulin Delivery, Healthcare Innovation.

OP-BM-72

Chitosan-Based Nano Formulated Herbal Gauze for Accelerated Wound Healing Using *Tridax Procumbens* and *Musa Paradisiaca*

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Abstract

To achieve successful wound treatment, the dressing materials must encourage tissue regeneration, inhibit microbial infection, and maintain a high degree of biocompatibility. We have synthesised chitosan nanoparticle (CNP)-based herbal cotton gauze using commercially available chitosan through ionic gelation. The gauze was then loaded with extracts from *Aloe barbadensis*, *Calotropis gigantea*, *Tridax procumbens*, *Musa paradisiaca*, as well as lauric acid, all of which were chosen based on their own unique therapeutic properties. Subsequently, various characterisation and assessments were performed on the dressing to evaluate its physicochemical and biological properties. Chitosan nanoparticles were prepared via ionic gelation and combined with herbal extracts through constant stirring. The mixture was coated onto sterile cotton gauze, followed by drying. UV–Vis, FTIR, and SEM analyses confirmed nanoparticle formation, surface binding, and morphology. The herbal–CNP gauze was also developed into a hydrogel-coated variant for comparative evaluation. CNPs showed uniform spherical morphology and optimal particle size to enable a sustained release of phytochemicals. The CNP-infused herbal gauze and hydrogel type exhibited superior antimicrobial and antioxidant actions compared to controls. Taken together, these findings yield evidence for synergistic healing effects, a robust inhibition of microbes, and excellent biocompatibility. The Chitosan-NP infused herbal gauze is environmentally friendly, biocompatible, and a highly effective wound dressing that demonstrates superior healing, antimicrobial, and antioxidant properties, making it suitable for the future of clinical applications.

OP-BM-73

Cytotoxic Evaluation of Green Synthesized Silver Nanoparticles from Cuttlefish Ink Against Breast Cancer Cells

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Abstract

Silver nanoparticles (AgNPs) are widely studied for antimicrobial and anticancer activity. Conventional synthesis often involves toxic chemicals, restricting biomedical applications. Green synthesis using natural biomolecules offers a safer and eco-friendly alternative. Cuttlefish ink extract, containing melanin, proteins, amino acids, and polysaccharides, was utilized as both reducing and capping agent. The nanoparticles were characterized by spectroscopic and microscopic techniques to confirm morphology features. Cytotoxicity was assessed using the MTT assay, a colorimetric method to measure cell viability after AgNP exposure. The synthesized AgNPs exhibited characteristic nanoscale features, confirming formation. MTT assay results showed a dose-dependent reduction in breast cancer cell viability, demonstrating significant cytotoxic activity of the green-synthesized nanoparticles. Cuttlefish ink-mediated AgNPs showed strong anticancer potential, supporting their promise as sustainable nanomaterials for biomedical use.

Keywords: Green synthesis, Silver nanoparticles, Cuttlefish ink extract, MTT assay, Cytotoxicity, Breast cancer, Nanomedicine.

OP-BM-74

Antioxidant Activity of Poly(N-cyclohexylacrylamide - Acrylamide-starchmethacrylate)$CaCO_3$ nanocomposite hydrogels

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Abstract

Poly (N-cyclohexylacrylamide - starchmethacrylate) $CaCO_3$ nanocomposite Hydrogels were synthesized by in-situ free-radical copolymerization in DMSO / Water medium using potassium persulfate (KPS) as the initiator and N,N'-methylenebisacrylamide (MBA) as a crosslinker at 70°C using CaCO3 nanoparticle. The amount of N-cyclohexylacrylamide (NCA) monomer was fixed and the amount of starchmethacrylate (SMA) was varied. The Hydrogels were characterized by FTIR & NMR spectroscopy. The surface morphology was studied by SEM analysis and it indicates the incorporation of nano particle in the matrix. Antioxidant activity of the synthesized hydrogels studied by DPPH method. Poly(N-cyclohexylacrylamide-co-Starchmethacrylate) $CaCO_3$ nanocomposite hydrogels were prepared via in-situ free-radical copolymerization in DMSO/water at 70 °C using KPS as initiator and MBA as crosslinker. The NCA content was fixed, while SMA was varied. Antioxidant activity was evaluated via DPPH assay. Thermal analysis indicated initial moisture loss at 125 °C followed by polymer and crosslinker decomposition. DPPH assays revealed concentration-dependent radical scavenging, with an IC_{50} of 48.71 μg/mL, demonstrating moderate but significant antioxidant activity. These results confirm that $CaCO_3$ incorporation improves hydrogel structural integrity, thermal stability, and functional performance, supporting potential biomedical applications. Poly(N-cyclohexylacrylamide-co-Starchmethacrylate) $CaCO_3$ nanocomposite hydrogels were successfully synthesized, with $CaCO_3$ nanoparticles uniformly integrated into the polymer matrix.

Keywords: Hydrogels, N-cyclohexylacrylamide, Starchmethacrylate, $CaCO_3$.

OP-BM-75

Exploring the Anti-Cancer Properties of Valencene against Breast Cancer: Mechanisms of Action and Therapeutic Potential

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Abstract

Valencene, a citrus-derived natural compound, shows anticancer effects against triple-negative breast cancer (TNBC) cells by inducing ROS-mediated apoptosis. In MDA-MB-231 cells, valencene reduced viability, increased ROS levels, and suppressed migration. It downregulated anti-apoptotic Bcl-2, upregulated pro-apoptotic p53, and reduced metastasis markers MMP-2 and MMP-9. Molecular docking confirmed strong binding with apoptotic proteins. These results highlight valencene's therapeutic potential in TNBC. MDA-MB-231 cells were treated with valencene, and cytotoxicity was assessed via MTT and LDH assays. Apoptosis and ROS were analyzed through staining, while migration was evaluated using wound healing assays. ELISA measured MMP levels, and PCR and molecular docking were used for gene and protein interaction analysis. Valencene significantly reduced cell viability and induced apoptosis via ROS production. It inhibited cell migration and lowered MMP-2 and MMP-9 expression. Gene and docking analyses confirmed modulation of Bcl-2 and p53, supporting its pro-apoptotic activity. Valencene induces ROS-mediated apoptosis and inhibits TNBC cell migration, suggesting its promise as a natural anticancer agent.

Keywords: Valencene, triple-negative breast cancer, apoptosis, oxidative stress, metastasis, MDA-MB-231, Bcl-2, p53.

OP-BM-76

Invitro Anticancer Activities of The Herbal Formulation Against Breast Cancer Mcf-7 Cell Lines

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Abstract

Cancer remains one of the most life-threatening diseases in India. Conventional chemical medications, though effective, often induce severe side effects in the human body. This has led to the exploration of traditional approaches using medicinal plants, which are rich in diverse phytoconstituents. These natural compounds serve as potential therapeutic agents due to their wide range of medicinal properties and have long been employed in the treatment and prevention of various cancers. Phytoconstituents exert their anti-cancer effects through mechanisms such as modulation of the cell cycle and induction of apoptosis, thereby selectively targeting and killing cancer cells. In the present study, the synergistic effect of phytoconstituents from a polyherbal formulation comprising Psoralea corylifolia, Curcuma longa, Melia dubia, and Camellia sinensis was evaluated for anti-cancer activity. Ethanolic extracts of the selected plants were subjected to phytochemical screening, anti-proliferative assay, MTT assay, and DNA fragmentation analysis against breast cancer cell lines (MCF-7). The phytochemical screening confirmed the presence of bioactive compounds such as terpenoids, flavones, steroids, glucosides, sugars, alkaloids, quinones, phenols, tannins, saponins, coumarins, and proteins. Anti-proliferative assays revealed concentration-dependent cytotoxicity of the individual plant extracts, with the highest activity observed at increased concentrations. Based on these findings, a herbal formulation was prepared and evaluated. The MTT assay demonstrated significant cytotoxicity against MCF-7 cells, and DNA fragmentation analysis further validated the apoptotic effect of the formulation.

Keywords: Anti-cancer, herbal formulation, apoptosis, cytotoxicity

OP-BM-77

Synthesis, Physicochemical Characterization, Antioxidant and Anticancer Evaluation of ZIF 67-Methionine Metal Organic Frameworks

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Abstract

ZIF-67, a cobalt-based zeolitic imidazolate framework (MOF), has gained significant attention in oncology due to its high surface area, tunable porosity, and versatile functionalization potential. In recent years, extensive research has explored ZIF-67 and its derivatives as multifunctional nanoplatforms for targeted drug delivery and synergistic therapeutic applications. In this context, the present study focuses on the synthesis of ZIF-67 loaded with L-Methionine (MI) at varying concentrations. The resulting MOF materials were characterized using FT-IR spectroscopy, UV–Visible spectroscopy, and X-ray diffraction (XRD) analyses to confirm their structural and physicochemical properties. The antioxidant potential was evaluated using the standard DPPH assay, while cytotoxicity was assessed against MDA-MB-231 breast cancer cell lines. The detailed findings and implications of this study will be presented during the session.

OP-BM-78

Invitro Anticancer Activities Of The Herbal Formualtion Against Breast Cancer Mcf-7 Cell Lines

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Abstract

Cancer is one of the life-threatening diseases in India. While treating cancer, it was realized that the chemical medications are inducing side effects in the human body. So, the traditional methods of treating cancer were opted with medicinal plants. Because medicinal plants contain diverse phytoconstituents which serves as a natural drug, which possess numerous medicinal properties which has been used for treating and preventing various types of cancer. These phytoconstituents work through several mechanisms like cell cycle pathway, apoptosis to target and kill the cancer cells. In the present study, the synergistic effect of the phytoconstituents in herbal formulation comprising of different medicinal plants such as Psoralea corylifolia, Curcuma longa, Melia dubia and Camellia sinesis was evaluated. Anticancer activity was performed using the four medicinal plants. The samples were subjected to analysis such as phytochemical screening of ethanolic extract of the medicinal plants, antiproliferative test, MTT assay and DNA fragmentation against breast cancer cell lines MCF-7.The efficacy of this formulation was studied and the results showed that the phytochemical screening of the four plants and the phytoconstituents were terpenoids, flavones, steroids, glucosides, sugars, alkaloids, quinones, phenols, tannins, saponins, coumarins and proteins. The results of anti-proliferative showed the cytotoxicity of individual plants. It showed highest toxicity with the increase in concentration. With the formulation prepared based on the highest cytotoxicity, MTT assay was performed on breast cancer MCF-7 cells lines. The efficacy of the herbal formulation was analysed through DNA fragmentation test

OP-BM-79

Phytochemical Analysis, Antioxidant And GC-MS Profiling of *Costus Igneus* (Insulin Plant): Insights Into Bioactive Compounds

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Abstract

Costus igneus, commonly known as the "Insulin Plant," has been traditionally used for its medicinal properties, including anti-diabetic and antioxidant effects. This study aimed to perform a comprehensive phytochemical analysis, assess antioxidant potential, and identify bioactive compounds present in *Costus igneus* leaves using Gas Chromatography-Mass Spectrometry (GC-MS) profiling. Preliminary qualitative tests revealed the presence of alkaloids, flavonoids, saponins, tannins, and phenolic compounds, indicating a rich phytochemical profile. Antioxidant activity, evaluated using DPPH and FRAP assays, demonstrated significant free radical scavenging potential. GC-MS analysis further identifiedseveral biologically active compounds with potential therapeutic applications, including anti-inflammatory, anti-diabetic, and antimicrobial properties. The findings of this study provide valuable insights into the bioactive composition of *Costus igneus* and support its potential use in pharmaceutical and nutraceutical applications. Future studies can focus on specific compounds and evaluating their mechanistic times in disease management.

OP-BM-80

Fire Ant Protein Mediated Selenium Nanoparticles Synthesis and Its Biological Applications

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Abstract

The present study focuses on the fire ant protein-mediated synthesis of selenium nanoparticles (SeNPs) and their potential biological applications. In this work, proteins extracted from Solenopsis invicta (fire ant) were utilized as natural reducing and stabilizing agents to fabricate eco-friendly SeNPs under mild reaction conditions. The biomolecules present in the fire ant protein extract played a dual role in reducing sodium selenite to elemental selenium and capping the nanoparticles, thereby preventing agglomeration. The synthesized SeNPs were characterized using UV–Vis spectroscopy, FTIR, XRD, SEM, and TEM analyses, confirming their crystalline nature, nanoscale size, and protein functionalization on the surface. The biologically synthesized SeNPs exhibited remarkable antioxidant, antimicrobial, and anticancer activities, demonstrating their potential in biomedical and pharmaceutical applications. The green synthesis approach using fire ant proteins offers a sustainable, non-toxic, and efficient alternative to conventional chemical methods, highlighting a new avenue for the utilization of insect-derived biomolecules in nanobiotechnology.

OP-BM-81

Comprehensive Phytochemical, Antioxidant and GC-MS Profiling of Costusigneus: Insights into Bioactive Compounds

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Abstract

Costus igneus, commonly known as the "Insulin Plant," has been traditionally used for its medicinal properties, including anti-diabetic and antioxidant effects. This study aimed to perform a comprehensive phytochemical analysis, assess antioxidant potential, and identify bioactive compounds present in C. igneus leaves using Gas Chromatography-Mass Spectrometry (GC-MS) profiling. Preliminary qualitative tests revealed the presence of alkaloids, flavonoids, saponins, tannins, and phenolic compounds, indicating a rich phytochemical profile. Antioxidant activity, evaluated using DPPH and FRAP assays, demonstrated significant free radical scavenging potential. GC-MS analysis further identified several biologically active compounds with potential therapeutic applications, including anti-inflammatory, anti-diabetic, and antimicrobial properties. The findings of this study provide valuable insights into the bioactive composition of C. igneus and support its potential use in pharmaceutical and nutraceutical applications. Future studies can focus on isolating specific compounds and evaluating their mechanistic roles in disease management.

OP-BM-82

Development of a Lipid-Based Nanodrug for Osteocarcinoma Using Ashwagandha and Quercetin

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Abstract

Ashwagandha (*Withania somnifera*) and Quercetin are two bioactive natural compounds that demonstrate significant pharmacological potential. Ashwagandha extract is renowned for its adaptogenic, neuroprotective, and immunomodulatory effects, whereas Quercetin, a potent flavonoid, exhibits strong antioxidant, anti-inflammatory, and anticancer activities. Emerging evidence suggests that the combination of these agents could provide synergistic benefits through complementary mechanisms of action. Both compounds target oxidative stress and inflammatory signaling pathways, regulate apoptotic cascades, and enhance mitochondrial stability. Their co-administration may amplify bioavailability, potentiate free radical scavenging, and modulate transcription factors such as NF-kB and Nrf2, thereby strengthening cellular defense systems. This dual approach holds promise in the prevention and management of chronic disorders including cancer, neurodegenerative diseases, cardiovascular dysfunction, and metabolic syndromes. The present review emphasizes the therapeutic rationale, mechanistic interactions, and translational significance of combining Ashwagandha extract with Quercetin, highlighting its potential as a novel integrative pharmacological strategy.

Key words: *Withania somnifera* extract, Quercetin bioflavonoid, Oxidative stress modulation, Anti-inflammatory therapeutics.

OP-BM-83

Formulation And Optimization Of Liposomal Encapsulated Cream Cookie

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Abstract

Pedalium murex Linn (family: *Pedaliaceae*) (P. murex) commonly known as Large Caltrops and Gokhru (India) is a shrub found in the Southern part, Deccan region of India and in some parts of Ceylon. Different parts of the plant are used to treat various ailments like, cough, cold and used as an antiseptic. In this work, the methanol extract of *Pedalium murex* stem was extracted. The extract were analysed by HPLC and FTIR. The crude extract of *Pedalium murex Linn* contains ketones, Bromine and alkaloid functional groups. The HPLC analysis (254 nm) of crude extract for Flavonoids finds the 8 compounds. The peak 9.387 was confirms the presence of pedalitin. Commonly worldwide 95% of people are taking cookies as a snack. In this work the cookies were formulated with various concentrations by using Wheat flour, Horse gram flour, Sorghum flour and Flax seed flour and it gets optimized. The drug is encapsulated by Liposomal Encapsulation process. The cream is formulated by Soy Lecithin, sunflower oil and then our compound pedalitin is added. It gets incorporated with the Cookie. It has quantitatively analysed. The 9 point hedonic test has done.

Keywords: *Pedalium Murex*, Pedalitin, Stem extract, Cookie, Soy Lecithin

OP-BM-84

Formulation Of Gel Containing Elephant Aloe Vera, Sesame Oil, Eucalyptus Oil And Veldt Grape For Pain Relief

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Abstract

Aloe vera, a medicinal herb, is used in health care and cosmetics due to its biological activity. Its gel contains acemannan, which has high water content, biocompatibility, biodegradability, and customizable properties. The process involves extracting fresh Aloe vera gel, blending it with eucalyptus oil, veldt grape and carbopol incorporating oils or waxes for a consistent gel base. The formulation was evaluated for its texture, spreadability, stability, and effectiveness in soothing skin conditions like dryness, irritation, and minor wounds. Preliminary results suggest that the gel is non-greasy, easy to apply, and shows promising skin-healing properties due to the synergistic effects of its ingredients. This study highlights the potential of utilizing sustainable, natural ingredients to develop cost-effective, skin-friendly gel suitable for personal care and dermatological applications. Further investigations can be conducted to enhance the product's shelf life and efficacy through advanced formulations.

Key words: Aloe vera, antimicrobial, antioxidant activity

OP-BM-85

Formulation And Optimization Of Probiotic Ice Cream From Millets

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Abstract

Ice cream is a delicious, nourishing frozen dairy product and a popular dessert which is preferred by all age groups. Ice cream is a complex food colloid that consists of an unfrozen serum phase, ice crystals, fat globules, and air bubble. In present Work Five different concentrated ice cream sample ware prepared from kodo millet. samples were analyzed in quantitatively for carbohydrate, lipids and protein, and also the samples was analyzed by nine point hedonic test to evaluate their sensory properties like colour, appearance, taste, texture, and order from the results of analysis the sample two shows better results than aver sample. the lactobacillus was Isolated from cured and it was confirmed by gram staining, catalase activity and . Simmon citrate ager method. The lactic acid bacteria incorporated was sample two and evaluate its viability after incorporation its shows 150 colonies in 20th day.

Keywords : kodo Millet, Lactobacillus , ice cream.

OP-BM-86

Anti-Quorum Sensing Efficacy Of *Mangifera Indica* Kernel Extract Against Biofilm Formation In *Pseudomonas Aeruginosa*

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Abstract

P.aeruginosa (PA) is responsible for causing both acute and chronic infections in immune compromised individuals. Multi-drug resistance among them is a very common phenomenon due to their complex biofilm forming nature enabling the bacteria to evade antibiotic treatment as well as human immune defence mechanism. In the present study, biofilm inhibition in *P.aeruginosa* was analysed using mango peel (MPE) and kernel extract (MKE). MKE has a greater content of phytoconstituents such as tannin and phenol (1.6458± 0.07 mg g-1 TAE; 1.56± 0.007 mg g^{-1} GAE) than MPE (0.2938± 0.05 mg g^{-1} TAE; 1.31± 0.003 mg g^{-1} GAE). MKE at 12.5-200µg ml^{-1} showed significant reduction of biofilm (70-75%) and quorum sensing (QS) (35-65%) against PA, and *C. violaceum* whereas, MPE showed only 20-23% of biofilm and 5-15% of QS inhibition. Epi-fluorescence and CLSM micrographs demonstrated the efficacy of MKE in inhibiting surface adhession and biofilm thickness. As a result, MKE at 50µg ml^{-1} (1/4 BIC) suppressed PA biofilm formation without impairing planktonic cell growth, reducing the possibility of the emergence of multi-drug resistance. Additionally, MKE inhibited the production of pyocyanin and had a negative impact on swarming and twitching motility. Eight distinct phytochemicals were found in MKE after it was characterised, but 2(3h)-furanone, 3-(15-hexadecynylidene)dihydro-4-hydroxy-5-methyl, 4r-(3e,4.alpha.,5.beta) represented 33.75% of the peak area and is presumed to be the antibiofilm compound.

Keywords: *Pseudomonas aeruginosa*, *Mangifera indica*, anti-biofilm, furanone, mango kernel, mango peel.

OP-BM-87

Formulation And Optimization Of Liposomal Encapsulated Polyherbal Health Mix Powder

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Abstract

This study aimed to formulate and optimize the liposomal encapsulation of polyherbal health mix powder, which is methanol extract of the leaves of *Myristica fragrans* and *Cissus quadrangularis*. The polyherbal extract contains anti-diabetic, anti-inflammatory, anti-oxidant, anti-osteoporotic properties. By this combination of the plant extract the anti-diabetic properties become faster. In this work, methanol extract of *Myristica fragrans* and *Cissus quadrangularis* was analyzed by FT-IR and HPLC. The hplc analysis of crude extract of plants confirming the presence of its components. The encapsulation process of polyherbal extract has done by liposomal. In this work, the health mix powder was formulated and optimized at different concentration. Sensory properties of the health mix powder were also been analyzed. The nutritional analysis of the health mix powder was also been determined.

Keywords: *Myristica fragrans*, *Cissus quadrangularis*, Liposomal encapsulation, Health mix powder, Nutritional analysis

OP-BM-88

Spatial Distribution Of Dengue Vector, *Aedes Aegypti* In Salem District, Tamil Nadu, India

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Abstract

The investigation of the importance of mosquito vectors for the control of arboviruses diseases worldwide, and detailed evidence on the distribution of their main vector, *Aedes aegypti* is essential for assessing disease transmission risk and for better planning of control interventions. The main objective of this study is to assess the changes in seasonal abundance and distribution of mosquito vectors in relation to climate factor such as rainfall, temperature and humidity. Consequently, this study was directed to determine the breeding habitats and presence of *Ae. aegypti*, the only *Aedes* species identified in the sequence of the survey carried out from January 2016 to December 2016 in four taluks namely (Salem, Omalur, Mettur and Idappadi). *Ae.aegypti* immatures were found together in 76 larval habitats. The presence of such a large immature population may indicate an imminent outbreak of dengue fever (DF) in the near future unless proper implementation of control and elimination measures is taken.

Keywords: Distribution modeling, Influencing factors, Environmental variables and ***Ae. aegypti.***

OP-BM-89

Formulation Of Ointment from Polyherbal Extracts and Estimation Of Its Wound Healing Activity

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Abstract

This study aimed to formulate and evaluate the polyherbal wound healing ointment which is ethanol extract of the leaves *Acalypha indica, Croton bonpladianum,* and *Tridax procumbens*. This polyherbal extract contains many wound-healing components. By this combination of the plant extract the wound healing process become faster. In this formulation, there were three different ratios of formulation have as been taken to check their estimation of its wound healing activity. Regarding different parameters like pH, spread ability, good consistency, and homogeneity, there was no change in the appearance, and no phase separation was noticed and these are checked at the end of stability studies. There was no evidence of skin irritation. Finally, this study has revealed that the polyherbal ointment has shown wound healing activity and Anti-microbial activity.

Keywords: *Acalypha indica, Croton bonplandianus, Tridax procumbens*, Ointment formulation, wound healing activity, and Anti-microbial activity

OP-BM-90

Formulation and Evaluation of Antifungal Soap from Herbal Essential Oils

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Abstract

The Modern world both women and men are very interested in beauty products. Soap plays a major role in our daily routine such as cleansing agent. The polyherbal soap are the one which contains nature herbal ingredients. This herbal soap lessens adverse effects and improves human health. Essential oil extracted from *Psoralea Corylifolia Linn, Osimum Basilicum, Melaleuca alternifolia, Syzygium Aromaticum* are rich in antifungal activities. Antifungal compounds are present in Bakuchiol, Linalool, Terpinen-4-ol, and Eugenol. These polyherbal essential oils also contain a lot of antifungal components and their efficiency of antifungal activity is highly sufficient for skincare. Our herbal soap base is prepared by formulation in coconut oil, sodium hydroxide, distilled water, and glycerin are used as anti-aging, moisturizing agents, and lye. Basic soap parameters are measured, including skin irritation, froth height, pH, and organoleptic properties. Antifungal activity is done by *Candida albicans*, *Aspergillus niger* +ve control of 24 and 21. When this soap would be compared with *Aspergillus niger* and Candida albicans have high antifungal activity. Prepared polyherbal soap looks nice, cleans well, foams up well, and has no negative side effects.

Keywords: *Bakuchiol, Corylifolia Linn, Linalool, Melaleuca alternifolia, Osimum Basilicum*

OP-BM-91

Identification Of Gymnemic Acid And Evaluation Of Its Anti-Oxidant Activity, Anti-Diabetic Activity

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Abstract

Gymnema slyvestre, belongs to the family *Asclepiadacea.* It can be found all over the world, including in South-east Asia, Africa, Australia, and India. It has the variety of medicinal value in the folk medicine. The phytochemicals extract of the *Gymnema slyvestre* using various solvents like distilled water, ethanol, chloroform, n-hexane, extracts shows the presence of phytochemicals like Flavonoids, Saponins, Titerpinoids, Phenolic compounds. Aqueous extract of leaf, stem, flower, were selected to evaluate antioxidant potential using an *in vitro* antioxidant assay or DPPH assay procedure. Finally, we get maximum inhibition in the aqueous extract of leaf (61.72%). FT-IR, NMR, LC-MS, GC-MS and anti-diabetic activity were studied for leaf extract.

Keywords: *Gymnema slyvestre,* DPPH assay, FT-IR, LC-MS, GC-MS, NMR

OP-BM-92

Assessment of antioxidant potential, MTT assay and GCMS analysis of crude extract from *Croton Bonplandianus*

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Abstract

The use of medicinal plants for wound healing is gaining great importance due to there refer affordability and effectiveness. In this present study, the ethanolic extract of *Croton bonplandianus* was extracted by Soxhlet extraction method. The extract was subjected to both qualitative and quantitative phytochemical analyses. The quantitative estimation revealed that plant extract contained 247.29 µg of phenolic compounds and 203.48 µg of flavonoids. Antioxidant activity was evaluated by FRAP and ABTS assay. The cytotoxicity of the extract was assessed by the MTT assay on L929 fibroblast cell lines.

Keywords: *Croton bonplandianus*, FRAB, ABTS, MTT assay, GCMS.

OP-BM-93

Phytochemical Characterization And *In Silico* Therapeutic Evaluation Of *Emblica Officinalis* Leaf Extract Against Musculoskeletal Frailty Syndrome

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Abstract

Musculoskeletal Frailty Syndrome (MSFS), which integrates sarcopenia, osteoporosis, and osteoarthritis, represents a critical geriatric health challenge [1,2]. Natural phytotherapeutics with multi-targeted actions are increasingly being explored as safe interventions to counteract musculoskeletal frailty. *Emblica officinalis* (amla) is known for its strong antioxidant, anti-inflammatory, and nutraceutical properties, making it a promising candidate for such interventions [3,4]. Methanolic extract of *E. officinalis* leaves was optimized through ultrasonic-assisted extraction and response surface methodology. Total phenolic content and antioxidant potential were determined using in vitro assays. Phytoconstituents were identified using LC-MS, followed by pharmacokinetic profiling and drug-likeness prediction. Transcriptomic datasets of MSFS were screened to identify intersecting molecular targets, while network pharmacology was employed to map compound–target–pathway interactions. Molecular docking and molecular dynamics simulations were carried out to validate binding stability and interactions of key compounds with target proteins. The optimized extract demonstrated high phenolic content and strong antioxidant activity. LC-MS identified bioactives with favorable pharmacokinetic profiles. Integrative transcriptomic and network pharmacology analyses revealed key intersecting targets and pathways regulating inflammatory, oxidative, and apoptotic responses. Molecular docking and MD simulations validated stable interactions of major compounds with these targets, supporting their therapeutic relevance.

OP-BM-94

Anthocyanin composite from Luffa and Red cabbage formulation and bioactivity evaluation of Microcrystalline cellulose with incorporated therapeutic agents

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Abstract

The present study is planned to develop a natural bioactive powder formulation by combining anthocyanin pigments extracted from *Brassica oleracea* var. *capitata f. rubra* (red cabbage) with microcrystalline cellulose (MCC) derived from *Luffa cylindrica*. The anthocyanin extract will be blended with MCC, gum arabic, and maltodextrin, and isopropyl alcohol (2-propanol) will be incorporated as a drying and stabilizing agent to obtain a free-flowing powder. The formulated composite is intended to undergo phytochemical screening to confirm the presence of phenolics, flavonoids, and anthocyanins. Its antioxidant potential will be assessed using DPPH and ABTS radical scavenging assays, while anti-inflammatory activity will be analyzed *in vitro* through protein denaturation methods. The study will also evaluate the cytotoxic effect of the composite on cancer cell lines. It is expected that the anthocyanin–MCC composite stabilized with gum arabic and maltodextrin will serve as a promising natural therapeutic and nutraceutical formulation with potent bioactive potential.

Key words: MCC, anthocyanin, antioxidant, anti-inflammatory.

OP-BM-95

Smartphone Addiction And Its Impact On Psychiatric Patients -An Observational Study

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Abstract

Smartphone addiction is an emerging behavioural health issue, particularly among psychiatric patients who may be more vulnerable because of their underlying mental health conditions. Over a 6-month period, a cross-sectional survey was conducted among 100 psychiatric patients at Kirupananda Variyar Medical College and Hospital, Salem. Data on demographics, psychiatric diagnoses, smartphone use patterns, and related health outcomes were collected and analyzed using Microsoft Excel and SPSS 28.0. Among the 100 participants, 52 % were male and 48 % were female. The most prevalent psychiatric diagnoses were insomnia (14 %), bipolar affective disorder – mania (13 %), and schizophrenia (12 %). Based on the smartphone addiction scale, 36 % exhibited moderate use, 34 % severe use, and 30 % mild use. Forty-five percent (45 %) of patients used their smartphones daily, and 30 % spent over 6 hours per day on them. The most common triggers for smartphone use were stress (24 %) and work demands (22 %). In terms of health outcomes, 46 % of participants reported moderate sleep quality, and 68 % showed moderate to severe anxiety. Patients with more severe smartphone usage tended to have poorer sleep quality, higher anxiety, and greater functional impairment. Smartphone addiction is increasingly serious among psychiatric patients and is significantly associated with poor sleep quality, elevated anxiety, and functional impairment. Targeted interventions are needed to reduce excessive use and improve mental health outcomes.

Keywords: Smartphone addiction, psychiatric patients, mental health, anxiety, sleep disturbance

OP-BM-96

Study On the Appropriateness Of Antimicrobial Therapy In Infectious Diseases In A Tertiary Care Hospital

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Abstract

Antimicrobial resistance (AMR) postures a serious challenge to global health, chiefly in low- and middle-income countries where irrational prescribing is extensive. Antimicrobial stewardship (AMS) programs show a vital part in endorsing rational drug use and averting resistance. This study aimed to assessment the appropriateness of antimicrobial prescribing practices, identify prescribing patterns, and assess the requirement for stewardship interventions in a tertiary care hospital. A prospective, observational study was conducted over 6 months between 132 inpatients diagnosed with infectious diseases in the general medicine department of a tertiary care hospital in Salem. Data were together from patient records and prescriptions, and the appropriateness of antimicrobial therapy was measured using Kunin's criteria in alignment with ICMR, WHO, and IDSA guidelines. Drug utilization was analysed using the Anatomical Therapeutic Chemical (ATC) classification and defined daily doses (DDDs). Statistical examines were performed using SPSS v28.0. The study population comprised 49.2% males and 50.8% females, with the majority belonging to the 51–60 years age group. Respiratory tract infections (49.2%) were the most widespread, followed by gastrointestinal (15.1%) and urinary tract infections (13.6%). Culture data recognized *E. coli* (9.8%) and *Klebsiella pneumoniae* (6.8%) as chief pathogens, however culture results were absent for 52.2% of cases. Ceftriaxone (9.8%), metronidazole (8.3%), and piperacillin–tazobactam (6.0%) were the utmost frequently prescribed antimicrobials. Particularly, 68.9% of patient's crucial need of stewardship intercession due to inappropriate empirical therapy, elongated duration of use, or inappropriate drug/dose assortment. The results highlight the wide-ranging use of broad-spectrum antibiotics, recurrent empirical advising without microbiological confirmation, and a significant need for AMS interventions.

Keywords: Tertiary care unit, rational use of antimicrobials

OP-BM-97

A Prospective Observational Study On Drug Utilisation Pattern Of Antihistamines

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Abstract

The Dermatology Department of one of the Tertiary Care Teaching Hospitals carried out an observational prospective study on Drug Utilization Pattern of Antihistamines to assess the rationality, safety and compliance to standard treatment procedure in prescribing of antihistamines. The rationale of the study was to evaluate the frequency of prescribing, preference of the therapeutic class, and the trend of antihistamine prescription in most dermatological conditions including urticaria, eczema, contact dermatitis, and atopic dermatitis. The research was conducted in a period of six months and a total sample of 150 prescriptions. The structural pro forma was used to gather data, and the following information entered was about the patient demographics, diagnosis, name and class of antihistamines prescribed (first- or second-generation), mode of administration, frequency, duration and complementary medications. The WHO core prescribing indicators were used to analyze the data and identify the rationality of the prescription and the compliance with the National Essential Medicines List (NEML). There were 82 (54.7) females and 68 (45.3) males among 150 patients with the majority of patients falling in the 61-70-year bracket. Contact dermatitis was the most endangered dermatological disorder (28%) and urticaria (21.3%). The most commonly used antihistamines were chlorpheniramine maleate (25.3%), levocetirizine (20%). Topical (40.7) was the most preferred with oral (34.7) and parenteral (24.6) coming second and third, respectively. The mean length of treatment was 14 days with chronic cases. There was also co-prescription in terms of corticosteroids (32.7) or antibiotics (29.3). The research determined that second-generation, non-sedating antihistamines would be used in a logical manner and treated as a long-term agent and first-generation agents were primarily applied to nocturnal pruritus.

OP-BM-98

A Prospective Study of Drugs Related Problems In Patient Undergoing Proximal Femoral Nail For Unstable Intertrochanteric Femoral Fracture

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Abstract

Proximal femoral nail (PFN) fixation is a preferred surgical procedure for managing unstable intertrochanteric femoral fractures, particularly among the elderly. However, patients undergoing PFN are at risk of drug-related problems (DRPs) due to multiple comorbidities and complex perioperative medication regimens, which can impact recovery outcomes. A prospective observational study was conducted in the Department of Orthopaedics, Vinayaka Mission's Kirupananda Variyar Medical College and Hospitals, Salem, Tamil Nadu, over six months (January–June 2025). Data were collected from 100 patients aged above 51 years who underwent PFN surgery. Case records were analyzed for demographic data, comorbidities, and medication-related discrepancies. Statistical analysis was performed using Microsoft Excel and SPSS software. Among the 100 patients, 56% were male and 44% were female, predominantly aged between 61–80 years. A total of 100 drug-related problems were identified—73% were potentially harmful, 19% required monitoring, and 8% were not harmful. The most frequent DRPs were omission of essential medications, inappropriate dosing, and incorrect frequency of administration. Hypertension and hypothyroidism were the most common comorbidities associated with these errors. Drug-related problems are prevalent among PFN patients, particularly the elderly. Structured medication review and increased pharmacist involvement during perioperative care can significantly reduce medication errors and improve patient outcomes.

Keywords: Proximal femoral nail, Drug-related problems, Orthopaedic surgery, Medication safety, Intertrochanteric fracture.

OP-BM-99

A Prospective Observational Study Of Prevalence And Risk Factors Among Children With Scabies And Impetigo

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Abstract

Scabies and impetigo are among the most prevalent paediatric skin infections, especially in low- and middle-income countries. They contribute significantly to morbidity and school absenteeism among children. This study aimed to assess the prevalence and risk factors associated with scabies and impetigo among children in a tertiary care hospital in Salem, India.

A prospective observational study was conducted over 6 months among 80 paediatric patients (aged 1–12 years) attending dermatology and paediatric departments with suspected scabies or impetigo. Demographic, socioeconomic, hygiene, environmental, and clinical data were collected and analyzed. The majority of affected children were aged 6–12 years (55%). Females (53%) were slightly more affected than males (48%). Underweight children comprised 42.5% of cases. Rural residence (56%) and poor hygiene (76.25%) were strongly associated with disease prevalence. Scabies was more common than impetigo, and 12.5% of children presented with both. Overcrowding, poor water source, and irregular school attendance also contributed as risk factors. Most children (87.5%) received either topical or oral treatment with a 91% good response rate. The study highlights the high burden of scabies and impetigo among rural, undernourished children in resource-limited settings. Poor hygiene, overcrowding, and low socioeconomic status are major risk factors. Integrated public health strategies focusing on hygiene, nutrition, and early treatment are essential for effective control.

Key words: Scabies, Impetigo, Prevalence, Children, Risk factors

OP-BM-100

Patterns Of Seizure Control And Anti Epileptic Drug Utilization In Paediatric Epilepsy Patients- Prospective Observational Study

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Abstract

Epilepsy is a chronic neurological disorder characterized by recurrent, unprovoked seizures resulting from abnormal electrical activity in the brain. Seizures are a major cause of morbidity and mortality in children under five years of age, making early diagnosis and proper management crucial. A prospective observational study was conducted for six months among 100 paediatric patients diagnosed with seizure disorders, selected based on predefined inclusion and exclusion criteria. Demographic data, seizure characteristics, and antiepileptic drug prescriptions were collected and analyzed. Among the 100 participants, females constituted 58% and males 42%, indicating a higher prevalence of seizures in females. Febrile seizures were the most common type, accounting for 51% of cases. Regarding frequency, 44% of children experienced two seizure episodes, and 62% exhibited mild seizures. The most frequently prescribed antiepileptic drugs were clobazam (63%) and lorazepam (63%), followed by levetiracetam (39%). The study highlights that febrile seizures are the predominant type of seizure among paediatric patients and are primarily managed with benzodiazepines such as clobazam and lorazepam. Understanding seizure patterns and drug utilization can help optimize treatment strategies and improve clinical outcomes in paediatric epilepsy management.

Keywords: Epilepsy, Seizure, Paediatric, Antiepileptic Drugs, Clobazam, Febrile Seizure, Seizure Pattern, Frequency

OP-BM-101

Rationality Of Antibiotic Use In Lower Respiratory Tract Infections In Paediatric Patients

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Abstract

Lower respiratory tract infections (LRTIs) are among the most common causes of morbidity and mortality in children under five years of age. Judicious antibiotic use is vital to ensure treatment efficacy and prevent antimicrobial resistance. A six-month prospective observational study was conducted in 200 paediatric patients of both genders diagnosed with LRTI. Data regarding demographic details, clinical parameters, and prescribed antibiotics were collected and analysed using Microsoft Excel and SPSS version 28.0. The rationality of antibiotic use was assessed based on standard guidelines. Of the 200 patients, males (53.5%) were slightly higher than females (46.5%). The most prevalent condition was LRTI (76%), followed by bronchiolitis (15%), while WALRI and bronchopneumonia each accounted for 4.5%. Ceftriaxone was the most frequently prescribed antibiotic (85.5%), followed by Azithromycin (8%), Amikacin (3.5%), Cefotaxime (1.5%), and Doxycycline (1.5%). Most patients received Ceftriaxone twice daily (BD) at doses greater than 1 g in 46.5% of cases, indicating rational and appropriate dosing. The study concludes that Ceftriaxone was the most commonly and appropriately used antibiotic in paediatric LRTI cases. Regular microbiological testing and adherence to antibiotic stewardship principles are recommended to prevent resistance and improve therapeutic outcomes.

Keywords: Lower respiratory tract infection, Paediatrics, Antibiotics, Ceftriaxone, Rational drug use.

OP-BM-102

A Clinico Epidemiological Study On Tinea Corporis With Assessment To Its Treatment Strategies And Drug Prescribing Practices In A Tertiary Care Teaching Hospital At Salem, South India

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Abstract

Tinea corporis or ringworm, is a common fungal infection affecting the skin, caused by dermatophytes like trichophyton species. Clinico-epidemiological studies help understand the relationship between clinical manifestations, epidemiology and treatment outcomes. A prospective study was conducted with 100 patients in the department of Skin and STD of a tertiary care hospital at Salem from Jan 2025 to June 2025. The various sociodemographic information was obtained by interviewing the patients and a detailed dermatological examination was performed by the dermatologists to describe the morphology of lesions and sites involved. The results were statistically analysed and expressed in the form of percentages. Most of the patients were in the age group of 38–50 years. The majority of patients were literate, skilled workers, married, belonging to the lower middle class, from rural localities, and with positive family histories. Most of the patients were suffering from Tinea corporis for more than 1 year. The commonly used treatment modality was combinational therapy which comprises oral and topical antifungals and antihistaminic drugs. The commonly prescribed antifungal was itraconazole and terbinafine. This study highlights the clinico-epidemiological profile and treatment outcomes of tinea corporis. Understanding this factors can help develop effective treatment strategies and improve patient care.

OP-BM-103

Evaluation of short-term effects of psychotropic drugs on angle parameters and intraocular pressure (IOP) among new users

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Abstract

Glaucoma, a progressive optic neuropathy, is characterized by irreversible loss of retinal ganglion cells and visual field defects, often associated with elevated intraocular pressure (IOP). Psychotropic drugs, commonly prescribed for psychiatric disorders, may influence ocular physiology by altering aqueous humour dynamics or anterior chamber angle configuration. New users of these medications may experience short-term ocular changes that could predispose them to ocular hypertension or angle-closure glaucoma. To evaluate the short-term effects of various classes of psychotropic drugs on intraocular pressure (IOP) and anterior chamber angle parameters among new users. A six-month prospective observational study was conducted in the Department of Psychiatry and Ophthalmology at Vinayaka Mission's Kirupananda Variyar Medical College & Hospitals, Salem. A total of 100 patients (≥20 years) newly initiated on psychotropic therapy were enrolled. Baseline and follow-up measurements of IOP, gonioscopy (Shaffer grading), anterior chamber depth, and pupil size were recorded across three clinical visits. Statistical analysis was performed using Microsoft Excel and SPSS version 28.0. Among the 100 participants, 62% were male and 38% were female, predominantly in the 20–40-year age group. The most commonly prescribed psychotropic drugs included Clonazepam (49%), Risperidone (25%). Benzodiazepines (36.4%) and antipsychotics (27.5%) were the most prescribed drug classes. Across three visits, most subjects maintained IOP within the physiological range (11–15 mmHg), with no significant pressure elevation observed. Gonioscopy revealed 89% of eyes with Grade 4 angles, indicating open and stable anterior chambers. Pupil size and chamber depth remained largely unchanged throughout the study, suggesting minimal short-term ocular variation following psychotropic drug initiation.

OP-BM-104

Prescription Pattern Analysis and Therapeutic Evaluation of Antihistamines in the Treatment of Acute Inflammation

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Abstract

Acute inflammation is a fundamental physiological response to tissue injury, infection, or allergens, characterized by redness, swelling, heat, and pain. Antihistamines, though primarily used in allergic disorders, play a significant role in managing inflammation by blocking histamine receptors and alleviating histamine-mediated symptoms. Understanding prescribing patterns of antihistamines helps promote rational drug use and optimize therapeutic outcomes. A prospective observational study was conducted in the Department of General Medicine at a tertiary care hospital in Salem over a period of six months (January 2024 – June 2024). A total of 200 patients aged ≥18 years diagnosed with acute inflammatory conditions were included. Data were collected from inpatient case records using a structured proforma, including patient demographics, comorbidities, and prescribed antihistamines. Prescriptions were analysed based on drug class, dosage form, generation, and type of therapy (monotherapy or combination). Out of 200 patients, 59% were male and 41% female. The majority of patients (53%) were in the 50–69 years age group. First-generation antihistamines were the most frequently prescribed (56%), followed by second-generation (29%) and third-generation agents (15%). The most prescribed drug was Chlorpheniramine Maleate (38%), followed by Levocetirizine (23%). Tablets were the predominant dosage form (76%), and monotherapy was more common (76%) than combination therapy (24%). The study revealed that first-generation antihistamines, particularly Chlorpheniramine Maleate, remain the most preferred choice for treating acute inflammation due to their proven efficacy and affordability.

Keywords: Prescribing patterns, Antihistamines, Acute inflammation, Drug utilization, Rational drug use, Hospital-based study.

OP-BM-105

Antibacterial Activity of Calcined Shell Calcium Prepared From Two Different Marine Skeletal Species –Perna Viridis And Penaeus Monodon On Human Teeth Enamel-An Invitro Study

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Abstract

Recently, the calcined powder of oyster shells has been found to possess antibacterial activity, and has been considered for use as a bactericidal agent. In this study, calcined shell preparations were made from oysters, scallops, clams and roll shells, and their antibacterial activities were compared using total aerobic counts and E. coli. It was found that the calcined shell calcium from surf clams had the highest activity. Further comparison of activity was made between the calcined surf oyster preparation which was known to have antibacterial activity and the calcined surf clam preparation, and calcined surf clam calcium was found to have higher antibacterial activities against pathogenic Escherichia coli O157:H7, Pseudomonas aeruginosa and Staphylococcus aureus. The antibacterial activity was due to the strong alkalinity of aqueous solutions of this calcined calcium preparation.

PP-BM-01

Advance In Pyrimidine Nanoparticles For Targeted Cancer Therapy: Mechanisms, Applications And Challenges: A Review

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Abstract

Derivatives of pyrimidines, which have long been investigated as anticancer agents, have shortcomings as clinical drugs because of low solubility, low bioavailability and systemic toxicity. New nanotechnological advances have made possible the creation of pyrimidine-loaded nanoparticles which are effective in the delivery of drugs, the targeting of tumour tissues and the reduction of adverse effects. These nanoparticles prevent the progression of cancer through various mechanisms such as preventing DNA replication processes, inducement of apoptosis and interfering with metabolic pathways. They have demonstrated encouraging preclinical findings in the management of several cancers including breast, NSCLC, pancreatic and ovarian cancer by enhancing therapeutic response and addressing drug resistance. Moreover, nanoparticles delivery can lead to stability of drugs and controlled release with site specificity. Even with these developments, there are still issues such as long-term toxicity, regulatory barriers and scalability of manufacturing. Nevertheless, the lack of a definitive future direction due to combinations therapies and safer nanomaterials points towards the transformative potential of pyrimidine nanoparticles in the field of precision oncology.

Keywords: Pyrimidine Nanoparticles, Targeted Drug Delivery, Cancer Therapy, Apoptosis Induction and Nanotechnology in Oncology.

PP-BM-02

Tooth Enamel Remineralization Potential of Sepia Officinalis Bone Silver Nanoparticle Powder Extracts – An In Vitro Comparative Study By Cls Microscopy

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Abstract

Dental caries is one of the most widespread chronic diseases, resulting from an imbalance between demineralization and remineralization of enamel. Remineralizing agents play a key role in restoring lost minerals, but conventional agents often show limited efficacy in patients with high caries risk. Cuttlefish bone, a rich source of calcium phosphates (CaPs), offers a sustainable and biocompatible alternative for enamel repair. When processed into nanoparticles, it releases calcium and phosphate ions that enhance remineralization, improve enamel hardness, and restore the Ca/P ratio. Utilizing cuttlefish bone also supports waste valorization, aligning oral health innovation with environmental sustainability. To evaluate the tooth enamel remineralization potential of Sepia officinalis bone silver nanoparticle powder extracts through an in vitro comparative study using confocal laser scanning (CLS) microscopy. Twenty unerupted mandibular molars were randomly selected and demineralized. They were then divided into two groups (n=10) and remineralizing agents were applied. Group I (control) received bioactive glass, while Group II was treated with Sepia officinalis bone nanoparticle powder extracts. Samples were analyzed using CLS microscopy to assess depth of penetration and X-ray fluorescence spectroscopy to quantify mineral deposition. Data were analyzed using one-way ANOVA, with significance set at $p < 0.05$. All tested agents exhibited remineralization potential. The Sepia officinalis bone silver nanoparticle powder extract demonstrated higher remineralization efficacy compared to bioactive glass. CLS microscopy and X-ray fluorescence spectroscopy confirmed increased calcium and phosphorus levels in the experimental group.

Conclusion: Cuttlefish bone–derived nanoparticle extracts demonstrate promising remineralizing efficacy, offering a biocompatible and economical alternative to conventional agents while contributing to sustainable use of marine by-products.

PP-BM-03

CRISPR/CAS9 in Oral Cancer: From Gene Editing to Therapeutic Promise

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Abstract

Oral squamous cell carcinoma (OSCC) is among the most common head and neck malignancies, contributing significantly to global cancer-related morbidity and mortality. Despite advances in surgery, radiotherapy, and chemotherapy, the five-year survival rate of OSCC patients remains unsatisfactory, emphasizing the need for innovative therapeutic strategies. CRISPR/Cas9, a revolutionary genome-editing tool, has emerged as a powerful technology in cancer research, enabling precise DNA modifications, gene knockouts, and functional genomic studies. Recent genome-wide CRISPR screens in OSCC models have revealed novel fitness genes, particularly within the Hippo signaling pathway, which plays a crucial role in regulating cell proliferation, apoptosis, and tumor progression (Chai et al.). These findings highlight the potential of CRISPR-based approaches in identifying key oncogenic drivers and therapeutic vulnerabilities. Moreover, CRISPR technology is revitalizing oral cancer research by facilitating the study of gene–drug interactions, tumor suppressor pathways, and mechanisms of drug resistance with unprecedented accuracy (Sowmya S.V.). However, significant barriers remain in translating CRISPR from bench to bedside. Off-target editing, delivery challenges to tumor-specific sites, and ethical considerations present major hurdles to clinical application (Bhatka et al.). Addressing these limitations through improved delivery systems, high-fidelity Cas9 variants, and regulatory oversight could accelerate the clinical adoption of this technology.

In conclusion, CRISPR/Cas9 represents a promising frontier in oral cancer research, with the potential to revolutionize diagnostics, prognostics, and personalized therapy. Continued integration of CRISPR into OSCC studies may pave the way toward precision oncology and improved patient outcomes.

Keywords: Oral cancer, CRISPR/Cas9, genome editing, Hippo pathway, targeted therapy

PP-BM-04

Nanoparticle-Enhanced Bioactive Hydrogels: Revolutionizing Regenerative Endodontics

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Abstract

Regenerative endodontic procedures (REPs) aim to restore the vitality of dental pulp by employing biomaterials such as hydrogels. The bioactivity of these hydrogels depends not only on the intrinsic properties of the biomolecules or chemical compounds used but also on several critical parameters, including hydrogel concentration, bioactive molecule solubility, and apical foramen size. The integration of nanoparticles into hydrogels offers a promising strategy to enhance their bioactivity by improving controlled release of growth factors, increasing antibacterial effects, and enhancing mechanical properties. However, insufficient understanding of these parameters and nanoparticle host interactions limits the ability to predict clinical outcomes, slowing the bench-to-bedside translation of these technologies. This review highlights how these parameters can be systematically identified and studied, and proposes the development of mathematical and computational models to predict nanoparticle–hydrogel behaviour and optimize their use in REPs. Future research should focus on tailoring nanoparticle-loaded hydrogels to achieve predictable, reproducible, and clinically successful pulp regeneration.

PP-BM-05

The Hedgehog (Paraechinus Nudiventris) In Biotechnology: Bioprospecting for Novel Therapeutic Agents

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Abstract

The hedgehog family (Erinaceidae) is an untapped resource in biotechnology, rooted in traditional ethnozoology. The endemic Madras Hedgehog (Paraechinus nudiventris) is subject to unsustainable harvesting in South India, where its fat (oil) and dried skin are folk remedies for diseases, including asthma and tuberculosis. This medicinal use suggests the presence of potent bioactive compounds. This research aims to transition traditional knowledge into a modern scientific framework. The core objective is to propose a program for bioprospecting and biochemical characterization of P. nudiventris tissues. The study begins with the systematic compilation and review of quantitative ethnozoological survey data detailing the medicinal uses, specific animal parts traded, and the scale of exploitation of P. nudiventris in regions like Tamil Nadu. This data guides for advanced biochemical analysis (e.g., LC–MS and GC–MS) of hedgehog fat and skin extracts. This analysis will focus on profiling the metabolome to identify unique lipids, peptides, or small molecules responsible for the reported anti-inflammatory or bronchodilatory effects. The persistent use of hedgehog derivatives in local medicine provides a strong rationale for bioprospecting. Isolating these natural products could yield significant leads for drug discovery against respiratory illnesses. Identifying the active ingredients offers a solution to mitigate the conservation crisis faced by P. nudiventris. The Madras Hedgehog serves as a vital model for bioprospecting, demonstrating how indigenous knowledge can steer pharmaceutical research. Characterizing its bioactive components promises the development of innovative therapeutic drugs and a pathway toward sustainable utilization of the species potential.

PP-BM-06

Assessing the Antimicrobial Properties of Green-Synthesised Silver Nanoparticle Peptides of Piper Nigrum Against Enterococcus Faecalis and Candida Albicans: An In Vitro Study by Qpcr

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Abstract

Persistent infections by Enterococcus faecalis and Candida albicans are major causes of endodontic failures. Although sodium hypochlorite (NaOCl) is effective, its cytotoxicity and limited biocompatibility have prompted interest in herbal alternatives. Piper nigrum (black pepper) contains antimicrobial peptides (AMPs) with therapeutic potential. This study assessed the antimicrobial activity of green-synthesised silver nanoparticle–conjugated P. nigrum AMPs against E. faecalis and C. albicans using qPCR. Thirty extracted mandibular premolars were inoculated with E. faecalis (ATCC #29212) and C. albicans (ATCC #24433). Following canal preparation, samples were irrigated with saline, NaOCl, or P. nigrum peptide–silver nanoparticles. Antimicrobial efficacy was determined by qPCR cycle threshold (CQ) values and residual microbial counts. Statistical analysis was performed with ANOVA and Bonferroni post hoc testing. Against E. faecalis, Piperin exhibited the highest antimicrobial activity (CQ = 28.16; residual = 10.72 CFU), significantly superior to saline ($p < 0.001$) and comparable to NaOCl. For C. albicans, Piperin (CQ = 29.78; residual = 23.89 CFU) and NaOCl (CQ = 29.15; residual = 27.78 CFU) both showed strong antifungal effects, with no significant difference, but outperformed saline ($p < 0.001$). P. nigrum AMPs conjugated with silver nanoparticles demonstrated potent antibacterial and antifungal effects, comparable—and in some aspects superior—to NaOCl. These findings suggest their potential as a safe, plant-based alternative irrigant in endodontic therapy.

PP-BM-07

Hydrothermal Synthesis of Mineral-Substituted Tricalcium Phosphate for Enhanced Bone Regeneration

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Abstract

Tricalcium phosphate (TCP) is a widely used biomaterial for bone tissue engineering due to its excellent biocompatibility and osteoconductivity. In this study, mineral-substituted TCP was synthesized via a hydrothermal method using under controlled conditions. Substitution with biologically relevant ions (Mg^{2+}, Sr^{2+}, Zn^{2+}) was employed to enhance the structural, mechanical, and biological properties of TCP. The synthesized materials were characterized using X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM), and energy-dispersive X-ray analysis (EDX) to confirm phase formation, morphology, and elemental composition. In vitro studies demonstrated improved bioactivity, with enhanced cell adhesion and proliferation on the substituted TCP compared to pure TCP. The results suggest that hydrothermally synthesized mineral-substituted TCP could serve as a promising candidate for bone regeneration applications.

Keywords: Mineral-substituted tricalcium phosphate, Hydrothermal synthesis, Bone regeneration, Bioceramics, Osteoconductivity

PP-BM-08

Nanoparticle-Enhanced Hydrogels for Regenerative Endodontic Procedures: Current Challenges and Future Perspectives

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Abstract

Regenerative endodontic procedures (REPs) aim to restore the vitality of dental pulp by employing biomaterials such as hydrogels. The bioactivity of these hydrogels depends not only on the intrinsic properties of the biomolecules or chemical compounds used but also on several critical parameters, including hydrogel concentration, bioactive molecule solubility, and apical foramen size. The integration of nanoparticles into hydrogels offers a promising strategy to enhance their bioactivity by improving controlled release of growth factors, increasing antibacterial effects, and enhancing mechanical properties. However, insufficient understanding of these parameters and nanoparticle host interactions limits the ability to predict clinical outcomes, slowing the bench-to-bedside translation of these technologies. This review highlights how these parameters can be systematically identified and studied, and proposes the development of mathematical and computational models to predict nanoparticle–hydrogel behaviour and optimize their use in REPs. Future research should focus on tailoring nanoparticle-loaded hydrogels to achieve predictable, reproducible, and clinically successful pulp regeneration.

PP-BM-09

Evaluation of Antibacterial Properties of Novel Spiro[acridine-9,3'-indole]-dione Derivatives Synthesized Under Mild Conditions

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Abstract

To synthesize novel 2,2,6',6'-tetramethyl-1'-phenyl-1',2,2',3,6',7'-hexahydro-1H-spiro[acridine-9,3'-indole] derivatives, we developed a straightforward and efficient method involving a one-pot, four-component condensation reaction. This approach utilizes two equivalents of dimedone, modified anilines, and various isatins in ethanol as the solvent, conducted at 70 °C. The reaction proceeds smoothly to yield spiro[acridine-9,3'-indole]-4,4'(5'H,10H)-dione derivatives in good to excellent yields within a short reaction time.This mild, catalyst-free protocol offers a practical and convenient route for the synthesis of structurally novel and potentially bioactive spiro compounds. The structures of the synthesized derivatives were confirmed by ^{1}H NMR, ^{13}C NMR, and FT-IR spectroscopy. The simplicity, high efficiency, and environmental friendliness of this method make it particularly appealing. Biological evaluations of the synthesized compounds are currently underway.

PP-BM-10

Utility of Three Disk-Based Methods to Evaluate Ceftazidime - Avibactam/Aztreonam Combination Synergism against Clinical Isolates

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Abstract

This study aimed to evaluate the *invitro* activity of aztreonam combined with Ceftazidime-Avibactam against MBL carbapenem resistant clinical isolates using disk stacking, disk replacement and double disk synergy methods. A cross- sectional study was conducted on eighteen geno typically confirmed carbapenem resistant Gram negative *Bacilli* collected during October 2023-February 2024. Nine *E.coli*, two *Klebsiella pneumoniae,* two *Enterobacter cloacae*, a single isolate of *Enterobacter cloacae,*three *Pseudomonas aeruginosa* and a single isolate of *Proteus mirabilis* were subjected to Ceftazidime-Avibactam/Aztreonam synergistic combination testing by three disk based methods. Out of 18 isolates showed Ceftazidime-Avibactam/Aztreonam combination synergism by all three tested methods. Out of 16 isolates which showed synergism, seven were *E.coli*, two were *Klebsiella pneumoniae*, two isolates of *Enterobacter cloacae,* a single isolate of *Enterobacter cloacae,* three were *Pseudomonas aeruginosa* and a single isolate of *Proteus mirabilis*. By double disk synergy test, bridging of zone of inhibition was observed among five isolates, appearance of zone of inhibition between Ceftazidime-Avibactam and Aztreonam was observed among four isolates and increase in zone size of more than 2mm was observed for seven isolates. An increase of 2-7mm zone size was observed for combination drugs by disk replacement method and disk stacking method**.**

Keywords: Ceftazidime avibactam/Aztreonam, Carbapenem Resistance, Antimicrobial Resistance, Double Disk Synergy Test, Hospital Infection Control.

PP-BM-11

Prevalence of ESBL Enterobacterales from Clinical Isolates

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Abstract

Extended-spectrum beta-lactamase (ESBL) producing *Enterobacterales* have emerged as a major threat to global healthcare, conferring resistance to most beta-lactam antibiotics and often to multiple other drug classes. Their rapid detection and characterization are crucial for guiding antimicrobial therapy and infection control. A retrospective study was conducted over a six-month period (July–December 2021). A total of 146 *Enterobacteriaceae* isolates obtained from 805 clinical samples were analyzed using the Kirby-Bauer disk diffusion method. Isolates with zone diameters ≤ 22 mm for Ceftazidime and ≤ 27 mm for Cefotaxime were considered ESBL producers. Among the isolates, *E. coli* (41.09%) and *Klebsiella pneumoniae* (44.52%) were the most prevalent species, followed by *K. oxytoca* (5.48%), *Proteus mirabilis* (5.48%), *Proteus vulgaris* (1.37%), and one isolate each of *Morganella morganii, Citrobacter diversus*, and *Enterobacter cloacae.* Out of 146 isolates, 125 (85.62%) were confirmed as ESBL producers. The proportion of ESBL-producing strains was highest in *K. oxytoca* (100%), followed by *E. coli* (91.67%), *K. pneumoniae* (83.08%), and *P. mirabilis* (75%). The high prevalence of ESBL-producing *Enterobacterales* underscores the need for continuous surveillance, strict antibiotic stewardship, and effective infection control practices to curb the spread of multidrug-resistant organisms.

Keywords: ESBL, *Enterobacterales*, Antimicrobial Resistance, *E. coli*, *Klebsiella pneumoniae,* Hospital Infection Control.

PP-BM-12

Multifunctional Silver–Benzene Tricarboxylic Metal Organic Frameworks: Structural Insights and Evaluation of Therapeutic Potential Against Pathogenic Microbes and Lung Cancer Cells.

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Abstract

Silver Benzene-1,3,5-tricarboxylate (Ag-BTC) metal–organic frameworks were synthesised at different Ag-BTC molar ratios (3:2, 4:2, 5:2) by solvothermal method. Characterisation by UV–Vis, FTIR, XRD, and FE-SEM confirmed highly crystalline structures with octahedral morphology. Among the variants, the 3:2 Ag-BTC MOF demonstrated the most potent bioactivity. Antimicrobial assays showed inhibition of *S. aureus* (14 mm), *E. coli* (13 mm), *C. albicans* (9 mm), and *A. flavus* (13 mm). The framework also exhibited strong , selective cytotoxicity was observed against A549 lung adenocarcinoma cells. For Further studies normal L929 fibroblasts and ROS-mediated oxidative stress, the anticancer mechanism has been analysed. These findings establish Ag-BTC (3:2) as a multifunctional nanoplatform with strong potential for lung cancer therapy, warranting further in vivo and mechanistic studies.

Keywords: Metal-Organic Framework, Silver Benzene Tricarboxylic Acid (Ag–BTC), Antibacterial, Antifungal, Antioxidant, ROS and Cytotoxicity for L929 and Anticancer A549.

PP-BM-13

Synergistic Integration of $BiFeO_3$ and g-C_3N_4 Nanocomposites for Enhanced Electrochemical Performance in Symmetric Supercapacitors

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Abstract

The development of efficient and stable electrode materials remains a key challenge for next-generation energy storage systems. In this study, a $BiFeO_3$/g-C_3N_4 nanocomposite was designed and synthesized through a hydrothermal–ultrasonication route to exploit the synergistic coupling between the perovskite oxide and the 2D carbon nitride matrix. $BiFeO_3$ nanoparticles prepared hydrothermally were uniformly anchored onto g-C_3N_4 nanosheets derived via thermal polycondensation, forming a well-integrated 1:1 hybrid. Structural and spectroscopic analyses confirmed the coexistence of both phases without lattice distortion, indicating successful interfacial integration. Electrochemical evaluations in 3 M KOH using cyclic voltammetry, galvanostatic charge–discharge, and impedance spectroscopy revealed a remarkably high specific capacitance of 740 F g^{-1} at 1 A g^{-1}, coupled with excellent rate capability, low charge-transfer resistance, and robust cycling stability. The outstanding performance originates from the synergistic interfacial interaction between $BiFeO_3$ and g-C_3N_4, which enhances electronic conductivity, accelerates ion diffusion, and promotes fast redox kinetics. These findings highlight the $BiFeO_3$/g-C_3N_4 composite as a promising electrode material for high-energy, long-life symmetric supercapacitor applications.

Keywords: Bismuth Ferrite, graphitic carbon nitride, specific energy, specific power, specific capacitance, electrolytic solution.

PP-BM-14

Conductivity-Enhanced PVA/CMC/Ag_2O/Graphene Oxide Nanostructures for Efficient and Durable Supercapacitors

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Abstract

The development of flexible and high-performance electrode materials is critical for next-generation energy storage devices. In this study, a Polyvinyl alcohol (PVA)/carboxymethyl cellulose (CMC)/ silver oxide (Ag_2O)/Graphene Oxide (GO) nanocomposite was fabricated and systematically investigated for supercapacitor applications. PVA and CMC provided a robust polymeric matrix, while Ag_2O nanoparticles and GO nanosheets acted as redox-active and conductive fillers, respectively. Structural and morphological analyses confirm the uniform dispersion of Ag_2O and GO within the polymer network, enabling an efficient electron transport pathway. Electrochemical performance was evaluated via cyclic voltammetry (CV), galvanostatic charge–discharge (GCD), and electrochemical impedance spectroscopy (EIS) in aqueous 3 M KOH, obtaining a high specific capacitance of 510 F g^{-1} at 1 A g^{-1}, excellent rate capability, and low charge-transfer resistance. The presence of synergistic interaction between Ag_2O and GO enhances an electronic conductivity and facilitates fast ion diffusion and promoting a reversible faradaic redox reaction within the polymer matrix, collectively enhancing the performances of PVA/CMC/Ag_2O/GO. Hence, these findings demonstrate that the PVA/CMC/Ag_2O/GO nanocomposite is a promising electrode material for high-energy, flexible, and durable supercapacitor devices.

Keywords: PVA/CMC nanocomposite, Silver oxide (Ag_2O) nanoparticles, Graphene oxide (GO), Supercapacitor electrodes, High-performance energy storage

PP-BM-15

Self-standing MXene Electrode Embellished with Bifunctional $NiMoO_4$ Nanorods for Electricity Generation from Urine and Fruit Juice

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Abstract

Two birds-one stone strategy, capable of solving two things with a single substance, has been widely used in electrochemical fields such as bifunctional catalysts. Herein, freestanding nickel molybdate ($NiMoO_4$) nanorods-decorated Ti_3C_2 MXene (MX) ($NiMoO_4$@MX) films are prepared and applied as electrode for electrochemical urea oxidation (UOR) and glucose oxidation reactions (GOR). Further, the $NiMoO_4$@MX_1 is exploited as self-supporting anode in direct urea fuel cell (DUFC) and direct glucose fuel cell (DGFC) and achieve the maximum power densities of 35.4 and 27.3 mW cm^{-2}, respectively. Furthermore, real samples of human urine, cow urine, and orange juice are used as the fuel for DUFC and DGFC, and obtained power densities of 29.8, 27.9, and 23.1 mW cm^{-2}, respectively. At the end of fuel cell operation, 94 and 92 % of urea in human urine and cow urine are, respectively, removed from DUFC and 86% of glucose is eliminated from DGFC.

Keywords: Urea fuel cell, glucose fuel cell, urea oxidation, $NiMoO_4$, MXene

PP-BM-17

Synthesis, Characterization, And Antibacterial Activity of Cinnamaldehyde Based Schiff Base

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Abstract

In most cases, aldehydes or ketones are combined with amines in a condensation process to produce Schiff bases which are showing great interest due to donor functional group imine. Since, they may contain aromatic or aliphatic side chains that have been substituted, they exhibit a wide range of biological functions. These compounds reportedly have a significant impact on the production of several pharmaceuticals. Hence, this research synthesised a single crystal of cinnamaldehyde and isoquinnoline amine condensed Schiff base for antibacterial applications against *E.coli, S. aureus* pathogens. It was characterized by UV, FTIR, and ^{1}H-NMR. Compound showed good inhibition against the pathogens and minimum inhibition concentrations observed between 9 and 11 µg/mL.

Keywords: Cinnamaldehyde, isoquinnoline, Schiff bases, characterization, anti-microbial

About iNEEBA-2025

The 5th International Conference on Nanoscience and Nanotechnology for Energy, Environment and Biomedical Applications (INEEBA-2025) will be held during October 13-14, 2025. This conference includes keynote lectures from eminent scientists across the world, oral presentation and poster presentation of various aspects of Nanoscience and Nanotechnology. The goal of the conference is to create a platform for materials scientists/physicists/chemists from academic institutions and industries around the world to present breakthroughs in their disciplines favorable to exchange ideas and scientific information. The conference will encompass the latest research advances in nanoscience and nanotechnology with a focus on energy, environment, and biomedical applications. It will highlight innovative approaches for sustainable energy generation and storage, environmental remediation, green technologies, advanced nanomaterials for healthcare, diagnostics, and therapeutics. Thus, the conference on nanomaterials will serve as a multidisciplinary venue for talks and deliberations. The INEEBA 2025 invites abstracts and full-length manuscripts in the thematic areas of material science and biomaterials for oral/poster presentations and peer-reviewed publications.

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