GARGI COLLEGE

(University of Delhi)

(Accredited Grade 'A+' by NAAC)

organizes

NATIONAL CONFERENCE

on

Integrating Green Chemistry into Academia and Industry for Sustainable Development

November 10- 11, 2025

Gargi College

Siri Fort Road, New Delhi - 110049

Anusandhan National Research Foundation

Conference Proceedings

RSYN RESEARCH

CONFERENCE SERIES

RSYN RESEARCH LLP, Indore, India
Integrating Green Chemistry into Academia and Industry for Sustainable Development
ISBN: 978-81-986231-0-2

Cover Page: Beena Negi
Editors: Uttara Dutta, Beena Negi, Niyati Singh, Salma Khan.

Digital download and online
books.rsyn.org
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Published in India
by RSYN RESEARCH LLP, Indore, India
www.rsyn.org
www.rsynpress.com

978-81-986231-0-2

Honorable Guests

Chief Guest

Prof. (Col.) Diwan S. Rawat
FNA, FNASc, FRSC, CChem London
Hon'ble Vice Chancellor, Kumaun University
Sr. Professor, Department of Chemistry,
University of Delhi

Guest of Honour

Dr. Neelima Alam
Scientist F & Associate Head
Climate, Energy and Sustainable Technology
(CEST) Division, DST

Eminent Speakers

Prof. Satya Narayan Naik
Professor Center for Rural Development & Technology,
Indian Institute of Technology Delhi

Prof. Bimlesh Lochab
Professor School of Natural Sciences
Shiv Nadar University

Prof. Ram Singh
Associate Dean Student Welfare
Professor Department of applied chemistry,
Delhi Technological University

Prof. Indrajit Roy
Director
Institute of Nanomedical Science
University of Delhi

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Chief Research & Development officer API
Walter Bushnell
Research & Development Pvt. Ltd.

Mr. Shakti Vinay Shukla
Director
Fragnance and Flavour
Development Centre Kannauj, UP

Dr. Yogendra Saxena
Expert on Sustainability & Corporate
Responsibility

Dr. Atul Agarwal
Chief Quality Control Technical
Manager &
Technical Head at Guwahati Refinery
Indian Oil Corporation Limited

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About the College

Established in 1967, Gargi College is a premier institution of the University of Delhi's South Campus and has been accredited with an 'A+' grade by NAAC. Inspired by the spirit of Gargi, the enlightened scholar, the college is committed to fostering excellence in education and the holistic development of its students. Over the years, Gargi College has made significant contributions to the fields of Arts, Humanities, Commerce, Science, and Education. It consistently ranks among the top educational institutions in the country. True to its mission, the college ensures that every student who graduates becomes a well-rounded individual, embodying the spirit of inquiry and enterprise that defines Gargi.

About the Department of Chemistry

The Department of Chemistry stands as one of the pioneering academic divisions of the College, established in 1967. It commenced with a one-year premedical program and subsequently expanded to offer B.Sc. (General) courses in both Physical and Life Sciences. The department owes its solid foundation to the visionary efforts of its founder member, the late Dr. C. K. Khurana, whose dedication, alongside that of his colleagues, was instrumental in shaping its academic excellence.

In 1991, the prestigious B.Sc. (Hons.) Chemistry program was instituted, with the inaugural cohort graduating in 1994. Presently, the department boasts a distinguished faculty of 18 members, each possessing expertise across a broad spectrum of chemical and interdisciplinary domains, including Medicinal Chemistry, Green Chemistry, Biochemistry, Stereochemistry, Heterocyclic and Bioinorganic Chemistry, Theoretical Quantum Chemistry, Nanochemistry, Analytical Chemistry, and Electrochemistry.

The department has a dedicated and well-trained team of supporting laboratory staff. The department's laboratories are furnished with state-of-the-art instruments such as UV-Vis spectrophotometer, colorimeter, electronic melting point apparatus, rotatory evaporator, magnetic stirrer, polarimeter, muffle furnace, and ultrasonicator. Complementing these facilities is a well-curated departmental library that caters to advanced academic and research needs. Each year, the Department of Chemistry attracts meritorious students from diverse regions and educational boards across India, drawn by the renown and academic rigor of the Chemistry Honours program at Gargi College.

Vision

The Department of Chemistry aspires to be a centre of excellence in all aspects of teaching, learning, research, and development, and it believes in holistic education that goes beyond the curriculum.

Mission

To create the best resource for students and researchers in chemical sciences. To instill a scientific mindset and cultivate professional and technological knowledge. To address the demands of institutes, industries, and contemporary society through educated social outreach.

About the National Conference

The National Conference on "**Integrating Green Chemistry into Academia and Industry for Sustainable Development**", organized by the Department of Chemistry, Gargi College, University of Delhi, is designed to promote sustainability and environmentally conscious practices through a meaningful exchange of ideas, innovations, and practical solutions.

This conference aspires to cultivate critical thinking, responsible innovation, and leadership among the next generation, reaffirming a shared commitment to sustainability and embedding green chemistry into research, education, and industrial practice.

This conference is funded by the **Anusandhan National Research Foundation** (ANRF), a statutory body created by an Act of Parliament-2023. The **American Chemical Society** has sponsored four prizes in the form of premium annual memberships. We also acknowledge the financial support provided by Chromachemie, Progression India, and Payolab India.

This two-day event will feature distinguished lectures, oral and digital poster presentations, and interactive hands-on sessions, offering participants foundational knowledge and practical insights into green practices, sustainable perfumery, and the vital role of green chemistry in pharmaceuticals and industry. The sessions will highlight how eco-friendly approaches can reduce waste, encourage the use of safer chemicals, and accelerate the adoption of sustainable technologies. Aligned with the United Nations Sustainable Development Goals (SDGs), the conference will introduce participants to environmentally responsible chemical processes, cutting-edge industrial solutions, and evolving regulatory frameworks. By bridging academia and industry, it aims to empower students, researchers, educators, and professionals to implement greener practices across diverse sectors.
As the global community reviews progress since the adoption of the SDGs in 2015, this conference takes on special significance. It provides a timely platform to exchange best practices, foster collaboration, and deliberate on actionable steps to overcome challenges and build a more sustainable future.

Highlights of the Conference:

- Lectures by eminent speakers from leading industries, MSMEs, research institutions, and academia
- Oral and digital poster presentations by participants
- Hands-on sessions on sustainable perfumery
- Discussions on industrial innovations and regulatory frameworks

This volume of **Conference Proceedings** brings together the abstracts presented at the National Conference on "Integrating Green Chemistry into Academia and Industry for Sustainable Development", organized by the Department of Chemistry, Gargi College, University of Delhi.
The proceedings include a wide spectrum of scholarly contributions and innovative ideas, featuring:

- 1 Keynote Address
- 6 Invited Talks by Experts
- 1 Workshop on Sustainable Perfumery
- 20 Oral Presentations
- 67 Digital Poster Presentations

Collectively, these contributions reflect the diversity of research and practices in the field of green chemistry, while emphasizing the importance of integrating sustainability into academia, industry, and society.

Themes of the Conference

- Role of academia in driving sustainable development
- Sustainable practices in sciences and industrial innovations
- Green chemistry & the Sustainable Development Goals
- Eco-friendly synthesis, catalysis, & reaction design
- Real-world applications of green processes across sectors
- Biodegradable materials and waste minimization strategies
- Addressing environmental challenges through green practices
- Regulatory frameworks and integration of green policies
- Green processes for a sustainable future and environmental stewardship
- Green methodologies in pharmaceutical, perfumery, & agrochemical industries

Organizing Team

Patrons

Sr. Prof. Pankaj Gupta
Chairperson
Governing Body, Gargi college

Prof. Sangeeta Bhatia
Principal (Offcg.)
Gargi college

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Prof. Reena Saxena, Department of Chemistry, Kirori Mal College

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Prof. Renu Agarwal, Professor, Dept. of Chemistry, Gargi College
Dr. B. Vaijyanthi, Associate Professor, Dept. of Chemistry, Gargi College
Dr. Chandana Mukherjee, Associate Professor, Dept. of Chemistry, Gargi College
Dr. Prem Khullar, Former Associate Professor, Dept. of Chemistry, Gargi College
Dr. Indu Tucker Sidhwani, Former Associate Professor, Dept. of Chemistry, Gargi College
Dr. Sushmita Choudhary, Former Associate Professor, Dept. of Chemistry, Gargi College
Dr. Anita Chugh, Former Associate Professor, Dept. of Chemistry, Gargi College
Dr. Keya Banerjee, Former Associate Professor, Dept. of Chemistry, Gargi College

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Associate Professor
Department of Chemistry
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Associate Professor
Department of Chemistry
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Message from the Chief Guest

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स्लीपी हॉलो, नैनीताल–263001, उत्तराखण्ड, भारत
Kumaun University, Nainital
Sleepy Hollow, Nainital-263001, Uttarakhand, India
(Accredited "B⁺" Grade by NAAC)

K U Nainital

प्रो० (कर्नल) दीवान एस. रावत
एफ एन ए, एफ एन ए एससी, एफ आर एस सी, सी केम (लन्दन)
कुलपति
Prof. (Col.) Diwan S. Rawat
FNA, FNASc, FRSC, CChem (London)
Vice-Chancellor

Message from the chief guest

It gives me immense pleasure to be associated with the National Conference on "Integrating Green Chemistry into Academia and Industry for Sustainable Development," being organized by the Department of Chemistry, Gargi College, University of Delhi.

The theme of this conference is both timely and significant, as the global scientific community continues to explore innovative strategies to address the pressing challenges of green chemical synthesis, climate change, environmental degradation, and sustainable growth.

Green Chemistry has emerged as a transformative approach that not only minimizes waste and reduces the use of hazardous substances but also fosters innovation across diverse sectors such as energy, pharmaceuticals, agriculture, and materials science.

By bridging the gap between academia and industry, this conference provides a much-needed platform for meaningful dialogue, collaboration, and knowledge exchange. I am confident that the deliberations through keynote lectures, invited talks, oral and digital poster presentations, and hands-on workshops will inspire students, researchers, academicians, and industry professionals alike to integrate sustainable practices into their research and professional endeavors.

I extend my heartiest congratulations to the Department of Chemistry, Gargi College, the Organizing Committee, and all participants for their dedicated efforts in making this conference possible. I wish the event great success in advancing the collective mission of building a greener and more sustainable future.

Prof. (Col.) Diwan S. Rawat
Vice Chancellor

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Message from the Guest of Honour

Dear Participants,

It gives me immense pleasure and a deep sense of honour to address this significant conference on “Integrating Green Chemistry into Academia and Industry for Sustainable Development.”
This gathering brings together brilliant minds united by a shared purpose to explore how we can innovate, create, and progress without compromising the well-being of our planet.
For too long, industrial and chemical growth has often come at an environmental cost. Green Chemistry offers us a new direction where innovation and responsibility go hand in hand. It enables us to design products and processes that are not only effective but also respectful of nature’s balance.
Our industry leaders hold the power to drive this transformation. By adopting sustainable and green practices, they can redefine progress — proving that environmental responsibility and economic growth can truly coexist. Sustainability is not a burden, but the true measure of advancement.
In this regard Department of Science and Technology (DST) , Govt of India is playing a critical role in nurturing and hand holding the Green technologies across their entire value chain relevant to resilient climate, Clean Water, Renewable energy systems, Industrial Decarbonization and GHG management.
I am delighted to know the enthusiastic participation of faculty members, research scholars, industry professionals, and students from both undergraduate and postgraduate levels. Your presentations, discussions, and ideas will make this conference a meaningful step forward and a platform that fosters collaboration and plants the seeds for future innovations.
May the deliberations over these two days inspire us all to translate ideas into action and to make green not just a colour of hope, but the defining shade of our collective future.
Wishing you all a truly successful, engaging, and inspiring conference.

Dr. Neelima Alam
Scientist F & Associate Head
CEST Division, DST

Chairperson's Message

Dear Esteemed Participants,

It is with great pleasure and a deep sense of responsibility that I extend my warmest welcome to all of you to the National Conference on “Integrating Green Chemistry into Academia and Industry for Sustainable Development,” being held on November 10–11, 2025. The relationship between technology, the environment, and the pursuit of a sustainable future has always been both dynamic and challenging. Emerging technologies, especially green methodologies in chemistry, are at the forefront of addressing these challenges and paving the way toward a sustainable tomorrow. Equally important, entrepreneurial initiatives within industry can help translate academic research beyond publications—toward commercialization and large-scale implementation of innovations. This synergy not only fosters economic growth but also ensures long-term safety and well-being for future generations. I am confident that your insights, expertise, and active participation will play an indispensable role in advancing environmental sustainability and societal progress. Let us embark on this intellectual journey with enthusiasm and a shared commitment to building stronger bridges between academia and industry—working together to create innovative, inclusive, and practical solutions for a sustainable future. This conference proudly witnesses enthusiastic participation, featuring oral presentations and digital poster presentations.

I wish you all a fruitful and enlightening conference.

Sr. Prof. Pankaj Gupta
Chairperson, Governing Body
Gargi College

From the Desk of Principal

Greetings!

Welcome to the Conference Proceedings of the Two-Day National Conference on “Integrating Green Chemistry into Academia and Industry for Sustainable Development,” being held on November 10–11, 2025, organized by the Department of Chemistry, Gargi College.

The purpose of this conference is to explore the prospects and impact of green approaches within Indian academia and industry. By examining various aspects of environmental sustainability and its transformational potential, we aim to enhance productivity, innovation, and societal well-being. The primary goal is to foster a comprehensive understanding of sustainability, promote environmentally safe practices, and position India as a global leader in emerging green technologies.

To achieve this vision, the conference brings together a diverse group of stakeholders and experts to share perspectives, evaluate challenges, and chart a roadmap for the future. Eminent speakers will deliberate on various facets of green chemistry, sustainability, energy conservation, and environmental safety. Faculty members, researchers, and students will present innovative ideas through insightful oral presentations, digital posters, interactive discussions, and collaborative exchanges. The event also provides an inspiring and thought-provoking platform for undergraduate students to engage in innovation and research.

It is heartening to witness enthusiastic participation from universities, colleges across the University of Delhi, as well as other academic institutions and industries, through their oral and digital poster presentations.

We hope that the deliberations and insights emerging from this conference will raise awareness, inspire meaningful action, and contribute to a brighter, safer, and more sustainable future for India.

Best Wishes
Prof. Sangeeta Bhatia
Principal (Offg.)
Gargi College, University of Delhi

Convener's & Co-Convener's Message

Dear Participants,

It is a distinct honour and pleasure to welcome you to the National Conference on "Integrating Green Chemistry into Academia and Industry for Sustainable Development" at Gargi College premises.

We are grateful to the **Anusandhan National Research Foundation** (ANRF), Government of India, for providing financial support to this conference. We are grateful to the **American Chemical Society** (ACS) for sponsoring four prizes for oral and poster presentations in the form of premium ACS memberships. We also extend our sincere thanks to our sponsors — Chromachemie, Progression India, and Pyolab India — for their generous financial support, and to Smiling Tree for providing beautiful potted plants.

Your presence here as researchers, educators, industry leaders, policymakers, and students underscores the critical importance of this theme. We stand at a pivotal moment where the fundamental principles of green chemistry must actively drive global sustainability goals.

The transition to a truly sustainable future hinges on a strong partnership between the institutions that innovate (academia) and the sectors that implement (industry). Green Chemistry, with its commitment to designing safer, more efficient, and less polluting products and processes, serves as the essential bridge between these two realms.

Over the next two days, we aim to move beyond discussion and towards actionable strategies. The conference has been thoughtfully designed to foster meaningful engagement and collaboration through:

- Keynote lectures by distinguished scientist who have pioneered green chemistry practices in academia.
- Technical sessions highlighting cutting-edge research in sustainable synthesis, process intensification, green materials and sustainability.
- A dedicated workshop focused on sustainable perfumery.
- Oral and poster presentations by academicians, industry professionals, and researchers showcasing diverse innovations in this vital field.

We encourage you to actively participate in all sessions and interact with fellow delegates. The diverse perspectives you bring from the laboratory bench to the industrial floor and the policy arena are invaluable in shaping a collective path toward sustainability.

We extend our heartfelt thanks to all participants for their enthusiasm and commitment to this important cause. May this conference serve as a launchpad for new collaborations and innovative partnerships that drive meaningful progress toward a sustainable future.

We look forward to engaging discussions and inspiring exchanges on green chemistry and sustainability.

With Warm Regards,
Dr. Uttara Dutta, Dr. Beena Negi, Dr. Niyati Singh & Dr. Salma Khan

Program Schedule

Day 1 - 10 November 2025

Inaugural Session

Day 1 (November 10, Monday)	
TIME	**PROGRAMME**
8:30 – 9:30 AM	Registration (Venue: Seminar Hall - Auditorium Block)
Inaugural Session (9:30 – 11:30AM) (Venue: Seminar Hall - Auditorium Block)	
9:30 – 9:40 AM	Lighting of Lamp
9:40 – 9:50 AM	Recital of Kulgeet of University of Delhi
9:50 – 10:00AM	Felicitation of Dignitaries
10:00 – 10:10 AM	Opening Address by Convener **Dr. Uttara Dutta**
10:10 – 10:20 AM	Welcome address by the Principal **Prof. Sangeeta Bhatia**

10:20– 10:50 AM	Address by the **Chief Guest Prof. (Col.) Diwan S. Rawat (FNA, FNASc, FRSC, CChem London), Hon'ble Vice Chancellor,** Kumaun University, Sr. Professor Department of Chemistry, University of Delhi
10:50 – 11:10 AM	Address by **Guest of Honour Dr. Neelima Alam**, **Scientist F** and **Associate Head** of the Climate, Energy, and Sustainable Technology (CEST) Division at the Department of Science & Technology (DST)
11:10 – 11:20 AM	Release of Conference Proceedings
11:20 – 11:30 AM	Vote of Thanks
High Tea 11:30 –12:00 noon (Venue: Auditorium Foyer)	

Day 1 - 10 November 2025

Technical Session 1

Technical Session 1 (12:00-1:30 PM) (Venue: Seminar Hall - Auditorium Block) **Chair - Prof. Renu Agarwal and Dr. Sushmita Chowdhry**	
12:00 – 12:05 PM	Welcome address and Felicitation of speakers
12:05 – 12:45 PM	**Keynote Address by Prof. Satya Narayan Naik,** Professor, Center for Rural Development & Technology, IIT Delhi
12:45 – 1:25 PM	**Invited Lecture 1: Prof. Bimlesh Lochab,** School of Natural Sciences, Shiv Nadar University
1:25 – 1:30 PM	Vote of thanks
Lunch 1:30 to 2:30 PM (Venue: Audi Foyer)	

Technical Session 2

Technical Session 2 (2:30-4:20 PM) (Venue: Seminar Hall - Auditorium Block) **Chair - Dr. Rita Bhatla and Dr. Keya Banerjee**	
2:30 – 2:40 PM	Welcome address and Felicitation of speakers
2:40 –3:20 PM	**Invited Lecture 2: Dr. Mohan Prasad**, Chief Research & Development Officer - API, Walter Bushnell
3:20 – 4:00 PM	**Invited Lecture 3: Prof. Indrajit Roy,** Director, Institute of Nanomedical Science, University of Delhi
4:00 – 4:10 PM	Vote of thanks
4:10-4:20 PM	Group Photo followed by Tea

Day 2 : 11 November 2025

Technical Session 3

Technical Session 3 (9:30-11:10 AM) (Venue: Seminar Hall - Auditorium Block) **Chair- Dr. B. Vaijyanthi and Dr. Chandana Mukherjee**	
9:30 – 9:40 AM	Welcome address and Felicitation of speakers
9:40 – 10:20 AM	**Invited Lecture 4: Prof. Ram Singh,** Associate Dean - Student Welfare, Professor - Department of Applied Chemistry; Delhi Technological University (DTU)
10:20 – 11:00 AM	**Invited Lecture 5: Dr.Yogendra Saxena,** Expert on Sustainability & Corporate Responsibility
10:20 – 11:00 AM	Vote of thanks
Tea Break 11:10 –11:30 AM (Venue: Seminar Hall - Auditorium Block)	

Hands-on session

Hands-on Session (11:30-1:00 PM) (Venue: Seminar Hall) **Chair- Dr. Indu Tucker Sidhwani and Dr. Prem Khullar**	
11:30 – 11:35 AM	Welcome address and felicitation of Resource Person
11:35 – 12:55 PM	Workshop: **Mr Shakti Vinay Shukla,** Director, Fragrance & Flavour Development Centre, Kannauj, UP
12:55 – 1:00 PM	**Vote of thanks**
Lunch 1:00 to 1:40 PM (Venue: Audi Foyer)	

Day 2 : 11 November 2025

Presentation Session

Presentation Session (1:40- 3:10 PM)
Oral Presentations- Faculty (Venue: Seminar Hall- Auditorium Block)
Oral Presentations- Research Scholars (Venue: New Academic Block)
Digital Poster Presentations- Faculty/Industry Professionals/Research Scholars (Venue: New Academic Block)
Digital Poster Presentations- UG/PG Students (Venue: New Academic Block)

Valedictory Session

Valedictory Session (3:10-4:30 PM) (Venue: Seminar Hall - Auditorium Block) **Chair- Dr. Anita Chugh**	
3:10 – 3:20 PM	Welcome address & Felicitation of the Invited Speaker and Judges of the Oral/Poster presentation
3:20 – 3:40 PM	**Invited Lecture 6: Dr. Atul Agarwal,** Chief Quality Control Manager Technical Head of Quality Control Guwahati Refinery, IOCL
3:40 - 4:00 PM	Result Announcement, Prize & Certificate Distribution to winners of Oral Presentations and Digital Poster Presentations (Sponsored by American Chemical Society)
4:00 – 4:10 PM	Vote of Thanks and National Anthem
4:10 – 4:30 PM	Group Photo followed by Tea

Eminent Speakers

Dr. S. N. Naik
Emeritus Professor
Centre for Rural Development & Technology
Indian Institute of Technology, Delhi.
Hauz Khas, New Delhi-110016
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About the speaker

Dr. S. N. Naik is Master in Chemical Technology with specialization in Oils, Fats and Waxes from Laxminarayan Institute of Technology Nagpur and Ph.D. in "Supercritical Fluid Extraction of Natural Products" from IIT Delhi in 1989. During Ph.D. he has worked at University of Siegen, Germany under Volkswagen Research Fellowship in 1986. He has handled many research projects sponsored by Government of India such as Department of Science and Technology, Department of Biotechnology, Ministry of Food Processing, Ministry of Agriculture and Farmers Welfare, Ministry of Tribal Affairs, GIZ Germany, General Motors R & D Centre, Detroit USA. He has produced 59 Ph.D. thesis and published more than 250 research publications in international and national journals with more than 26000 citations and 15 patents. He has transferred patented Technology to various Industries. He has been offered visiting faculty position in University of Siegen (Germany), University of Saskatchewan (Canada) and University of Aston (U.K.) Kyoto Institute of Technology (Japan) and University of Moratuwa (Sri Lanka). He has also been awarded with Dr. H S Zaheer Memorial Award (2010), Prof J G Kane Memorial Award (2019) by Oil Technologist Association of India and Dr. D. R. Dhingra Memorial Award (1989) by Essential Oil Association of India. His research interest is Oils and Fats, Extraction of Natural Plant Products (Essential oils, Oleoresins, Food Colors, Bio pesticides, Nutraceutical and Cosmeceutical) by using Subcritical and Supercritical fluids as well as processing of non-edible oil seeds for production of Bio-fuels, Bio-lubricants and Oleo-chemicals, Value added Chemicals from Biomass.

ISBN No 978-81-986231-0-2

Upcycling of waste to multitude of applications (energy storage, adhesives, drug delivery, antibacterial) using the tenets of Green Chemistry

Prof. Bimlesh Lochab (FRSC)
Department of Chemistry, Professor & Head
Shiv Nadar Institution of Eminence
Greater Noida, India

About the speaker

Prof. Bimlesh Lochab (Department of Chemistry, Professor & Head, FRSC) did M.Sc., M.Tech. from IIT, Delhi, D. Phil. from the University of Oxford. She did PDF from University of Nottingham and University of Oxford, and was a lecturer (retained) at University of Oxford. Recipient of the DST Young Scientist Award, the first Most Creative Research Award@Luxembourg Institute of science & Technology, Research Excellence Award@ Shiv Nadar University, CRSI Bronze award, APA Young Scientist Award, BIRAC-SRISTI GYTI (Gandhian Young Technological Innovation) award, Distinguished alumna award, and amongst 75 Women in SHE IS - 75 WOMEN IN CHEMISTRY. Her outstanding achievements in the field of Sustainable Materials Science received media coverage nationally and internationally by DST, YouTube, DD News, Newspapers Indian Express, Hindustan Times etc. Her research interests are upcycling of waste to multitude of applications (energy storage, adhesives, drug delivery, antibacterial) using the tenets of Green Chemistry.

ISBN No 978-81-986231-0-2

Green Chemistry Practices in Pharmaceutical Synthesis

Dr. Mohan Prasad
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About the speaker

Dr. Mohan Prasad is presently the Chief R&D officer - API, Walter Bushnell R&D Pvt. Ltd., Sector -32, Gurugram. Before joining Walter Bushnell, he was the Senior Vice President - R&D & Global Head – API R&D and Site Head – R&D Gurugram at Sun Pharmaceutical Industries Limited, Gurugram, India, leading a team of about 400 scientists based at Gurugram, Vadodara & Israel. He previously held the positions of increasing responsibility within R&D of various Indian pharma companies. He started his career at Malti Chem Research Centre, Vadodara, followed by Lupin Laboratories Limited, Mumbai, and Ranbaxy Laboratories Limited, Gurgaon. Before joining Malti Chem, Dr. Prasad has completed his Ph.D. degree in Medical Chemistry from the Central Drug Research Institute, Lucknow in 1984. He learned his Master's degree in Organic Chemistry from Agra University, Agra, in 1979. He is a Member of the European Federation of Biotechnology and a Member of the Editorial Board of the British Journal of Pharmacy. He has published around twenty publications and has more than 350 patents to his credit. He guided 6 students in the Ph.D. program. He is a member of the Board of Research Studies
at APJ University, Gurgaon, and Guru Jambheshwar University of Science and Technology, Hisar. He has more than 42 years of research experience in the area of organic synthesis, enzymatic transformation, and Green Chemistry. He is also a member of the senior management team of the Company for the strategy & development of generic products, filing, approvals, and marketing all over
the globe.

Abstract

This presentation explores the principles and applications of green chemistry, a transformative approach to chemical design, manufacture, and use that minimizes or eliminates hazardous substances. Traditional chemical processes often generate significant waste, consume non- renewable resources, and pose risks to human health and the environment. Green chemistry offers a sustainable paradigm by focusing on twelve core principles, including atom economy, catalysis, the use of safer solvents, and the design for degradation. We will delve into key methodologies such as benign synthesis, flow chemistry, and the utilization of renewable feedstocks, illustrating how these innovations lead to reduced pollution, improved safety, and enhanced resource efficiency. Through real-world examples from pharmaceuticals, materials science, and industrial processes, this presentation will demonstrate the tangible benefits and growing imperative for integrating green chemistry into research, development, and education, fostering a more sustainable future for the chemical industry and beyond.

ISBN No 978-81-986231-0-2

Role of Green Chemistry towards the Sustainable Development Goals

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About the speaker

Prof. Ram Singh has done his schooling from Sainik School Tilaiya, Bihar. He has Bachelor & Master in Chemistry from Ramjas College, University of Delhi. He has done Ph.D. in Chemistry from Department of Chemistry, University of Delhi, under the supervision of Prof. S.M.S. Chauhan. He has an experience of teaching at both Undergraduate and Postgraduate level at University of Delhi and Delhi Technological University (DTU), where he is currently working as Professor in the Department of Applied Chemistry. Prof. Singh has published 115 research papers, authored 18 books, 25 book chapters, 31 Modules for ePG Pathshala, and contributed in more than 100 symposia and seminars. He has two patents from his work. He has supervised eight PhD students and more than 20 M Tech/M Sc students. His research interests are at the interface of chemistry, biology, biomaterials, and natural products. His group has been involved in solving challenging problems related to human health and society giving emphasis on neurodegenerative diseases like Alzheimer's and Parkinson Diseases. He is on the Editorial Advisory Board of various journals of repute and Life Member of various societies.

Abstract

Chemistry has to play an important role in the development of sustainable society and fulfil the sustainable development goals. Organic synthesis being an inseparable part of chemistry always requires modifications to achieve environmental responsibility, resource efficiency, and the minimization of waste. The synthesis of both simple and complex organic molecules is a requirement in all aspects of life. The principles of green chemistry redesign traditional synthetic methodologies leading to reduction in their ecological footprint while maintaining or improving efficiency and selectivity. Strategies like use of recyclable catalysts, biocatalysis, better atom economy, solvent-free synthesis, and the use of renewable feedstocks contribute to cleaner and safer reactions. The journey from traditional synthesis to sustainable and green synthesis is not so easy. Organic chemists are putting a lot of effort into exploring the possibilities of new methods that fulfil the current requirements of societies. Some of the sustainable synthetic efforts, their benefits to the environment shall be discussed in detail.

ISBN No 978-81-986231-0-2

Nanobiophotonics for high-precision disease diagnostics and treatment

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About the Speaker

Prof. Indrajit Roy is a Professor at the Department of Chemistry, and Director of Institute of Nano Medical Sciences, at the University of Delhi. Prof. Roy has specialized in the use of inorganic and polymeric nanoparticles for applications in targeted drug delivery, non-viral gene delivery, photodynamic therapy (PDT), and multimodal diagnostic imaging. He has published more than 130 research articles in leading scientific journals, in addition to holding three US patents.His research interests are hybrid nanomedicine platforms for triggered drug and gene delivery for the treatment of cancer, respiratory, neurological and infectious diseases.

Abstract

Nanobiophotonics involve the interaction of certain nanosized materials with light of suitable wavelength/s for addressing key biomedical challenges. Early diagnosis and proper staging of a disease holds the key for guidance towards a successful therapeutic intervention. Nanobiophotonic platforms integrating a bioimaging probe with a light-activated therapeutic approach can enable high-precision treatment of several diseases, such as cancer, neurological diseases, autoimmune disorders, etc. This lecture shall provide a snapshot of the cutting edge research and clinical practices involving nanobiophotonics, with representative examples from our and other laboratories.

ISBN No 978-81-986231-0-2

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FIE (India)
Sustainability and Governance Advisor

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Chief Sustainability Officer, Tata Power
Chief of EHS & Sustainability, Jubilant Life Sciences
Sr. Vice President - EHS, Ambuja Cement
United Nations Development Program, Jamaica (WI)
Central Pollution Control Board

About the Speaker

Dr. Yogendra Saxena holds a bachelor's degree in Biochemical Engineering from Harcourt Butler Technological Institute, Kanpur, and a Master's in Fermentation Technology from the prestigious University Department of Chemical Technology, Bombay. He has also earned his Doctorate in the field of Environment Management with more than four decades of experience in EHS and Corporate Sustainability, Dr. Saxena has led the sustainability agenda at leading Indian Corporates Tata Power, Jubilant Life Sciences, and Ambuja Cements, as well as multilateral organizations such as United Nations Development Programme and Central Pollution Control Board. A sustainability leader of international repute, Dr. Saxena has been instrumental in several key policy advocacy initiatives, leading a diverse stakeholder base, and representing businesses, governments, academia, civil society, etc. Dr. Saxena was superannuated as the Chief Sustainability Officer of Tata Power, wherein he led the organization's Sustainability, Corporate Environment, Biodiversity, and CSR functions, including its national and international subsidiaries. He also served as a Director on the Board of Power Community Development Trust (TPCDT) and as the Managing Trustee of the Mannat Foundation. Post his superannuation, Dr. Saxena is supporting and hand-holding corporates and other non-profit organizations in an advisory capacity. With much passion for volunteering, he focuses on greater awareness about the 'Swatch Bharat Abhiyaan,' primarily targeting school children on Me & My @SwaachBharat and on Why CSR & Sustainability? to various Business Schools. His professional association includes membership in various national/international bodies. Dr. Saxena served as a Stakeholder Council Member of the Global Reporting Initiative (GRI), The Netherlands, from 2003-08 and as a Member of the G4 Working Group on Governance and Remuneration in 2012-13. Dr. Saxena has also been instrumental in developing and releasing the G3, RI Sustainability Reporting Standards through his active involvement with GRI. Dr. Saxena has authored two books (Environment Explained and Eclipsed or Illumined – A Biography) and more than 175 papers in various national/international journals/seminars, and conferences. Besides many awards, Dr. Saxena was recently adjudged the "CSO of the Year" by Sustainability Outlook at the Parivartan Sustainability Trailblazer Awards 2014. In 2003, the Centre for Science & Environment (CSE) adjudged him as the "Best Environment Manager" of the nation under its Green Rating Project in association with UNDP. Recently, Dr. Saxena was bestowed with the Mahatma Award, 2020, for Leadership in Sustainability, an initiative of the Aditya Birla Group.

ISBN No 978-81-986231-0-2

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About the speaker

Technological inputs to Indian Aroma Industry

Joined Fragrance & Flavour Development Centre (FFDC), Kannauj in 1992 as Scientific Assistant and became Principal Director in 2012.

Established the fragrance & flavour division & designed more than 400 fragrances & flavours. Working on aromatherapy too and developed a number of products. More than 100 papers/presentations on essential oil, fragrance, flavour & aromatherapy, two books & one patent are to his credit. Handled a 21 of projects for different government organizations, industry associations & industries. Developed standards for Sandalwood oil, Agarbatti, Restricted & Prohibited list of fragrant raw materials as members BIS for last 25 years. Contributing to industry as member Executive Committee to Essential Oil Association of India & member managing committee to Fragrance & Flavour Association of India for last 10 years & also lead 4 international event as Chairman Technical committee

Skill Development in Fragrance & Flavour

Established training Division and designed short terms and one year diploma courses in Essential oils, Aroma Products & Fragrance, Flavour & aromatherapy since 1995 & recently launched M.Sc Fragrance & Flavour with CSJM University Kanpur. Trained more than 20000 people in last 30 years. Students are well placed in industry across the world.

International Training for Entrepreneurs in Aroma Industry

1) 19 Rwandans for 3 months at FFDC Kannauj, India in 2014
2) Imparted training to 70 Egyptians Industry via EMAP, UNIDO in 2015 at Cairo.
3) Imparted training to 10 persons from Bhutan, Sri Lanka, Bangladesh, Senegal etc.
4) Imparted training to 8 Rwandan farmers & government officials at FFDC Kannauj in 2015
5) Training cum study tour to 13 Egyptian industry FFDC Kannauj, Industry in 2015.
6) Training to 15 Srilankans for 10 days at FFDC in 2018.
7) Training to Egyptian delegates during Medicinal & Aromatic Plants Festival 2024 at Fayoum Egypt.
8) Trained 2 batches of 56 Egyptian SMEs on Essential Oil, Perfumery and Aromatherapy in 2025.
9) Trained 24 officials & Scientist of government organization of Egypt in 2025.

Awards & Achievements

1) Young Scientist award by Council of Science & Technology, Govt of Uttar Pradesh in 2001.
2) UP Ratna Award in year 2010
3) Life Time Achievement Award of Rs. 51000/- by Essential Oil Association of India, Noida in 2022.
4) Special Recognition Award by Fragrances and Flavours Association of India in 2023
5) Other awards by different associations such as Oil Technology Association of India, Association of Indian Anaesthesits, local district authorities & local Social organisations as well.

ISBN No 978-81-986231-0-2

Indian Oil Corporation Limited sustainability and a net zero future through a multi-pronged strategy focused on alternate fuels, energy efficiency, and renewable energy

Dr. Atul Agarwal
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IOCL, Quality Control Laboratory
Guwahati Refinery, Guwahati-781020, India

About the speaker

Dr. Atul Agarwal has completed his Ph.D. from Agra University, Agra, and joined Indian Oil Corporation Limited (IOCL) in 2005 as a Quality Control Officer at Gujarat Refinery, Vadodara. Over the course of his distinguished career, he has served in key roles at Paradip Refinery, Odisha, and Panipat Naphtha Cracker. He is currently serving as the Chief Quality Control Manager and Technical Head (QC) at Guwahati Refinery. With rich experience in petroleum and petrochemical quality control, Dr. Agarwal has expertise in water testing, ambient monitoring, pollution assessment, and petroleum & petrochemical testing. He has successfully established and commissioned advanced petroleum and petrochemical laboratories at Gujarat Refinery and Paradip Refinery, contributing significantly to technological upgradation and process excellence.
Dr. Agarwal is a member of IJMREAD and an accredited assessor for NABL and ISO 14001:2018. His work encompasses green energy initiatives, plastic recycling, and studies on various grades of polymers including polypropylene (PP) and polyethylene (PE). His contributions reflect a strong commitment to sustainability, environmental stewardship, and industrial innovation.

Abstract
IndianOil, a Maharatna PSU under the Ministry of Petroleum and Natural Gas, is India's foremost integrated energy conglomerate. As a leader across the entire hydrocarbon value chain, we are dedicated to delivering sustainable and affordable energy solutions that steer the nation's energy landscape. Beyond conventional operations, our commitment extends to diversification into alternative energy sources, adopting cutting-edge technologies and commitment for targeting net-zero operational emissions till 2046.
Indian Oil is actively reducing its emission intensity, scaling up non-fossil energy capacity, and enhancing carbon sinks through afforestation, modernising refineries, expanding the use of natural gas, accelerating renewable energy adoption, and improving energy efficiency to lower carbon intensity across operations, encouraging adoption of cleaner technologies, transition to cleaner fuels by promoting biofuel blending in MS, HSD & ATF, adopt to generate the green H2 technology, and natural gas accessibility, and enabling electric mobility.
Sustainability is at the core of Indian Oil's long-term vision, guiding our role as not just an energy provider, but a driver of positive change aligned with national priorities and global sustainability goals. We integrate environmental responsibility, social equity, and economic resilience across our operations to ensure inclusive, future-ready growth. Our initiatives generate wider impacts such as job creation, community upliftment, and equitable access to clean energy, thereby contributing to India's progress while supporting global sustainability priorities.

With a steadfast commitment to innovation, resilience, and inclusive growth, Indian Oil continues to strengthen its contribution to the nation and world while shaping a sustainable energy future for the nat
ion.

ISBN No 978-81-986231-0-2

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OP-2	Dr. Ashima Sharma	Dr. Renu Masiwal	Delhi Skill and Entrepreneurship University (DSEU)	Advancing Sustainability through Green Buildings and Business Practices
OP-3	Dr. Mahesh Chand	NA	USAR, Guru Gobind Singh Indraprastha University, East Delhi Campus Delhi	Aqua Mediated Synthesis: A Clean, Benign and Green Approach for the Synthesis of Novel Heterocyclic Compounds
OP-4	Dr. Mohammad S. Javed	NA	Department of Chemistry, DSB Campus Kumaun University, Nainital, India	Exploring Antioxidant and Antibacterial Potential of Chicorium intybus-mediated Silver Nanoparticles
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OP-10	Dr. Gunjan Tuteja	NA	Gargi College	Role of Education and Skill Development in Strengthening the Rural Non-Farm Economy in Haryana: A Pathway to Sustainable Development

Beyond Pesticides: Harnessing 24-Epibrassinolide for Eco-Friendly Crop Protection in Mustard

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OP-1

Abstract

The effect of 24-epibrassinolide (24-EBL) on the biotic stress tolerance of Brassica juncea L. cv. Varuna has been investigated against two fungal pathogens, Alternaria brassicae and Sclerotinia sclerotiorum, which cause Alternaria leaf spot and sclerotia stem rot, respectively. The 24-EBL at 15 µM was effective in enhancing the germination frequency, seedling biomass and maintained a higher relative water content. The 24-EBL-treated plants showed enhanced tolerance to both phytopathogens, as indicated by the number of days to disease symptom onset and disease severity. The treated plants exhibited higher tolerance to fungal infection owing to higher proline retention, an elevated K+/Na+ ratio, increased activity of antioxidant enzymes and redox pools of ascorbate and glutathione, reduced membrane damage, enhanced stomatal density, an elevated transpiration rate, higher photosynthetic efficiency, and enhanced chlorophyll content. Epifoliar application of 24-EBL increased the endogenous level of salicylic acid and decreased abscisic acid under pathogenic stress, the key regulators of the defence network in plants. This study highlights the protective potential of 24-EBL against fungal diseases of mustard, leading to higher yields in an environmentally sustainable manner.

Keywords: Brassica juncea, 24-epibrassinolide (24-EBL), Alternaria brassicae, Sclerotinia sclerotiorum, disease resistance, stress tolerance.

ISBN No 978-81-986231-0-2

Advancing Sustainability through Green Buildings and Business Practices

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OP-2

Abstract

Increasing environmental concerns have prompted a global drive towards carbon neutrality and net-zero emissions, necessitating green processes as an essential component across all sectors. Green processes are new or modified approaches that reduce the impacts on environment by minimizing resource consumption, waste generation, and pollution emission throughout a product or service's lifecycle. This is achieved through an emphasis on energy efficiency, sustainable design, use of clean energy sources, waste reduction, etc.

The buildings and construction sector accounts for an astounding 37% of the global greenhouse gas emissions, as well as responsible for nearly 30-40% energy-consumption. Therefore, working on sustainability within this sector is the key to reducing the impact on the environment, economy and society. This work highlights the emergence of green buildings and sustainable business practices as transformative approaches integrating environmental responsibility with economic efficiency, contributing to an enhanced operational performance. The approach asserts that sustainability is no longer a cost-intensive initiative, rather it should be viewed as a strategic investment. Businesses adopting green processes benefit from reduced environmental footprints, improved stakeholder trust, significantly lower operational costs, a stronger brand reputation and long-term financial gains.

This calls out for a dire need for a collaborative approach involving policymakers, academia, and industry to accelerate the transition toward greener, and resilient built environments that align with the sustainable development goals (SDGs).

Keywords: Carbon neutrality; Net-zero emissions; Sustainability; Resource Efficiency; Green Buildings; SDGs

ISBN No 978-81-986231-0-2

Aqua Mediated Synthesis: A Clean, Benign and Green Approach for the Synthesis of Novel Heterocyclic Compounds

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OP-3

Abstract

The increasing demand for sustainable and environmentally friendly chemical processes has propelled the development of green synthetic methodologies. Aqua mediated synthesis, which utilizes water as a reaction medium, represents a paradigm shift in organic and inorganic synthesis by offering a clean, benign, and ecologically responsible alternative to conventional solvent-based systems. Water, being non-toxic, non flammable, inexpensive, and abundantly available, serves as an ideal solvent that aligns with the principles of green chemistry. efficient This motivated us to center on the aspect of ‘‘On Water’’ blend of heterocycles of the development of novel bioactive heterocycles synthesis. Herein a report of highly selective and method for the synthesis of a library of hydrazones, alkyl/arylbenzimidazoles, spiro compounds (symmetrical & unsymmetrical via hitherto unknown Schiff base’s) and some bis-spiro indoles in aqueous medium under ecofriendly conditions along with the synthesized 1,2,3-triazoles on distinctive heterocyclic moieties such as quinoline, quinazolinone and indolin-2,3-dione. Comparison with respect to rate of reaction and time was also done by carrying the reaction using different solvents. The faster rate of reaction in water indicates that water plays a specific role in promoting the condensation reaction. Detailed engineered technique as well as the organic assessment of these novel compounds will be displayed and talked about at the Conference.

ISBN No 978-81-986231-0-2

Exploring Antioxidant and Antibacterial Potential of Chicorium intybus-mediated Silver Nanoparticles

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OP-4

Abstract

In this study, a methanolic extract of Chicorium intybus leaves was produced using Soxhlet extraction, and silver-magnesium oxide nanocomposites (Ag/MgO-NCs) were made utilising this extract using an ecologically sound method. Additionally, steam distillation was used to extract the essential oil from the leaves of C. intybus. Both essential oil and Ag/MgO-NCs' medicinal potential was investigated, with an emphasis on their antibacterial and antioxidant qualities. Analysis using gas chromatography-mass spectrometry (GC-MS) revealed bioactive substances in the methanolic extract. X-ray Diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), Ultraviolet-Visible Spectroscopy (UV-Vis), and Transmission Electron Microscopy (TEM) are all examples of comprehensive characterisation techniques. They showed that the Ag/MgO-NCs have a cubic crystalline structure, a crystallite size of 13.74 nm, and a spherical shape. Antimicrobial efficacy was assessed against bacterial strains, including S. aureus, P. multocida, B. subtilis, and E. coli, revealing significant inhibition zones up to 32 mm for Ag/ MgO-NCs. Antioxidant activity was evaluated using hydrogen peroxide radical scavenging assays, where Ag/MgO-NCs exhibited a potent IC50 value of 2.29 µg/mL. This multidimensional approach sheds light on the promising applications of these compounds in healthcare and pharmaceutical sciences, paving the way for further optimisation for clinical use.

Keywords: C. intybus leaves ·Ag/MgO-NCs · Essential oil · Antibacterial · Antioxidant potential

ISBN No 978-81-986231-0-2

The Little Fly, the Big Impact: Drosophila in Green Chemistry Research

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OP-5

Abstract

Designing chemical products and processes that minimize or eliminate the usage and production of hazardous materials is the goal of green chemistry principles. The fruit fly, Drosophila melanogaster, has emerged as a potent in-vivo model organism for evaluating the biological impact, environmental fate, and toxicity of novel, greener chemicals (e.g., catalysts, solvents, or degradable polymers) and the waste products they produce. The short lifespan, low maintenance costs, and conserved genetics with humans (about 75% of human illness genes have a fly ortholog) are the key reasons for the usefulness of Drosophila. It can quickly screen chemical libraries and have the risk profile and biocompatibility assessed of the chemicals created by green synthetic processes. Specifically, Drosophila models provide high-throughput toxicity screening, which makes use of basic metrics like as viability, lifespan, and fecundity to evaluate acute and chronic toxicity across different life stages. They link chemical structure to biological activity by using their transgenic lines to investigate chemical impacts on conserved biological pathways including neurotoxicity, mitochondrial function, or oxidative stress. They are utilized to evaluate the ecological safety and bioaccumulation or biotransformation potential of chemicals in organisms. Drosophila, plays a crucial role in validating the safety and success of green chemistry initiatives from the laboratory to industrial application as it offers a quick, ethical, and genetically tractable animal model system that accelerates the identification of sustainable and benign chemicals.

Keywords: Drosophila, toxicity, green chemistry, fruit fly, biological pathways

ISBN No 978-81-986231-0-2

Air Purification and Spiritual Conservation: The Role of Indoor and Navagraha Plants

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OP-6

Abstract

The environment is the foundation of our lives, and its importance cannot be overstated. Protecting nature is not someone else's responsibility; each one of us can do our bit. Air pollution is one of the major environmental threats. There is a misconception that only the outdoor air is polluted, but the indoor air could also be polluted. Indoor air pollution is fast becoming a grave environmental risk to public health. Just as trees clean our outdoor environment, foliage plants act as natural purifiers indoors by absorbing VOCs, dust, and excess carbon dioxide, and by releasing oxygen. Beyond their ecological value, they also contribute to physical and mental well-being, making them an essential part of sustainable lifestyles. In contemporary times, however, biodiversity faces immense threats from deforestation, overexploitation, industrialization, and unsustainable development. So propagation of these plants not only ensures their conservation but also empowers individuals with the skill to grow and nurture greenery. By learning and practicing simple propagation methods of common indoor plants, we can create small patches of green cover in our homes and communities. These little steps, when multiplied, can make a big difference for our environment and for future generations. This makes them a bridge between environmental conservation and healthy living indoors. Planting and revering species according to one's astrological chart is not only a means of spiritual alignment but also a vital strategy for biodiversity conservation, benefiting both individuals and the environment. Worshipping plants has served as a cultural foundation for conservation, ensuring their survival across generations.

ISBN No 978-81-986231-0-2

Synthesis and characterization of Zinc oxide (ZnO) nanoparticles using extract of Madagascar periwinkle plant and its application in degradation of toxic methylene blue dye

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OP-7

Abstract

Herein, we have synthesized ZnO nanoparticles by biosynthesis methods using 5 mL and 10 mL Madagascar periwinkle leaf extract. These biosynthesized ZnO nanoparticles (namely L5 and L10) have been characterized using various techniques. The size and morphology of synthesized nanoparticles were determined using Scanning Electron Microscopy (SEM), Field Emission Scanning Electron Microscopy (FESEM), and Transmission Electron Microscopy (TEM). The Powder X-ray diffraction (PXRD) revealed that synthesized ZnO nanoparticles consist of a typical hexagonal wurtzite phase. The BET analysis shows that the measured surface areas of L5 and L10 nanoparticles are 10.202 m^2/g and 38.762 m^2/g respectively. The photocatalytic activity of both the synthesized nanoparticles was determined against methylene blue (MB) organic dye. It was evident from the results that L10 is a better catalyst than L5. Herein, MB dye was degraded (94.09%) in 600 min by ZnO (L5) photocatalyst and (97.92%) in 360 min by ZnO (L10) photocatalyst. Therefore, synthesized ZnO (L5) and ZnO (L10) nanoparticles could be employed as an efficient photocatalyst for the degradation of toxic organic dyes.

Keywords: Biosynthesis, ZnO nanoparticles, Photocatalytic degradation, organic dye

Sustainable Environmental Remediation using Green Routes

Dr. Shubhra Barwa

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OP- 8

Abstract

The Transport sector accounts for 13 percent of the country's energy-related CO2 emissions (MoEF, 2010). The transport sector's share of country's total primary consumption will increase from 8.1% (2010) to 11.3 percent in 2030. India's petroleum product demand reached nearly 3.7 million barrels per day, (EIA, 2014). However, India's growing transport sector can become more sustainable and climate compatible. Global transport emissions can be reduced by adopting a sustainability approach, which includes measures such as increased public transport use, higher utilization of biofuels, and enhanced vehicle efficiency. Unless alternative fuels based on indigenously-produced renewable feedstock are developed to substitute or supplement petro-based fuels, India's energy security will remain vulnerable. Biofuels are emerging as the most promising alternative options to conventional fuels, as they can be produced locally, and can substitute diesel or gasoline to meet the transportation sector's energy requirements. Biofuels could have positive implications for national energy security, local air quality and GHG mitigation, employment generation and rural development. Sweet sorghum, for example, has advantages that make it a potential source of raw material for commercial ethanol production (Basavaraj et al., 2013). Second-generation biofuels are derived from agricultural residues and by-products, organic wastes, and materials from energy plantations, using a variety of woody, grassy, and waste materials as a feedstock. These new fuels offer considerable potential for promoting rural development and improving economic conditions in emerging and developing regions. Some other alternative fuel sources such as alcohol and ethanol are commonly derived from molasses, a by-product of sugar production. Sustainably produced, second-generation biofuels can potentially promote rural development and improve economic conditions in developing regions. Here we explore the status and potential of biofuels in India, identifies key challenges in achieving the country's biofuel targets, and analyses their role in India's long-term transport scenarios and aims to search for alternative biofuel feedstocks. Therefore, by promoting the use of sustainable energy technologies we aim to contribute to the development of a more sustainable global economy.

Key words: Biofuels, First and Second-generation fuels, sustainability, economic returns, environment remediation

ISBN No 978-81-986231-0-2

PMI-based positive selection system for genetic transformation of bread wheat, T. aestivum

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OP-9

Abstract
Plant genetic transformation technologies have played a crucial role in significant improvement of target traits with respect to various biotic and abiotic aspects as well as nutrition. To develop an effective and dependable transformation approach, selectable marker genes (SMG's) are extremely useful in indicating the success of transformed cells. However, these transformation systems have always employed the use of antibiotics or herbicide gene as selectable agents to allow growth of transformed cells by killing other cells. The use of these selectable markers has been criticized for their biosafety concerns and their negative impact on humans as well as the environment. Unlike negative selection, positive selection-based approach is environmentally safe as well as user-friendly and has potential to drive a sustainable and greener future for obtaining transgenic crops.
Present study has shown that E. coli PMI gene can be used for positive selection-based genetic transformation of bread wheat, T. aestivum. It is expressed in wheat cells, conferring them an ability to utilize mannose as the carbohydrate source. In future, work would be done to improve efficiency of positive selection system, without using undesirable antibiotics/herbicides /marker genes.

Role of Education and Skill Development in Strengthening the Rural Non-Farm Economy in Haryana: A Pathway to Sustainable Development

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OP-10

Abstract
The rural non-farm economy (RNFE) in Haryana has become increasingly significant as agriculture alone is no longer sufficient to provide secure livelihoods due to shrinking landholdings, rising mechanization, and unstable farm revenues. This study explores how education and skill development contribute to strengthening the RNFE by enhancing human capital, expanding occupational choices, and promoting sustainable rural growth. The main objectives of the study are: (1) to examine the existing educational and skill profile of the rural workforce in Haryana, (2) to evaluate the impact of formal education and vocational training on access to non-farm employment, and (3) to identify constraints and suggest measures to improve the effectiveness of education and skill development initiatives in the state.
The methodology adopted is descriptive and analytical, relying primarily on secondary information drawn from official reports, Haryana economic surveys, NSSO datasets, policy documents, and academic studies. Additionally, state-level initiatives such as the Haryana Skill Development Mission and the State Skill University have been reviewed to understand implementation experiences.
The findings suggest that improved educational attainment and relevant skill training significantly enhance job prospects in non-farm sectors including agro-processing, micro-enterprises, trade, services, transportation, rural tourism, and digital livelihood platforms. However, challenges persist in the form of uneven training infrastructure, limited outreach to remote areas, skill-job mismatches, gender-based barriers, and inadequate industry linkages.
The study concludes that a stronger focus on education and skill development is vital for promoting inclusive growth, reducing rural distress, and achieving sustainable development in Haryana.
Keywords: Rural Non-Farm Economy, Education, Skill Development, Employment Diversification, Sustainable Development, Haryana.

ISBN No 978-81-986231-0-2

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(Category- Research Scholars)

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OP-12	Aarshiya Kwatra	NA	IGDTUW	Green synthesis of metal oxides and application as potent anticancer and antibacterial agent
OP-13	Anshu Kumari	Dr. Dimple Kumari	Patliputra university	Green Synthesis of Silver Nanoparticles using Fruits and Vegetables Peel Extracts for antimicrobial studies
OP-14	Aysha Siddiqui	Geeta Tewari, Chitra Pande, Girish kharkwal, Shreya Jukaria	D.S.B.Campus Nainital	Comparative Analysis of Fresh and Dried Pre-Flowering Stages of Hyptis suaveolens (L.) Poit. Essential Oil from Pithoragarh Region, Uttarakhand, India
OP-15	Deepika Thakur	Deepika Thakur, Shivam A. Meena, Manvi Sharma and Akhilesh K. Verma*	University of Delhi	Gold/Silver-Catalyzed Synthesis of Functionalized Indoles from N-Allyl-2-Alkynylanilines and Diazo Compounds via 1, 3-Allyl Migration
OP-16	Khushbu Wadhwa	Dr. Neha Kapoor and Prof. Hardeep Kaur	Ramjas College, University of Delhi, Delhi.	Antifungal and antibiofilm effect of green synthesized silver nanoparticles from leaf extract of Selaginella bryopteris against Candida spp.
OP-17	Manisha Joshi	Geeta Tewari, Chitra Pande, Girish C. Kharkwal	DSB Campus, Kumaun Univeristy, Nainital	Evaluation of Essential Oil Profile and Antioxidant Potential of Thymus linearis Benth. along with Computational Insights
OP- 18	Priya Jha	Dr.Gurjeet Kaur	Department of Ecology and Environmental Science, School of Life Sciences, Pondicherry University	The Pollution Stress: Biochemical Parameters And Enzymatic Activity Alterations
OP-19	Sonal Nigam	Mamtesh Singh, Gajendra Pratap Singh	Gargi college, University of Delhi ,School of Computational and Integrative Sciences Jawaharlal Nehru University,	Assessment of the potential of Scenedesmus as microalgal feedstock for biopolymer production
OP-20	Yogita	NA	University of Delhi	A Coumarin-appended pyridine dicarbohydrazide-based chemosensor for highly sensitive and selective colorimetric recognition of Ni+2 ions

Qualitative and Quantitative Variation in The Chemical Composition of The Rhizome Essential Oil of Hedychium Spicatum

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OP-11

Abstract

Hedychium spicatum is a traditional Indian medicinal and a perennial rhizomatous herb from the Zingiberaceae family, also known as Kapoor Kachri, Van-Haldi and Ginger lily. This herb has been utilised in several conventional treatments for conditions like bronchitis, indigestion, eye illness, inflammation, and diarrhoea. This study investigates the qualitative and quantitative changes in the chemical composition of H. spicatum rhizomes from two places in Uttarakhand, India. The Nainital collection had the major constituents 1,8-cineole, elemol, 10-epi-γ-eudesmol, α-eudesmol and the Ramgarh collection had constituents 1,8-cineole, elemol, germacrene-4-ol, α-muurolol and α-cadinol. The study also assessed the antioxidant potential via DPPH, Metal chelating and H_2O_2 methods, which concluded that the Ramgarh collection had higher antioxidant potential than the Nainital.

Keywords: Essential oil, Hedychium spicatum, rhizomes, antioxidant activity, Uttarakhand.

ISBN No 978-81-986231-0-2

Green synthesis of metal oxides and application as potent anticancer and antibacterial agent

Aarshiya Kwatra
IGDTUW

OP-12

Abstract

This article provides an effectual, naturally amiable and jejune approach to synthesize green ZnO nanoparticles from zinc powder. The Tamarindus indica (tamarind) pulp extract was used as natural reductant in synthesis of ZnO NPs from zinc powder. UV–Visible spectroscopy and X-ray diffraction were utilized to measure absorption maxima and to calculate crystallite size respectively of synthesized NPs. XRD of green synthesized ZnO NPs heated at 500 °C, 600 °C and 700 °C revealed crystallite sizes of 4.89 nm, 23.3 nm, and 27.32 nm respectively. X-ray photoelectron spectroscopy (XPS) was applied to confirm the chemical composition. FE-SEM studies revealed that ZnO nanoparticles annealed at 700 °C displayed homogeneous nanoflakes morphology. Elemental composition for synthesized ZnO nanoparticles was confirmed using EDX. The synthesized nanoparticles were scrutinized for their antibacterial activity against Klebsiella pneumoniae MTCC 3384 strain using agar-well diffusion method with inhibition zone to be 20.5 ± 0.46 mm at a concentration of 15 mg/mL. SW480 cancer cell line was used to analyse the anticancer activity of synthesised ZnO NPs and the IC_{50} value was found to be 62.559 µg/mL. ZnO nanoparticles possess good antibacterial and anti-cancer activity due to ROS mechanism. DPBF (1,3- diphenylisobenzofuran) assay confirmed that ZnO NPs generates singlet oxygen was the agent behind destroying cancer cells.

ISBN No 978-81-986231-0-2

Green Synthesis of Silver Nanoparticles using Fruits and Vegetables Peel Extracts for antimicrobial studies

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OP-13

Abstract

This study demonstrates green synthesis for silver nanoparticles (AgNPs) using fruit and vegetable peel extracts as natural reducing and stabilizing agents. Peels from pomegranate, banana, orange, sponge gourd, cucumber, carrot, radish, pear, onion, papaya, water chestnut, kiwi, bottle gourd, apple, and potato generate bioactive-rich aqueous extracts, facilitating the reduction of silver nitrate to form AgNPs. UV, FTIR, XRD, SEM and TEM confirm successful nanoparticle synthesis and reveal controlled size and shape. The AgNPs exhibit promising antimicrobials properties, highlighting their potential in biomedicine, Synthesis parameters including extract concentration, temperature, and reaction time are optimized to produce stable particles. The research affirms that fruit and vegetable peels are effective, low-cost resources for producing AgNPs, advancing green nanotechnology and offering diverse prospects for antibacterial and anticancer applications.

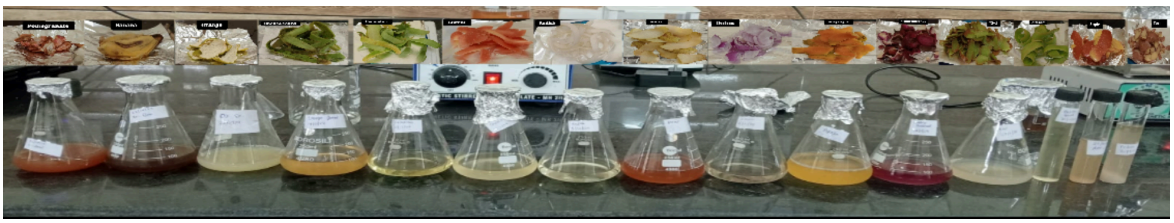

Fig:- Different Peel Extract

Keywords: Silver nanoparticles, green synthesis, fruit peels, vegetable peels, anti-bacterial properties, anti-cancerous properties.

ISBN No 978-81-986231-0-2

Geographic Influence on the Phytochemical Composition of Hyptis suaveolens Aerial Parts

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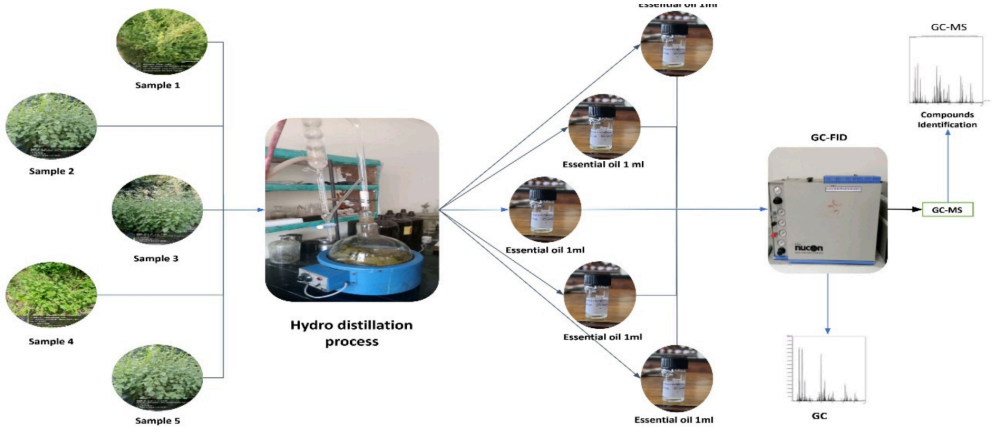
OP-14

Abstract

Hyptis suaveolens (L.) Poit., a plant of great importance due to its use in traditional medicine and essential oil, was collected from its flowering parts in five different places in India – Haldwani (Uttrakhand), Pithoragarh (Uttrakhand), Rishikesh (Uttarakhand), Bisalpur (Uttar Pradesh), and Mohania (Bihar), during the flowering season due to its antimicrobial, anti inflammatory and analgesic uses. The essential oil was extracted using hydro-distillation, and its constituents were analyzed using Gas Chromatography (GC) and Gas Chromatography Mass Spectrometry (GC-MS). The key compounds identified include Sabinene, (E)-Caryophyllene, Bicyclogermacrene, 1,8-Cineole, and Terpinolene, all of which have drastic variations in percentage across the sampled locations. This is due to the differences in geographic and environmental factors such as altitude, longitude, humidity, rainfall, and sunlight or shade. No comprehensive study on the chemodiversity of H. suaveolens has been reported up to this date, which illustrates the importance of this research on understanding the influence of climate on its phytochemistry and geographical aspects for the development of the pharmaceutical, cosmetic, pest control, and agro-industrial products.

Keywords: Hyptis suaveolens, phytochemical, secondary metabolites, hydro-distillation, GC, GC-MS.



ISBN No 978-81-986231-0-2

Gold/Silver-Catalyzed Synthesis of Functionalized Indoles from N-Allyl-2-Alkynylanilines and Diazo Compounds via 1, 3-Allyl Migration

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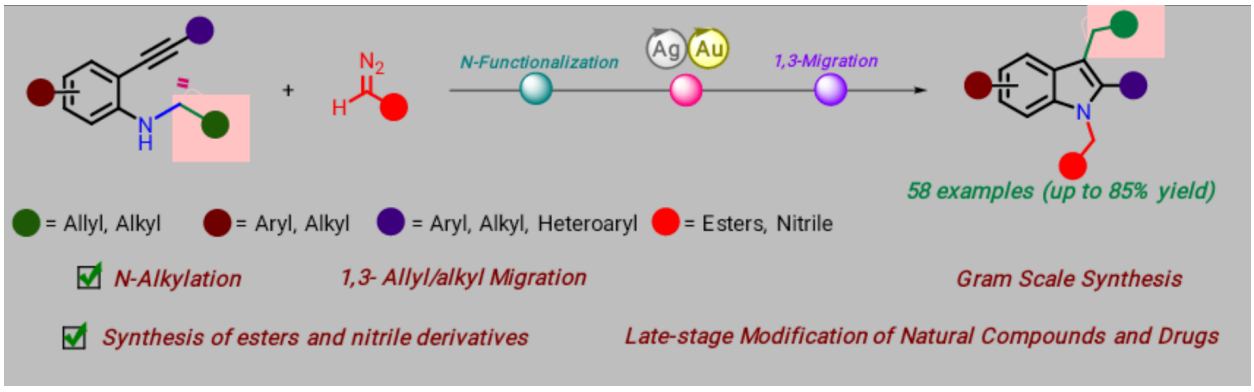
Department of Chemistry
University of Delhi

OP-15

Abstract

Gold-catalyzed synthesis of decorated indoles has been developed through carbene insertion into N-H bonds of N-allyl-2-(aryl/alkyl ethynyl)anilines using α-diazo compounds followed by cyclization and concomitant 1,3 migration of allyl fragments. The developed protocol tackles the inherited challenge of direct C3 functionalization and eliminates the need for a tertiary aniline precursor for the 1,3-migration reaction. The applicability of this transformation is showcased through the practical synthesis of analogs of small drug-like and pharmaceutically relevant molecules such as ibuprofen, estradiol, menthol, and borneol, etc. The mechanism is well supported by control experiments and isolation of the reaction intermediate.
Keywords: N-Allyl-2-Alkynylanilines, Indole, [1,3]-Migration.



ISBN No 978-81-986231-0-2

Antifungal and antibiofilm effect of green synthesized silver nanoparticles from leaf extract of Selaginella bryopteris against Candida spp.

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OP-16

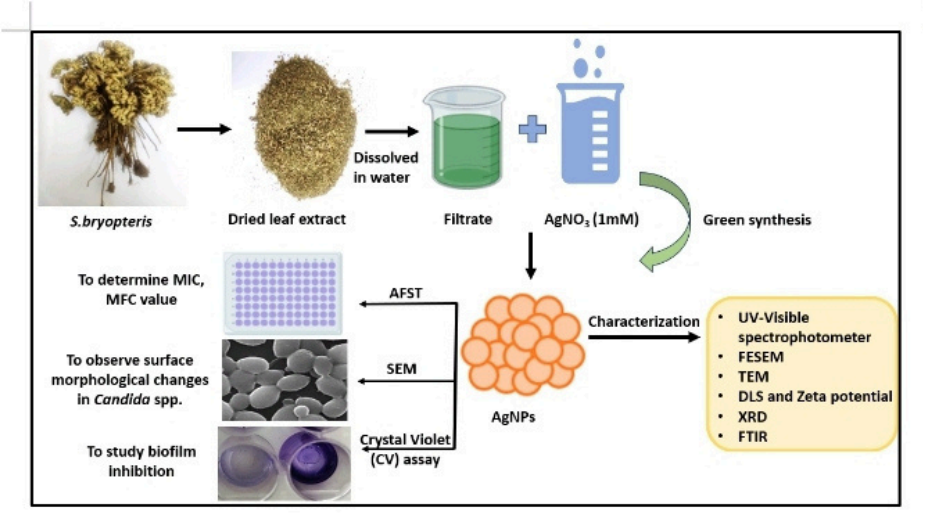
Abstract

Objectives
There is an urgent need to develop novel and potent antifungal drugs to encounter invasive fungal infections.

Methodology
The optimization of parameters involved in the green synthesis of AgNPs includes pH, temperature, concentration of silver nitrate, reaction time. The physicochemical properties of AgNPs were further analysed by UV-visible spectrophotometer, FESEM, TEM, DLS, zeta potential, FTIR and XRD studies.

Results
The MIC and MFC value of AgNPs were found to be 0.003 and 0.006 ng/mL against Candida spp. The AgNPs caused damage to the morphology of Candida, affected cell membrane, cell wall and ergosterol biosynthetic pathway. AgNPs also inhibited biofilm formation in Candida spp. as confirmed by crystal violet assay and SEM analysis.

Keywords: Green-synthesis, silver nanoparticles, Candida, biofilm.



ISBN No 978-81-986231-0-2

Evaluation of Essential Oil Profile and Antioxidant Potential of Thymus linearis Benth. along with Computational Insights

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OP-17

Abstract

The essential oil of Thymus linearis, a Himalayan aromatic herb, was extracted from three distinct locations of Uttarakhand (Ranikhet, Almora, Lohaghat) to evaluate its chemical composition and antioxidant potential. The constituents of the oils were identified using GC and GC-MS. Antioxidant activity was determined through DPPH, ABTS, and metal-chelating assays. To support the experimental findings, molecular docking of the major constituents was performed against oxidative stress-related target protein. Significant variation in metabolite profiles among the oils was observed. Thymol was the dominant constituent, ranging from 61.95% to 73.05%, with the highest proportion in Ranikhet. Other major compounds included γ-terpinene, p-cymene, and β-(E)-caryophyllene in varying amounts. Oxygenated monoterpenes were the most abundant class across all samples. Ranikhet oil exhibited the highest radical-scavenging capacity, correlating with its high thymol content. Docking revealed strong binding affinities, particularly for thymol, supporting its role as the major antioxidant agent. Overall, the findings demonstrate that T. linearis essential oil possesses significant antioxidant activity driven by oxygenated monoterpenes, and that compositional variation among regions influences its bioefficacy. The study highlights the potential of T. linearis essential oil as a natural source of bioactive compounds for developing phytopharmaceutical, nutraceutical, and antioxidant formulations.

Keywords: Thymus linearis, GCMS, antioxidant activity, thymol, oxygenated monoterpenes, molecular dockingTop of FormBottom of Form

ISBN No 978-81-986231-0-2

THE POLLUTION STRESS: BIOCHEMICAL PARAMETERS AND ENZYMATIC ACTIVITY ALTERATIONS

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OP-18

Abstract

Objectives
The study aims to determine the Air Pollution Tolerance Index (APTI) and the activities of two antioxidant enzymes: superoxide dismutase and catalase and to examine their correlation in assessing the tolerance of common urban plant species in the Pondicherry region.

Methodology
Air quality parameters including $PM_{2.5}$, PM_{10}, particulate matter, CO_2, HCHO, temperature, and humidity were measured weekly during summer at 12 sites using a Temtop portable instrument, and mean values were used for quantification (Farid et al., 2023). Seven common urban plant species occurring across all sites along a pollution gradient were selected. The Air Pollution Tolerance Index (APTI) was calculated using physiological and biochemical parameters: leaf relative water content, ascorbic acid content, total chlorophyll, and leaf extract pH, following the formula of Singh and Rao,1983 (Singh et al., 1989). Antioxidant enzyme activities (SOD and catalase) were analysed spectrophotometrically using the methods of Beauchamp and Fridovich, 1971 and standard CAT protocols, respectively (Zhang et al., 2020; Ghorbanli et al., 2007). Data were statistically analysed using Pearson correlation tests.

Result
Results from summer season showed that APTI varied across species and locations. Industrial sites exhibited higher APTI values than residential areas, indicating moderate pollution tolerance. In heavy vehicular zones, Prunus and Tectona showed elevated APTI values, while other species displayed slight declines, suggesting greater air stress due to pollutants. Correlation patterns between APTI and antioxidant enzyme activities were species-specific. Tectona grandis showed positive correlations of APTI with both catalase and SOD activity, Azadirachta indica and Nerium oleander correlated positively with catalase, and Delonix regia with SOD. Conversely, Ficus religiosa, Prunus dulcis, and Polyalthia longifolia showed negative correlations with both enzymes. These results indicate that enzymatic responses to air pollution are species-specific and not always consistent with APTI. While APTI represents overall pollution tolerance, enzyme activity reflects oxidative stress response. Species showing negative correlations may rely on non-enzymatic defences like waxy leaves, stomatal regulation, or antioxidants such as ascorbate and phenolics.

Keywords: Air Pollution, Air Pollution Tolerance Index (APTI), SOD, Catalase, antioxidant activity

ISBN No 978-81-986231-0-2

Assessment of the potential of Scenedesmus as microalgal feedstock for biopolymer production

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OP-19

Abstract

Polyhydroxyalkanoates (PHAs) offer a next-generation sustainable solution that surpersedes plastics due to their 100% biodegradability, recyclability, and mechanical properties that are similar to those of petroleum-derived plastics. However, there has not been much progress in the large-scale commercial application of PHAs due to their uneconomical production. Recently, microalgae have stood out as a sustainable option for biopolymer production due to their minimal nutrient requirements and resilience across diverse environments. Nevertheless, challenges associated with intracellular PHA production by microalgae have necessitated looking for alternative options. Adopting a “two-module system” that leverages the strengths of microalgae (photoautotrophic) and bacteria (heterotrophic) may prove to be an ideal strategy. Among different microalgae, Scenedesmus, an oleaginous green microalga, has garnered great attention for PHA production, as it surpasses other microalgae in terms of high growth rate, ability to adapt to diverse environments, and accumulation of large quantities of polymer precursors, such as lipids and carbohydrates. This study aims to propound Scenedesmus as a potential photoautotrophic component in a two-module system, its advantages over others, and discuss optimal culture conditions and strategies for enhancing PHA production through environmental and genetic interventions.

Keywords: Bioplastics, Biopolymer, Polyhydroxyalkanoates (PHA), Scenedesmus sp., Two-module system

ISBN No 978-81-986231-0-2

A Coumarin-appended pyridine dicarbohydrazide-based chemosensor for highly sensitive and selective colorimetric recognition of Ni2+ ions

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OP-20

Abstract

A novel coumarin-appended pyridine dicarbohydrazide-based colorimetric chemosensor (H1) has been designed and synthesized for the highly sensitive and selective detection of Ni^{2+} ions. The sensor exhibits a distinct 'naked-eye' color change upon complexation with Ni^{2+}, with an ultrafast response time of 1 s. The binding interactions between H1 and Ni^{2+} were systematically investigated through UV–Vis spectroscopy, ^1H NMR titration, and theoretical (DFT and TDDFT) studies, revealing a 1:1 binding stoichiometry and coordination through the carbohydrazide moiety. The binding constant was calculated as $0.94 \times 10^4\ M^{-1}$, and the limit of detection (LOD) was determined to be 97 nM, confirming the high sensitivity of the probe. Selectivity experiments demonstrated negligible interference from other competing metal ions. The practical applicability of H1 was validated using paper strips and silica gel-based solid supports, enabling rapid and visible Ni^{2+} detection under a broad pH range. Moreover, reversibility studies using EDTA indicated the regenerative potential of the sensor. The successful detection of Ni^{2+} in real samples such as fruit juice and blood further highlights the robustness and analytical potential of H1 for environmental and biological monitoring.

ISBN No 978-81-986231-0-2

Digital Poster Presentations

List of Digital Poster Presentations

(Category- Faculty, Industry Professional & Researchers)

SNo	Author	Co-Author	Affiliation	Title of Poster Presentation
DP- 1	Anchal Aneja	N.D.Kandpal, Mahesh Chandra Arya	Department of Chemistry,D.S.B Campus, kumaun University, Nainital	Synthesis and characterization of metallic soap nanoparticles
DP-2	Anita Kumari	Prof.rakesh Kumar	Bioorganic Laboratory, University of Delhi	Rhodamine-based turn-on dual-mode chemosensors for the selective recognition of Ni2+, Cu2+, and Zn2+ ions and their practical and theoretical application
DP-3	Bhawana Pant	Deep Prakash, Priyanka Sagar	D.S.B Campus, Kumaun University, Nanital	Catalytic Carbonylation Of organic substrate by using Palladium Schiff base Metal complexes as Catalyst
DP-4	Bindu Anand	Dr.Rajeev Kharb	Jagran Public School,sector-47, Noida	Update on Microwave Assisted Synthesis of Imidazole Derivatives: A Sustainable Green Chemistry Approach
DP-5	Deepti shukla	Dr.Jaya Tuteja	Galgotias University	Transition Metal-Based Heterogeneous Catalysts as Emerging Tools for Sustainable Organic Transformations
DP-6	Dr. Priyanka Pandey	Manasvani Singh, Riya, Shreya Singh, Tanvi	Gargi college	Silver nanoparticles from Tabasheer
DP-7	Dr.Rekha Tank	Bhaskar Pramanik, Yogesh Kumar , Vivek Singhal	Mathura Refinery, Indian Oil, Mathura (Up)	IOCL’s pioneering Efforts to De-carbonization through SAF value chain
DP-8	Dr.Deepshikha Joshi	Anand B. Malkani, Lalit Mohan, Manoj K. Nailwal , Rajendra Prasad	D.S.B Campus, Kumaun University, Nainital	Essential oil composition of ligularia amplexicaulis (wall.) Dc. Aerial parts from two different regions of uttarakhand, India and its antifungal activity- a comparative study

List of Digital Poster Presentations

(Category- Faculty, Industry Professional & Researchers)

SNo	Author	Co-Author	Affiliation	Title of Poster Presentation
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DP-10	Neeraj Kumari	Dr. Manish Rawat	Galgotias University	Development of a Cu-Mg Catalyst for Sustainable Dye Degradation and Aniline Acetylation
DP-11	Rahul Kataria	Abhijeet Singh, Mahendra Nath	University of Delhi	Poster Presentation on Porphyrins
DP-12	Anupama Sharma	Ritika,Neha, Rahul Sahu, Kajal, Saurav Kumar	CSIR- Central Scientific Instruments Organisation ,AcSIR - Academy of Scientific And Innovative Research	Glycerol–Choline Chloride Natural Deep Eutectic Solvent: A Green Alternative for Caffeine Extraction
DP-13	Sonia Ratnani	Savita Bargujar	Ramjas College	A Green Approach to Dibenzalacetone Synthesis
DP-14	Savita Bargujar	Sonia Ratnani	Ramjas College	Applying Reuse and Reduce in an Undergraduate Organic Laboratory: Sustainable Practices

Synthesis and characterization of metallic soap nanoparticles

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DP-1

Abstract

Nanosized particles exhibit specific physical and chemical properties that enable the creation of new composite materials, which are crucial for various applications in biology and medicine, such as infection control. Metal nanoparticles, mainly copper, exhibit many pharmaceutical and biological properties. In this research work, copper-olive oil soap nanoparticles were prepared using copper sulphate pentahydrate as a precursor, along with an olive oil and clove oil mixture in a fixed ratio. The double decomposition method was used for the preparation of copper-olive oil soap nanoparticles. In this method of the double decomposition process, two reactions are involved. The first reaction is between the alkali and fatty acid constituents of oil and the second reaction is between the potassium soap prepared in the first step and copper sulphate pentahydrate to form the copper-olive oil soap nanoparticles. The soap nanoparticles were characterized using EDX, powder X-ray diffraction, Fourier transform-infrared spectroscopy, UV-vis spectroscopy, transmission electron microscopy, scanning electron microscopy and BET.

Keywords: Nanoparticles; Soap; Copper sulphate pentahydrate; FTIR; BET

ISBN No 978-81-986231-0-2

Rhodamine-based turn-on dual-mode chemosensors for the selective recognition of Ni2+, Cu2+, and Zn2+ ions and their practical and theoretical application

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DP-2

Abstract

This study presents a rhodamine-based colorimetric and turn-on fluorescent chemosensor (AV2) for the selective detection of Ni^{2+}, Cu^{2+}, and Zn^{2+} ions. Sensor AV2 showed distinct colorimetric and fluorescence responses with high sensitivity and selectivity, indicating a 1:1 binding stoichiometry confirmed by Job's plot and Benesi–Hildebrand analysis. The binding constant and detection limit were measured as 0.63×10^4 M^{-1}, 0.69×10^4 M^{-1}, and 0.67×10^4 M^{-1} and 2.82 μM, 2.97 μM, and 2.67 μM, respectively. Interference studies demonstrated minimal effects from other metal ions. The crystal structure analysis of AV2 confirmed its molecular geometry and structural stability. Practical application was shown using paper strips and silica gel systems, which remained stable across a wide pH range. A molecular INHIBIT logic gate and a "write–read–erase–read" binary memory function were also achieved using Ni^{2+}, Cu^{2+}, and Zn^{2+} and EDTA inputs. DFT studies supported the binding mechanism, while analysis of real samples confirmed effective detection of Ni^{2+}, Cu^{2+}, and Zn^{2+} in juice samples. These findings highlight a promising, reversible, and versatile sensor for environmental and analytical applications.

ISBN No 978-81-986231-0-2

Catalytic Carbonylation of Organic Substrate by using Palladium Schiff base Metal Complexes as Catalyst

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DP-3

Abstract

A series of Schiff base ligands, N-[(E)-phenylmethylidene]aniline (LA), 2-(phenylimino)methylphenol (LB), (E)-4-((4-chlorobenzylidene)amino)phenol (LC), and (E)-4-(benzylideneamino)phenol (LD), were synthesized and employed in the preparation of binuclear palladium(II) complexes: $[Pd_2(LA)_2Cl_2]$ (1A), $[Pd_2(LB)_2Cl_2]$ (1B), $[Pd_2(LC)_2Cl_2]$ (1C), and $[Pd_2(LD)_2\ Cl_2]$ (1D). These complexes were evaluated as catalysts for the carbonylation of organic substrate. The catalytic efficiency of the complexes followed the trend: 1C > 1D > 1B > 1A. The characterization was done using IR, NMR and GC-MS.

Keywords: Schiff base ligand, Palladium Schiff base metal complex, Catalytic carbonylation

ISBN No 978-81-986231-0-2

Update on Microwave Assisted Synthesis of Imidazole Derivatives: A Sustainable Green Chemistry Approach

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DP-4

Abstract

Green Chemistry is a sustainable form of chemistry focusing on prevention of environmental pollution by avoiding use and generation of hazardous chemical substances. The ultimate objective of green chemistry is to design the synthesis of compounds by utilizing novel methods of synthesis like microwave assisted synthesis involving use of environment friendly safer solvents or even solvent free methods. Conventional methods of synthesis are having various limitations like long heating hours, use of hazardous chemicals and low yield of products. Therefore, there is an urgent need to replace conventional methods of synthesis with green synthesis especially microwave assisted synthesis as it can minimize or eliminate the usage of hazardous chemicals. Microwave assisted synthesis offers multiple advantages over conventional synthesis methods like it accelerates the rate of reaction, gives higher chemical yield, and has great potential for significant energy savings. Imidazole is a five-membered heterocyclic ring structure in which there are three carbons and two nitrogen atoms which are arranged at position numbers 1 and 3 respectively. It is present in the chemical structure of large number of drugs available in clinical practice for example antifungal drugs like clotrimazole, miconazole, ketoconazole etc. It is also constituent of several biomolecules such as histamine, histidine, biotin, alkaloids and nucleic acids. Looking into these scientific facts, it was considered significant to report the recent updates on microwave assisted synthesis of imidazole derivatives. The valuable information compiled in this communication may be found suitable for implementation of environment friendly methods of synthesis through sustainable green chemistry approach which is the need of the hour globally.

Keywords: Green chemistry, microwave assisted synthesis, environment friendly, imidazole, solvent free, hazardous chemicals

ISBN No 978-81-986231-0-2

Transition Metal-Based Heterogeneous Catalysts as Emerging Tools for Sustainable Organic Transformations.

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DP-5

Abstract
Transition metal-based heterogeneous catalysts are now flexible and long-lasting tools for current organic transformations because they are very selective, active, and recyclable. These catalysts are very important for organic transformations, energy conversion, making medicines, and cleaning up the environment. Layered Double Hydroxides (LDHs) have recently garnered interest as versatile substrates for transition-metal nanoparticles (NPs). Incorporation of metal nanoparticles into layered double hydroxides (LDHs) matrices enhances their dispersion, stability, and catalytic activity. Because they have a lamellar structure, may have their metal composition changed, have a large surface area, and are naturally basic, LDHs are good substrates for stabilizing nanoparticles that are active in catalysis. The eco-friendly creation of LDH-supported metal nanoparticles presents a feasible method for generating effective and sustainable catalysts. This study aims to examine the structural, morphological, and electronic characteristics of transition-metal nanoparticles supported on layered double hydroxides (LDHs), develop environmentally sustainable synthesis methods, and assess their catalytic efficacy in essential organic transformations, including oxidation, hydrogenation, cross-coupling, and asymmetric catalysis. The catalysts will be made using methods that are good for the environment, and then they will be tested using advanced analytical tools like FTIR, XRD, SEM, TEM, EDX, UV-Vis, NMR, and XPS. Initial research suggests that LDHs improve the stability and spread of metal nanoparticles, which leads to better catalytic activity. The green synthesis of metal nanoparticles on LDHs represents next-generation approaches for designing highly efficient and eco-friendly catalysts. This study highlights the potential of LDH-supported transition-metal heterogeneous catalysts in advancing sustainable catalysis and provides insights into addressing current challenges and investigating future opportunities in environmentally friendly organic synthesis.

Keywords
Transition Metal-Based Heterogeneous Catalysts, Sustainable Organic Transformations, Layered Double Hydroxides (LDHs, Green Synthesis, Metal Nanoparticles

Silver nanoparticles from Tabasheer

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DP-6

Abstract

Biological entities including plants have an ability to reduce metal precursors. Green synthesis is a bottom up approach involving chemical reduction reaction for replacement of reducing agent (reductant, an expensive chemical) with an extract of a natural product such as leaves or fruits. The end product is the metal or metal oxide nanoparticle. Evergreen plants like bamboos have been used for production of silver and silicon nanoparticles. Tabasheer or Bans lochan, a pharmaceutical compound with extensive medicinal uses has been used in the present report to prepare silver nanoparticles. Pulverized tabasheer (10g) was mixed with 100 ml of distilled water. The mixture was heated at 60° C for 20 minutes and allowed to cool at room temperature. The mixture was filtered through Whatman filter paper 42 and centrifuged for 20 minutes at 81g. The extract was stored in refrigerator and used for preparation of silver nanoparticles using silver nitrate precursor solution. Serial dilutions of 1.0 mM to 5.0 mM precursor solutions were made from the stock solution of 10 mM silver nitrate solution. Precursor solutions of silver nitrate were mixed with tabasheer solution in a ratio of 1:1 (v/v) to make final volume of 50 ml in a conical flask. It was wrapped with the aluminium foil and heated in a water bath at 60 ° C for 5 hours. The solutions were cooled to room temperature and observed for colour changes and readings were taken for absorbance using UV-vis spectrophotometer from 200 to 700 nm after 24 hours of incubation at room temperature. The development of colour in the incubation mixture to reddish brown was observed as an indicator of formation of silver nanoparticles. Spectrophotometric analysis of the silver nanoparticles in solution showed maximum absorbance at 420 nm with 9 mM and 10 mM concentrations of precursor solutions. The results show probable formation of silver nanoparticles in tabasheer solution and open up new frontiers for their characterization and analysis.

ISBN No 978-81-986231-0-2

IOCL's pioneering Efforts to De-carbonization through SAF value chain

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DP-7

Abstract
The aviation industry is among the most dynamic engines of global growth, but it is also one of the hardest sectors to decarbonise. Air travel currently contributes about 2–3% of global CO2 emissions, and with passenger numbers projected to double by 2040, this share is expected to rise sharply without immediate interventions. The industry's international commitment to achieve Net-Zero carbon emissions by 2050, as outlined by the International Air Transport Association (IATA) and supported by the International Civil Aviation Organization (ICAO), places a spotlight on sustainable energy solutions. Among the available options, Sustainable Aviation Fuel (SAF) has emerged as the most viable and scalable pathway. SAF is a drop-in fuel, fully compatible with existing aircraft engines and fuel infrastructure that can reduce lifecycle greenhouse gas emissions by up to 80% compared to conventional jet fuel. Unlike long-term technologies such as hydrogen propulsion or electric aviation, SAF offers an immediate solution that can be deployed within the existing aviation ecosystem. As per IATA estimation SAF could contribute around 65% of the reduction in emissions needed by aviation to reach Net-Zero CO2 emissions by 2050. As India's leading energy company, Indian Oil is pioneering efforts to establish the SAF value chain. IOCL's Panipat Refinery has become the first Indian Refinery to receive ISCC CORSIA certification for SAF production. This certification ensures that Indian Oil's SAF meets globally accepted sustainability and emissions reduction criteria, enabling its use in both domestic and international flights. IOCL's pioneering efforts to de-carbonization through SAF value chain are deliberated in this study.

ISBN No 978-81-986231-0-2

ESSENTIAL OIL COMPOSITION OF LIGULARIA AMPLEXICAULIS (WALL.) DC. AERIAL PARTS FROM TWO DIFFERENT REGIONSOF UTTARAKHAND, INDIA ANDITS ANTIFUNGAL ACTIVITY- A COMPARATIVE STUDY

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DP-8

Abstract
The genus Ligularia (Asteraceae) is represented by three species in Kumaon and Garhwal regions of Uttarakhand. Various species of the Ligularia have long been used as folk remedies for their medicinal value. The essential oils of the airal parts from L.amplexicaulis growing wild in Chopta (Rudraprayag, Garhwal) and Munsiyari (Pithoragarh, Kumaon) were isolated by steam distillation and analysed by capillary GC and GC/MS. The chemical composition of the oils from both places were similar according to qualitative and quantitative analysis. There were 36 compounds in the volatiles from L.amplexicaulis(Chopta), comprising 93.7% of the total oil, with Limonene (32.5%), p-cymen-8-ol (15.0%), α-pinene (9.5%) and o-cymene(6.5%) as the main constituents whereas 28 constituents were identified from L.amplexicaulis (Munsiyari), representing 97.0% of the total oil, with o-cymene(35.0%), Limonene(21.0%), α-pinene(8.0%), p-cymen-8-ol(7.0%), and Terpinolene(5.5%) as the major constituents.
The fungicidal activity of both the oil samples was tested against three fungal strains using the disc diffusion method. The essential oil of L. amplexicaulis (Tungnath) showed significant zone of inhibition against Aspergillus flavus (18mm) and Aspergillus niger (16.17mm) while the oil offrom Munsiyari showed the highest zone of inhibition against A. niger (18.17mm). L. amplexicaulis (Munsiyari) showed inhibitory effect against A. niger and the oil of L. amplexicaulis (Tungnath), showed MIC value against A. flavus at the concentration of 62.5μL/mL. The present investigation revealed that in antifungal analysis of the essential oil samples have shown remarkable activity against two fungal strains.

Keywords: Ligularia amplexicaulis, Asteraceae, Chemical composition, Limonene, α-pinene , p -cymen-8-ol, o-cymene, Terpinolene, fungicidal activity, Aspergillus flavus, Aspergillus niger, Candida albicans.

Design, Synthesis, and Biological Evaluation of Schiff-Base Isoxazole Hybrids: Exploring Novel Antimicrobial Agents

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DP-9

Abstract

The rise of multidrug-resistant bacteria has intensified the search for new antimicrobial medicines with improved efficacy and innovative mechanisms of action. As potential antibacterial drugs, Schiff-base isoxazole hybrids are the subject of this study's design, in silico studies, synthesis, and biological evaluation. Several Schiff-base isoxazole hybrids were developed to target important microbial proteins using theoretical computational methods such as molecular docking, MD simulation, DFT calculations, and ADMET predictions. The energy gap is smallest for compound A20 (-0.0919 Hartree), according to Density Functional Theory. Molecular docking analysis showed binding affinities between -11.3 and -7.00 (kcal/mol), which are in the same ballpark as those of conventional pharmaceuticals. The stability of the protein-ligand complex was verified through molecular dynamics simulations and the pharmacokinetics and safety were assessed using ADMET predictions. The produced chemicals showed encouraging antibacterial activity in biological tests. The antifungal activity against strains C. albicans and C. glabrata of A20 was substantial (MIC: 64 µg/mL), while the antibacterial activities against strains E. coli and S. aureus of A7 were noticeable (MIC: 256 µg/mL). In general, the synthetic compounds demonstrated encouraging signs of being powerful antifungal agents; in fact, a few of them even demonstrated broad-spectrum antibacterial properties. Additional research into the generated compounds' mode of action and prospective applications in the battle against microbial diseases is warranted in light of these findings, which highlight their therapeutic potential.

ISBN No 978-81-986231-0-2

Development of a Cu-Mg Catalyst for Sustainable Dye Degradation and Aniline Acetylation

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DP-10

Abstract

Development of efficient heterogeneous catalysts for the environment remediation and organic transformations remains a challenge toward sustainable chemistry. In this work, a CuMg catalyst was prepared by co-precipitation method and used for the degradation of Congo red dye and acetylation of aniline at ambient conditions. The catalyst Characterized by using pXRD, SEM, and BET surface area analysis confirmed the formation of a porous structure with well dispersed active sites. The CuMg catalyst show effective degradation of dye with high stability over several cycles. Furthermore, the same catalyst was used for the acetylation of aniline with excellent yields and could be easily recovered without loss of activity. The CuMg catalyst shows promise for sustainable green organic synthesis.

Keywords: Cu-mg catalyst, catalysis, Acetylation, Green chemistry.

Poster Presentation on Porphyrins

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DP-11

Abstract

Porphyrins are an important class of π-conjugated tetrapyrrolic heterocycles as they play a crucial roles in a variety of biological processes including oxygen transport and phtosynthesis in living organisms. Besides, these molecules also exhibited a wide range of usage in many areas such as photosensitizers in photodynamic therapy for the treatment of cancers and in light harvesting devices.

Keywords: Porphyrins, Synthesis

ISBN No 978-81-986231-0-2

Glycerol–Choline Chloride Natural Deep Eutectic Solvent: A Green Alternative for Caffeine Extraction

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DP-12

Abstract

Caffeine ($C_8H_{10}N_4O_2$) is a major bioactive compound present in tea leaves, coffee beans, and chocolate. Caffeine acts a stimulant to our central nervous system and mostly used in food and medicinal products. This has led to increasing interest in developing more environmentally sustainable extraction methods. This study involved the synthesis and application of a natural deep eutectic solvent (NADES) composed of glycerol (hydrogen bond donor) and choline chloride (hydrogen bond acceptor) for the extraction of caffeine from tea leaves. Fourier-transform infrared spectroscopy (FTIR) was employed to examine the structural and physicochemical characteristics of the synthesised NADES. The pH, viscosity, conductivity, and thermal stability of the NADES were carefully evaluated. Extraction studies were conducted at varying concentrations of NADES (25–100%) to optimise caffeine yield. Ultra-high-performance liquid chromatography (UHPLC) and the Folin–Ciocalteu technique to quantify caffeine and total polyphenol content (TPC) respectively. Distinct shifts in key absorption bands in FTIR of NADES prove the molecular interactions, mainly hydrogen bonding, between choline chloride and glycerol. The glycerol–choline chloride NADES demonstrated significantly enhanced extraction efficiency, yielding up to the amount of caffeine compared to conventional solvent systems. This suggests that this NADES combination may serve as an effective greener method for extracting caffeine from tea without using any harmful solvent.

Keywords: NADES, Glycerol, Caffeine, HPLC, Tea

ISBN No 978-81-986231-0-2

A Green Approach to Dibenzalacetone Synthesis

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DP-13

Abstract

Organic synthesis today emphasizes green methodologies that address both environmental and health concerns. One of the key strategies in this direction is minimizing or eliminating the use of organic solvents, which contribute significantly to chemical waste and health hazards. This article reports an efficient solvent-free synthesis of dibenzalacetone via an aldol condensation between acetone and benzaldehyde. The experiment, designed for undergraduate students, provides practical training in essential laboratory techniques such as grinding, recrystallization, functional group analysis, and thin-layer chromatography (TLC). The developed protocol replaces the conventional route with a greener alternative, aligning with the principles of sustainable chemistry.

Keywords:Undergraduate experiment, Dibenzalacetone, Green chemistry, Solvent-free, Grinding.

Methodology: Dibenzalacetone was synthesized through an environmentally benign protocol involving the manual grinding of acetone and benzaldehyde in the presence of a base, without using any organic solvent. The product was characterized using TLC, functional group tests and spectroscopic techniques.

Results and Discussion: The methodology proved to be safe, simple, cost-effective, and energy-efficient. The reaction required minimal time, eliminated solvent usage, and generated negligible waste. In addition, grindstone chemistry enhanced the reaction rate and product yield while offering superior atom economy compared to the conventional solvent-based synthesis. The approach not only reduces environmental burden but also demonstrates to undergraduate students the practical relevance of green chemistry principles.

ISBN No 978-81-986231-0-2

Applying Reuse and Reduce in an Undergraduate Organic Laboratory: Sustainable Practices

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DP-14

Abstract
Laboratory work has a significant impact on the environment as it involves the consumption of energy, resources, and chemicals. As chemists, apart from developing eco-friendly protocols, we should also strive to reduce, reuse, and recycle in the laboratory exercises. Organic preparations, which form a major component of the undergraduate curriculum, can be effectively utilized for other laboratory experiments. The products of such preparations can also serve as starting materials for subsequent syntheses. This approach reduces the quantity of chemicals required for conducting experiments beyond organic preparations. The present work illustrates a few organic preparations that can be reused for other laboratory exercises. Such a strategy may serve as a model of sustainability for undergraduate teaching laboratories.

Keywords: Reuse, Reduce, Sustainable practices, Laboratory experiments.

Methodology: The protocol involved three routine organic preparations whose products were subsequently used as principal compounds for other laboratory exercises, including melting point determination, extra-element detection, and functional group analysis.

Results: Reuse of substances is considered one of the most effective strategies for reducing chemical waste. By incorporating these strategies, an institution with nearly 100 students enrolled in chemistry courses can save up to 40% of the annual budget allocated for purchasing chemicals. This proactive and voluntary step towards environmental awareness can contribute significantly to the sustainability of laboratory practices for future generations.

ISBN No 978-81-986231-0-2

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Microalgae Cultivation and Diversity Assessment as a Foundation for Bacterial PHA Production

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DP-15

Abstract

Microalgae are unicellular photosynthetic microorganisms that are vital to aquatic ecosystems and have diverse applications including biofuel production, wastewater treatment and bioplastic synthesis. Their rapid growth, high lipid and carbohydrate content, and ability to fix CO_2 make them a sustainable biomass resource. Polyhydroxyalkanoates (PHAs), on the other hand, are biopolymers synthesized by microorganisms (bacteria) as intracellular carbon and energy reserves. They are promising alternatives to conventional plastics due to their biodegradable, biocompatible, and non-toxic properties. However, their large-scale production is limited by the high cost of carbon substrates. Integrating microalgal cultivation with bacterial PHA synthesis offers a potential alternative by providing a renewable, low-cost feedstock.
In the present work (Phase I), water samples from multiple Delhi water bodies were collected and inoculated into standard growth media to isolate and culture naturally occurring microalgae. Growth was monitored visually and microscopically, revealing successful proliferation of species including Chlorella and Scenedesmus. The biomass was harvested for further downstream processing to liberate carbon sources and Phase II focuses on use of these c-source for PHA polymer production and evaluating polymer yield.
This preliminary cultivation study establishes a baseline for biomass generation, representing the first step toward developing an integrated, sustainable microalgae-to-PHA bioplastic production platform.

Keywords; Microalgae cultivation and diversity, Biomass production, Polyhydroxyalkanoates (PHA), Sustainable feedstock, biopolymer production.

ISBN No 978-81-986231-0-2

Hydrothermal Synthesis and Comprehensive Characterization of Metal oxide Nanoparticles for Enhanced catalytic Performance.

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DP-16

Abstract

A facile chemical route was used to produce metal oxide nanoparticles with controlled shape and crystallinity. The synthesised materials were characterised by ultraviolet-visible spectroscopy (UV-Vis). surface area analyses by scanning electron microscopy (SEM), transmission electron microscopy (TEM), and X-ray diffraction (XRD). Structural and morphological studies confirmed the successful production of nanoscale mixed metal oxides. The synthesized nanoparticles are found have various application showing strong photocatalytic performance due to its high surface to volume ratio enhancing pollutants adsorption and catalytic efficiency under visible light radiation. This strategy illustrates how mixed oxides absorb visible light, generate charge carriers, and efficiently produce reactive radicals that break down pollutants, making them highly effective for photocatalysis in environmental remediation.

Keywords: nanoparticles, hydrothermal synthesis , nickel cobalt oxide , binary composite, photocatalysis

ISBN No 978-81-986231-0-2

Green Nanobiotechnology: Sustainable Advancements in Healthcare, Agriculture, and Environmental Remediation

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DP-17

Abstract

Nanotechnology has emerged as a transformative interdisciplinary field driving sustainable innovation in life sciences and biotechnology. By manipulating materials at the nanoscale, researchers have achieved enhanced precision in drug delivery, advanced diagnostic platforms, and novel antimicrobial strategies. Recent developments emphasize green synthesis of nanoparticles using biological sources such as plants, fungi, and bacteria, thereby reducing toxic solvents and energy consumption. In agriculture, nano-fertilizers and nano-pesticides improve nutrient efficiency, minimize chemical runoff, and increase productivity while ensuring consumer safety. A significant subfield, green nanotechnology, offers eco-friendly approaches for water purification and bioremediation through bio-based nanoparticle systems. Naturally derived nanomaterials, such as carbon-based nanoparticles, are being used to replace hazardous chemicals and integrate renewable feedstocks in synthesis protocols. These advances align with the United Nations Sustainable Development Goals, promoting sustainable healthcare, food security, and environmentally responsible industrial processes. Despite remarkable progress, further research is required to optimize green synthesis methods, elucidate mechanistic pathways, and expand applications in regenerative medicine and environmental biotechnology. Overall, the integration of nanotechnology with biological systems is reshaping sustainable development by minimizing environmental impact and maximizing benefits across health, agriculture, and industry.

ISBN No 978-81-986231-0-2

Green Synthesis of Biometallic Nanoparticles and their Multifunctional Applications

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DP-18

Abstract

Bimetallic nanoparticles (BMNPs) are nanomaterials combined with two different metal atoms. They can be categorized based on their size, origin, and structure, and they can be produced through physical, chemical, and biological processes (1). BMNPs possess excellent thermal and chemical stability, adjustable electrical and optical characteristics, and improved catalytic performance arising from the synergistic interaction between different metal components (2). The green synthesis of BMNPs has been widely recognized as a sustainable and environmentally friendly approach to fabricating advanced functional materials. By relying on renewable resources like plants (e.g., neem and aloe vera), biopolymers (like chitosan), and microorganisms (such as bacteria and fungi), they are commonly used among other natural sources and minimize both harmful chemical usage and energy demands relative to conventional processes (3). For example, BMNPs like Cu–Ni, Cu–Pt, Fe–Ni, Fe–Ti, and Fe–Mn are used for dye degradation and wastewater treatment (4); Au–Fe NPs and Ni–Co NPs serve as CT/MRI contrast agents; Fe–MgO NPs and Fe–TiO_2 NPs are utilized for wastewater remediation; Cu–AgO NPs is applied in biosensors; ZnO–Ag NPs is effective for dye degradation and antimicrobial activity; Fe–CuO NPs aid in magnetic separation and pollution control; Ag–Bi_2O_3 NPs and ZnO–Bi_2O_3 NPs are employed for photocatalysis; CuO–Bi_2O_3 NPs is used in supercapacitors and batteries; and FeO–ZnO NPs are designed for antibacterial coatings and water purification. Future prospects lie in optimizing synthesis parameters for wider production, exploring novel biogenic precursors, and integrating these materials into multifunctional devices for energy, environmental remediation, and healthcare sectors (5). However, many preparation procedures are expensive, difficult, and unscalable, limiting industrial use. BMNPs' toxicity and environmental consequences are unknown, causing disposal and health issues. Addressing these will be critical for advancing green synthesised BMNPs from laboratory research for industrial applications, supporting sustainable development goals, and technological innovation.

ISBN No 978-81-986231-0-2

Regulatory Frameworks and Incentives in Industries: Towards Green Chemistry

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DP-19

Abstract

Figure 1:12 principles of Green Chemistry

Industries are the one of the major parts of human resources. All the resources such as clothes, food, metals are gone through the industry. In recent years, global warming is increasing day by day because of not using sustainable resources. The observable change in human system due to global warming is the loss of ecosystem (e.g., reduced access to safe water) that is supported by biodiversity (1). One of the main reasons of global warming is industries, the release of vast amount of greenhouse gases (GHGs) into atmosphere, direct disposal of harmful chemical in water streams etc (2). In several countries, the remarkable development of the 'green economy' in recent years has gone hand in hand with the implementation of strategies of integration (more or less rapid and thorough) of public policies linked to the environment (3). The primary objective of this research is to integrate regulatory framework and economic incentives effectively to motivate industries to follow 12 principles of Green Chemistry as shown in figure 1.
Many industries have changed their conventional methods to the greener methods. The companies like Pfizer have changed their synthesis of specific drug and reduce the waste production (Principle 1) by almost 80%. The manufacturing of the painkiller ibuprofen by BASF was converted from a 6-step to a 3-step process, increasing atom economy (Principle 2) from 40% to 77%. The industry has focused on replacing large volumes of toxic organic solvents (Principle 5) with safer alternatives like water, supercritical CO2, or bio-based solvents. Merck's process for the diabetes drug Sitagliptin uses an engineered enzyme, eliminating a high-pressure hydrogenation step, while reducing waste by 19% by replacing harsh, stoichiometric reagents with highly selective catalysts and enzymes (Principle 9) (5)(6). It demonstrates that incentives which enhance industry profitability are significantly more effective than fines. When financial benefit is shown, the adoption of green technology accelerates. Training future chemists in policy and risk assessment within academic ensures they design safer and sustainable products from the outset. This integration is crucial for achieving long-term pollution reduction and sustainable development.

Keywords: Green Chemistry, Regulatory Frameworks, Sustainable Policy, Sustainability, Global Warming, Industry/Industries, Greenhouse Gases (GHGs), Economic Incentives, Pollution Reduction.

Green Cooling Technologies: Addressing Water Consumption Crisis in Artificial Intelligence Infrastructure

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DP-20

Abstract

The exponential expansion of artificial intelligence (AI) technologies has brought about an environmental crisis defined by excessive cooling system water consumption and carbon emissions. Conventional evaporative cooling technologies utilize around 1.5 billion liters of water every day for the world's AI infrastructure, while specific hyperscale data centers consume between 2.5 billion liters every year. This compounds water scarcity in drought-sensitive areas while also leading to thermal pollution. This project explores environmentally friendly replacement technologies for the cooling technologies that are water-intensive. Namely, immersion cooling, free-air cooling, and new heat recovery technologies.

Objectives: To evaluate the environmental impacts of conventional AI cooling technologies and analyse the potential of water-free versions for environmental footprint minimization.

Methodology: A detailed literature review and comparison of cooling technologies conducted to analyze energy efficiency ratios, utilization of water factors, and carbon discharge statistics of hyperscale and enterprise data centers across a number of climate zones.

Results: Immersion cooling showed 91-95% water reduction relative to conventional technologies, while free-air cooling showed 90% or higher energy efficiency for temperate conditions. Heat recovery technologies facilitated thermal energy recovery for co-location facilities. These alternatives lower water consumption by as much as 665 million liters per year per 100MW facility while lowering Power Usage Effectiveness (PUE) from 1.58 to 1.05-1.10, thereby making significant strides towards the vision of sustainable AI infrastructure construction.

Keywords: cooling, artificial intelligence, data centers, water, immersion cooling, environmental effects, green technology, dielectric fluids for cooling, geothermal cooling, cryogenic cooling, radiative cooling

ISBN No 978-81-986231-0-2

1,4-Diazabicyclo[2.2.2]octane Trifluoroacetate acts as an efficient Organocatalyst for the Cyanosilylation of Carbonyl Compounds

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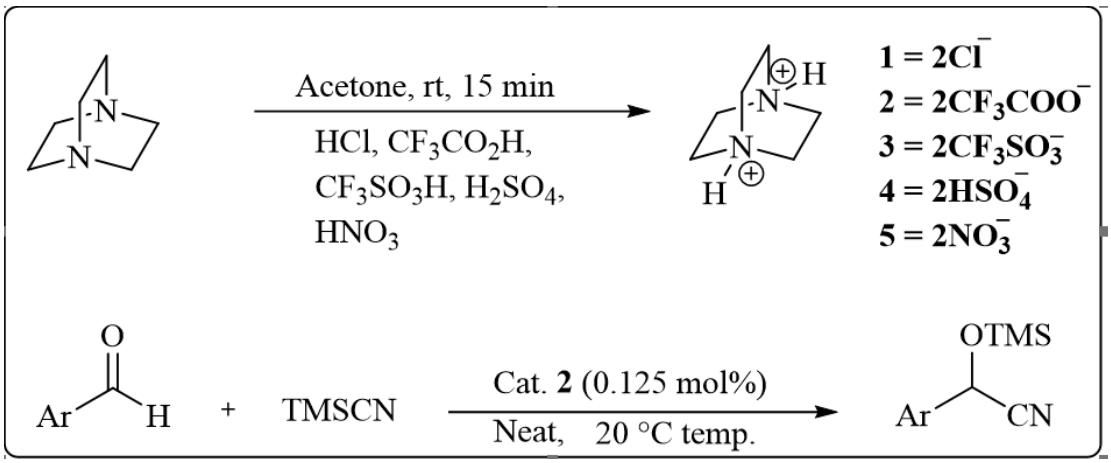
DP-21

Abstract
Salts of DABCO (1,4-diazabicyclo[2.2.2]octane) were synthesized, and their catalytic activities (0.125–1 mol%) were assessed for the cyanosilylation of various aldehydes and ketones under solvent-free conditions using TMSCN (trimethylsilyl cyanide). Aldehydes showed greater reactivity than ketones, achieving excellent yields of the corresponding cyanosilyl ethers within 5 minutes to 54 hours. Cyanosilylation of aldehydes and ketones with electron-withdrawing groups proved more reactive than those with electron-donating groups. The silylcyanation of isatin and its derivatives was also performed, yielding 74-90% of the corresponding products within 3–10 minutes. Additionally, we demonstrated that the catalyst could quantitatively deprotect the TMS group of cyanosilyl ethers in methanol.



Keywords:
Cyanosilylation; trimethylsilyl cyanide; aldehydes;ketones;isa';ltins

ISBN No 978-81-986231-0-2

Green Synthesis of Nanomaterials and their Applications

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DP-22

Abstract

Nanotechnology has emerged as one of the most significant and rapidly advancing frontiers in science over the past decade. Its wide-ranging applications and growing global demand have driven the development of innovative approaches for synthesizing high-quality nanomaterials. Initially, conventional synthesis techniques were employed, which depended heavily on carcinogenic chemicals and required high energy inputs to produce nano-sized materials. The environmental pollution resulting from these traditional methods created an urgent need for safer and more eco-friendly synthesis processes. As the impacts of climate change continue to intensify, the scientific community is actively exploring sustainable alternatives to mitigate the damage caused by toxic production techniques. Green synthesis methods utilize natural biological systems for the fabrication of nanomaterials. This work traces the evolution of nanoparticle synthesis, beginning with traditional techniques and advancing toward environmentally benign green methods. Green synthesis offers an equally effective, if not superior, alternative to conventional processes by using naturally derived precursors and energy-efficient pathways. Therefore, integrating green synthesis into scientific research and large-scale production represents a promising strategy to overcome the limitations associated with traditional synthesis approaches.

Keywords: Green synthesis, Nanomaterials, Bacteria, Yeast, Fungi etc.

ISBN No 978-81-986231-0-2

Sonicating Towards Sustainability: Ultrasonic Waves in Green Organic Synthesis

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DP-23

Abstract

Ultrasonic waves have become the dominant force in organic synthesis, providing a green and efficient alternative for the traditional methods. This poster presents ultrasound-assisted synthesis in various organic reactions, showing its advantages like higher reaction rates, better yields, and less impact on the environment. The process of cavitation is the key to the ultrasonic waves in that it leads to the production of high-energy intermediates, thus making the reaction selective and fast at the same time. Not only the reaction times are shorter, but also the energy consumed is lower and the waste produced is minimal which are the associated with green chemistry principles. Some exemplary cases of ultrasonic-assisted syntheses will be shared indicating this technique's potential for sustainability in organic synthesis.

Keywords: Ultrasonic waves, green organic synthesis, sustainable chemistry, cavitation, sonochemistry.

ISBN No 978-81-986231-0-2

Cultivation and uses of microalgae for biofuel production

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DP-24

Abstract

Unlocking the potential of microalgae for greener future is the need of the hour. As it can be easily and economically cultivated. It has high growth rate and high cellular lipid production. Present study was conducted to optimize microalgae production under laboratory conditions and utilization of its biomass for biofuel production.

Objective
To cultivate microalgae.
Identification of different microalgae
Analysis and optimization of the growth and performance of different microalgae.

Methodology-Water sample collection was carried out from different water bodies of Delhi, followed by preparation of BG-11 media (0.8134 g of BG-11 in 500ml of distilled water) and autoclaved at 121 degrees Celsius at 15psi then inoculation of this media in sterile environment and growth of microalgae was studied microscopically after regular interval. We have kept the culture in sunlight for the optimal growth. The biomass obtained will be further utilized for biofuel production.

Result: Successful cultivation of microalgae under laboratory conditions and its process optimization. We have identified two different species of microalgae based on their morphological characteristics.

Keywords: microalgae cultivation, biofuel

ISBN No 978-81-986231-0-2

Computational Green Chemistry Approaches for Screening Natural Therapeutics in Alzheimer's Disease: A Review

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DP-25

Abstract

Alzheimer's disease (AD) is a progressive neurodegenerative disorder characterized by amyloid-β plaque deposition and tau protein aggregation leading to neuronal death and reduction in overall brain volume. Despite extensive research, current therapies are largely symptomatic, providing temporary relief from cognitive or behavioral issues without halting the disease's progression. This underscores the need for more targeted approaches that address the underlying pathology of AD. Phytochemicals have emerged as a promising candidate due to their structural diversity, biocompatibility, and antioxidant properties. Various computational approaches are employed to virtually screen and identify such natural, eco-friendly therapeutic molecules against AD. Recent studies have employed multi-omics and transcriptomic analyses, such as human brain RNA-seq datasets to identify region-specific AD hub proteins and differentially expressed genes, providing a rational framework for in silico screening of phytocompounds with potential to be used as sustainable AD multi-target therapeutics. The present review work aims to compile such in silico based studies exploring phytochemical potential against AD. The integration of computational and green methodologies represents a transformative path toward developing environmentally responsible and biologically effective therapeutics for Alzheimer's disease.

Keywords:
Alzheimer's disease, phytochemicals, in silico screening, RNA-seq datasets

ISBN No 978-81-986231-0-2

Click Chemistry: Sustainable approach to strategic bonding

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DP-26

Abstract

This presentation aims to explore how click chemistry captures the essence of green chemistry in reactions that bring together precision, modularity, and environmental sustainability. The discussion takes copper(I)-catalyzed azide–alkyne cycloaddition (CuAAC) and its copper-free equivalent (SPAAC) as central examples. The reactions are explored against the twelve principles of green chemistry, with a special focus on atom economy, reaction efficiency, and reduction of toxic reagents and solvents. Evidence from literature and recent applications in drug design and materials science are used to illustrate the sustainability metrics of such click processes.
Click chemistry is highly selective, quantitative in yield, and tolerant of functional groups under mild aqueous conditions. The absence of heavy-metal catalysts in SPAAC enhances biocompatibility and reduces the volume of purification waste. Collectively, these traits reduce environmental impact while increasing synthetic reliability.
Click chemistry represents a convergence of innovation and sustainability in the form of a reproducible and scalable system for green synthesis. Its adaptability across disciplines like biological, material science, and environmental domains highlights how molecular precision can align with ecological, ethical and economic priorities in modern chemical practice
.

Keywords: Click chemistry, green chemistry, CuAAC, SPAAC, sustainable synthesis, bioorthogonal reactions

ISBN No 978-81-986231-0-2

Water as a Green Solvent in Agrochemical Industry for Sustainable Development

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DP-27

Abstract

The use of green solvents in agrochemical industries has become a crucial step toward achieving environmental sustainability. Water, being a non-toxic, inexpensive, and abundantly available solvent, plays a significant role in promoting eco-friendly chemical synthesis. Many pesticides, like fenvalerate, are normally dissolved in organic solvents such as toluene. These solvents are flammable, harmful to the environment, and release VOCs. This study presents a greener approach by replacing toluene with water using phase transfer catalysts (PTC) and surfactants to make an oil-in-water (O/W) emulsion.

Fenvalerate was first dissolved in a carrier oil and then mixed into water containing tetrabutylammonium bromide (TBAB) as PTC, along with surfactant Tween 80 and Span 80. The PTC helps move the pesticide into the water droplets, while surfactants keep the droplets stable. Using high-shear stirring, microemulsions were formed. At the same time, the amount of harmful organic solvent was reduced by over 90%, making it safer for the environment.

This method shows a practical way to make eco-friendly pesticide formulations without losing effectiveness. It can also be applied to other hydrophobic pesticides, supporting sustainable and green chemistry approaches in agriculture.

Keywords:

Water, Fenvalerate, phase transfer catalyst, oil-in-water emulsion, green pesticide, TBAB, microemulsion, Agrochemical Industry, Sustainable Development

ISBN No 978-81-986231-0-2

Analysis of Spatial Variability of Smog Episodes in Delhi During the Diwali Period (October-November) and the Implications of GRAP

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DP-28

Abstract

Air Pollution is a major concern in Delhi, with frequent smog episodes causing poor visibility and various health issues, particularly respiratory problems in current times. In recent past several severe smog incidents were observed, especially around the Diwali festival (October-November), with very high PM2.5 and PM10 levels. This study analysed on primary data to examine smog episodes in Delhi before, during and after Diwali. The data has been collected from various monitoring stations. The results revealed that during the study period, the Air Quality Index (AQI) and concentrations of PM2.5 and PM10 exceeded beyond the permissible limits across all monitoring stations. The findings suggested that the burning of firecrackers, agricultural stubble burning in neighbouring regions, along with the transportation, contributed to the high AQI in the studied areas.

Keywords: AQI, PM2.5, PM10, GRAP, GIS

ISBN No 978-81-986231-0-2

Harnessing Green Chemistry to Restore Balance in Agro-Ecosystems.

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DP-29

Abstract

The widespread use of synthetic agrochemicals has led to ecological imbalance, microbial resistance, and adverse health outcomes, prompting an urgent shift toward sustainable agricultural practices. Green agrochemicals—biodegradable, target-specific, and derived from natural sources—offer a promising alternative that aligns with the twelve principles of green chemistry. These formulations minimize environmental pollution, preserve beneficial soil microbiota, and reduce nutrient runoff, thereby curbing eutrophication and enhancing food chain stability. This paper explores the scientific rationale, chemical principles, and practical applications of green agrochemicals, including biopesticides, biofertilizers, and nanotechnology-enabled delivery systems. It highlights innovations in solvent-free synthesis, energy-efficient methodologies, and biocatalyst integration. Analytical advancements such as microwave-assisted reactions, ultrasonication, and microextraction techniques further enhance sustainability by reducing energy and solvent use. Despite their ecological and health benefits, green agrochemicals face challenges in scalability, cost, and formulation stability. The paper discusses strategies to overcome these limitations through enzyme engineering, catalyst innovation, and the use of lifecycle assessment tools. Ultimately, green agrochemistry represents a transformative approach to agricultural sustainability—balancing ecological integrity with technological innovation for a resilient and health-conscious future.

Keywords: Green chemistry, biopesticides, biofertilizers, sustainable agriculture, nanotechnology, environmental safety

ISBN No 978-81-986231-0-2

Positive Selection System: An Environment Friendly Strategy for In-Vitro Selection of Transgenic Plants

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DP-30

Abstract

Selectable marker genes (SMGs) have played a crucial role in developing an effective and dependable transformation approach. Earlier these transformation systems have employed the use of antibiotics like kanamycin for NptII gene and hygromycin for Hpt gene, or herbicide for bar or PPO gene. The use of these SMGs has been criticized for their biosafety concerns and their negative impact on humans as well as the environment. One alternative to produce transgenic plants was adopted by using positive SMGs that make use of external non-toxic substrates as selectable agents like mannose for phosphomannose isomerase gene, arabitol for arabitol dehydrogenase gene, ribitol for ribitol operon from Escherichia coli and xylose for xylose isomerase gene among many others. Furthermore, transgenic cells are provided with a metabolic advantage to grow normally by using the respective external substrate as source and is essential for recovering genetically modified crops for sustainable agriculture. This approach proves to be environmentally safe and has been exploited across diverse crops with improved transformation frequencies including many rice, wheat, millet and maize varieties as well as fruit tree crops which highlight their potential for a sustainable and greener future for obtaining transgenic crops.

Keywords: Positive SMGs, sustainable agriculture, transgenic crops.

ISBN No 978-81-986231-0-2

A Comprehensive Review on Biodegradable Packaging Solutions for Pharmaceuticals

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DP-31

Abstract

Background
The packaging garbage generates in 2024 was over 418 million tons, 1% of this is pharmaceutical packaging waste which significantly led to environmental degradation and climate change. This demands an urgent shift towards sustainable alternatives.
Objectives
This comprehensive review is aimed at:
(1) Evaluate the environmental impact of traditional pharmaceutical packaging materials
(2)Analyze biodegradable packaging technologies like polylactic acid (PLA), polyhydroxyalkanoates (PHA), and other *emerging biopolymers
(3) analyze regulatory frameworks and market influencing their use
(4) Recommendations
Methodology
A systematic literature review was conducted on materials use, regulatory aspects, market effect, and real-world applications. Multiple databases were searched for peer-reviewed articles, regulatory documents, and industry reports. Case studies from diverse geographical regions were analyzed to identify success factors and implementation barriers.
Results
Biodegradable alternatives have performance characteristics matching traditional materials but have advantages as they significantly reduce environmental footprint. The main barriers include higher production costs, technological limitations, and regulatory controls. Life cycle analysis, Consumer awareness and corporate responsibility initiatives are also helpful. **Conclusions**
Success requires coordinated efforts at different levels. This shift corresponds to a pathway toward sustainable pharmaceutical industry.
Keywords
Biodegradable packaging, pharmaceutical sustainability, polylactic acid, polyhydroxyalkanoates, environmental impact, circular economy, biopolymers

ISBN No 978-81-986231-0-2

Collagen extracted from fish scales and air bladders: A waste to value approach

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DP-32

Abstract

Collagen is one of the most abundant structural proteins in animals and plays a vital role in various biomedical, pharmaceutical, cosmetic and food-related applications. Conventional collagen sources mainly of mammalian origin face limitations such as high costs, cultural restrictions and potential for zoonotic disease transmission. Fish-derived collagen has emerged as a safer, eco-friendly and more sustainable alternative especially when obtained from underutilized by-product of fish processing industries which include scales and air bladders that are usually discarded as waste. Despite being valuable sources of collagen, fish industry by-products are produced in large quantities in India adding to the environmental burden. An extensive review has been done to study the various extraction procedure and techniques employed to characterize the collagen isolated from fish scales and swim bladder. The study is expected to highlight the suitability of fish industry waste as an economical and sustainable source of collagen. A comparative evaluation will be made to determine differences in yield, structural integrity and physiochemical properties between collagen derived from scales and that of air bladders. By converting low-value fishery waste into a high-value biomaterial, the finding could support sustainable practices in the fish industry, while also promoting collagen-based applications while reducing environmental burden.

Keywords: Collagen; Fish processing industries; Waste minimization; Biomaterial.

DES as a Potent Green Solvent and Catalyst for the Synthesis of Biologically Active Pyrimidinethiones

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DP-33

Abstract

production, and severe catalytic conditions, such as longer reaction times, higher temperatures, and reduced yields. A simple, sustainable, and environmentally friendly protocol for synthesizing 4,6-diaryl-3,4-dihydropyrimidine-2(1H)-thiones from chalcones using the biodegradable, cheap, and easily accessible deep eutectic solvent (DES) is reported. The pyrimidinethiones with a wide range of structural diversity were obtained by this method in yields ranging from good to excellent (45-99%) under optimized reaction conditions. A novel DES was used for the first time in a synthetic protocol and was found to be an augmenting medium for the reaction. The protocol involves a simple work-up procedure and filtration of the product, and does not require column chromatography for purification. Hopefully, this DES solvent system will pave the way for the development of newer, greener solvents for organic synthesis.

Keywords: Dihydropyrimidine-2(1H)-thiones, Chalcones, Green chemistry, Deep eutectic solvent

ISBN No 978-81-986231-0-2

Green synthesis of medicinally important compounds: A case study

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DP-34

Abstract

The large-scale production of medicinally important compounds always led to the significant accumulation of persistent organic pollutants in the environment. This causes some serious health risks to humans and wildlife. In most of the cases, medicinally important compounds are synthesized through conventional organic synthesis processes which contribute to environmental pollution and this forced the organic chemists to shift toward greener and more sustainable methods of synthesis. Green chemistry focuses on the atom economy, waste reduction, and design of products and processes that minimize or eliminate the use and generation of hazardous substances. This presentation will discuss the comparison of traditional synthesis and sustainable synthesis of medicinal compounds like Ibuprofen. Ibuprofen is a non-steroidal anti-inflammatory drug (NSAID) used to relieve pain, reduce inflammation, and lower fever.

ISBN No 978-81-986231-0-2

Sustainable Nanotechnology in Forensics: Green Synthesis and Application in Fingerprint Detection

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DP-35

Abstract

Green synthesis has emerged as a promising and sustainable approach for the fabrication of nanoparticles. This method utilizes natural biological entities such as plant extracts, microorganisms, and fungi as reducing and stabilizing agents. In forensic science, particularly in the detection of latent fingerprints (LFPs), nanomaterials have shown great potential due to their unique physicochemical properties. This study focuses on the synthesis of metal oxide nanoparticles (NPs) via green methods and their application in the optical visualization of LFPs.

Keywords : Nanotechnology, Green Synthesis, Latent Fingerprint Detection

Objective:
To explore the application of green-synthesized metal oxide nanoparticles in the optical imaging of latent fingerprints (LFPs).

Methodology
Nanoparticles were synthesized using plant-based green methods and applied to latent fingerprints using a dry dusting technique. Imaging was performed using a digital microscope and a smartphone camera.

Result
All metal oxide nanoparticles improved latent fingerprint visibility under optical imaging. The dry dusting method was simple, quick, and non-destructive, making it suitable for on-site forensic use.

ISBN No 978-81-986231-0-2

A solvent free mechanochemical route to indole synthesis

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DP-36

Abstract

Indole is a bicyclic aromatic heterocyclic structure consisting of a benzene ring fused with a nitrogen containing pyrrole. Its a core structural motif present in many synthetic and natural bioactive compounds. Due to its versatile structure, indole has become a privileged scaffold in medicinal chemistry. It is of supreme significance in both synthetic drug and natural product design, primarily because of its exceptional ability to participate in diverse biological interactions. Indole derivatives are indispensible in the pharmaceutical sector, due to their potent activity as anticancer, antibacterial, antiviral and anti-inflammatory drug use and as precursors of psychoactive and neuroprotective agents. The indole moiety enables rational drug design to favour therapeutic efficacy and selectivity.

Mechanochemistry is a prominent area of research that uses mechanical forces like grinding, milling, or shearing, for stimulating and sustaining chemical reactions. Its significance lies in its adherence to the principles of Green Chemistry since it reduces the reliance on highly volatile and often toxic organic solvents and greatly increases the overall sustainability and energy efficiency of synthetic processes. The integration of mechanochemistry in the indole synthesis is an important development in research, primarily led by the technique's potential to allow solvent free synthesis. Mechanochemical conditions have been successfully applied to numerous indole-forming procedures, often due to increased efficiencies characterized by the shorter durations of reactions and the improved yields of the end-products.

Therefore, the aim of this study is to review the various mechanochemical approaches used to synthesize indole and its pharmaceutically relevant derivatives.

Keywords: Solvent free, Mechanochemical, Indole, Green Synthesis

Kasturi Herbals: Integrating Green Chemistry for Sustainable Development of Herbal Eco- Friendly Products

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DP-37

Abstract

Green chemistry has emerged as a cornerstone for achieving sustainable industrial and academic innovation. By emphasizing atom economy, process efficiency, and the elimination of toxic reagents, it offers a scientific framework for minimizing environmental impact while advancing chemical research and manufacturing. The integration of green chemistry principles into product design not only reduces hazardous waste but also enables scalable, cost-effective, and environmentally responsible processes. Kasturi Herbals, a green chemistry–based startup incubated in the Department of Chemistry, Maitreyi College, operationalizes these concepts through the development of 100% natural, eco-friendly formulations for personal, home, and skin care. The product line includes organic soaps, shampoo and conditioners, baby care products each derived from biodegradable, non-toxic raw materials of natural origin. Our synthetic pathways strictly adhere to the Principles of Green Chemistry as this initiative also integrates chemical education with sustainable entrepreneurship. Kasturi Herbals represents a chemistry-driven model for translating green chemistry principles into scalable solutions, linking academic innovation with sustainable industrial development.

Keywords:
Green Chemistry. Industrial Application, Zero Waste, Sustainable Products

ISBN No 978-81-986231-0-2

CytoGuard : A Computationally Optimized Synergistic Formulation for Mitigating Hard Water-Induced Hair Damage Using Sustainable Ingredients

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DP-38

Abstract

Objectives: Prolonged exposure to hard water, rich in calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions, damages hair by causing mineral buildup, cuticle erosion, and reduced tensile strength. This study aimed to computationally design a sustainable and effective alternative to synthetic, environmentally persistent chelators like EDTA for hair protection.

Methodology: A dataset of nine ingredients was compiled and evaluated on key parameters: chelation strength, cost, skin safety, pH, and eco-friendliness. A proprietary Python-based multi-criteria optimization algorithm was developed to systematically rank all two- and three-ingredient combinations, weighting efficacy, safety, and cost.

Results: The computational model identified the synergy between Citric Acid and Magnesium Sulfate as the optimal formulation, named "CytoGuard." The formulation achieves an ideal hair-safe pH of 5.5 and is projected to reduce calcium ion deposition by approximately 65% at a 0.5 g/L dose. Compared to EDTA-based softeners, CytoGuard offers a 50-60% reduction in cost and a superior environmental safety profile.

Conclusion: CytoGuard represents a significant advancement in sustainable cosmetic science, providing a safe, affordable, and effective solution to hard water damage. This research also establishes a replicable, data-driven framework for the rational design of future personal care products.

Keywords: Computational Formulation, Sustainable Cosmetics, Hard Water, Citric Acid, Magnesium Sulfate, Multi-Criteria Optimization

ISBN No 978-81-986231-0-2

Photocatalytic degradation of dyes using nanoparticles synthesized by banana peel

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DP-39

Abstract

The accidental release or dumping of polluted wastewater into streams and rivers, which plays a major role in water pollution, is the main cause for which the various industry is a major source of world pollution. According to a World Bank report, textile dyeing and finishing activities are responsible for causing between 17 and 20 percent of industrial water pollution [1] .Photocatalytic degradation of dyes such as methylene blue by visible radiation is greatly accelerated by green-synthesized CuO, ZnO, and ZnO/CuOnanocomposites in banana peel extracts. ZnO/CuO composites outperform single-element ZnO or CuO nanoparticles, enlightening over 90% effectiveness in degradation. The enhanced activity in this case has been attributed to the synergistic effect of ZnO and CuO, which maximizes surface area, minimizes electron-hole pair recombination, and optimizes hydroxyl radical generation, in short, significant in efficient depletion of dye [2].
It also contains flavonoids and banana peel phenolic acids that work as reducing and stabilizing media in the production of nanoparticles. The compounds yield proper nanomaterials for photocatalytic applications due to proper bandgap characteristics in addition to high stability [3].
Sunlight-irradiated green-processed nano-copper oxide and doped zinc- copper oxide breaks down dyes such as congo red due to its porosity, which gives numerous sites of action so that adsorption and degradation of dyes take place efficiently [4][5]. Literature shows that banana peel-based green synthesis is a biocompatible and safe approach to fabricating nanostructures such as CuO or doped nanoparticles that clean up dye-based wastewater by photocatalysis [1][2][3][4][5].
Keywords :
Green synthesis ,Banana peel extract ,Nanoparticles (CuO, ZnO, ZnO/CuO, TiO2) Photocatalysis ,Wastewater treatment ,Antioxidant activity ,Dye degradation,Visible radiation , Biocompatibility

Harnessing Nature-Based Solutions for Water Purification and Sustainable Agriculture: Advancing SDG 6

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DP-40

Abstract

Access to clean water and sanitation is challenged by several critical factors, including population growth, pollution, agriculture being the largest consumer of freshwater, and climate change. Achieving Sustainable Development Goal 6 (SDG 6) aims to address the challenges mentioned above. The nature-based solutions (NbS) utilise natural processes to enhance water quality and strengthen ecosystem resilience, directly supporting SDG targets 6.3 (water quality) and 6.6 (ecosystem protection). The microbial communities perform bioremediation for wetland restoration and riparian buffer zones, which act as a natural filtration system. NbS methods for the agricultural sector include agroforestry, organic soil enhancers, conservation tillage, etc., to reinforce the ecosystem services. Heavy metals, fertilisers, and organic contaminants are successfully removed from water bodies using techniques including charcoal filtration, algal remediation, bioremediation, and nanomaterial-based solutions. This article aims to discuss the implementation of such sustainable NbS and green catalytic methods that can prevent toxic byproducts from industrial wastewater treatment from entering the aquatic biome. Incorporating NbS into policy frameworks and securing sustainable financing are vital steps for achieving long-term water security and sustainable development by 2030.

Keywords: Nature-based solutions, water security, SDG 6, bioremediation, nanomaterials, Green Chemistry ecosystem conservation.

ISBN No 978-81-986231-0-2

Water as a Universal Solvent in Pharmaceutical Industry for sustainable development

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DP-41

Abstract

This research focuses on the use of water as a universal solvent to replace dichloromethane (DCM) in the synthesis of Ixazomib, a drug for blood cancer. In the 2nd step DCM was replaced by water(H2O), a Phase transfer catalyst (PTC) named Benzyltriethylammonium Chloride and Polyethylene glycol (PEG) that gave the desired amide resulting in the formation of [N-(2,5-dichlorobenzoyl)glycine ester] N-(Leucine pinacol boronic acid) through Schotten-Baumann reaction. This approach aligns with one of the 12 principles of green chemistry, emphasizing non-toxic and environmentally benign solvents. Our results indicate that utilizing water not only reduces the ecological footprint of pharmaceutical manufacturing but also meets safety standards required in modern medicinal chemistry. The successful synthesis of Ixazomib using water presents a promising pathway for the incorporation of sustainable practices within the industry.

Keywords
Water, Dichloromethane (DCM), Phase transfer catalyst (PTC), sustainability, green chemistry, Anti-Cancer

ISBN No 978-81-986231-0-2

Evaluation and comparison of antioxidant activity of Indian spices and herbs

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DP-42

Abstract

Reactive Oxygen Species (ROS) are highly reactive molecules and free radicals responsible for oxidative stress, a condition associated with various chronic diseases. The increasing demand for safe and natural ROS inhibitors has intensified research into plant-based alternatives. India, often referred to as the land of spices, has a long-standing tradition of utilizing herbs and spices not only for flavouring food but also for their therapeutic benefits. Several Indian spices such as turmeric, clove, coriander, cinnamon, black pepper, garlic, ginger, and fenugreek are rich in natural antioxidants. These bioactive compounds—including phenolics, flavonoids, tannins, and essential oils—effectively neutralize free radicals, thereby reducing oxidative stress linked to diseases like cancer, diabetes, and cardiovascular disorders. The primary objective of this study is to assess and comparatively rank the in vitro free radical scavenging activity of various Indian herbs and spices, establishing them as potent, natural, and sustainable antioxidant sources for the food and nutraceutical sectors.

The antioxidant potential of extracts from these spices and herbs will be evaluated using the standard 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay. This method measures the ability of the extracts to donate a hydrogen atom, causing the purple DPPH radical solution to decolorize. The percentage inhibition will be calculated at different concentrations, and IC_{50} values will be determined for each sample to measure their relative antioxidant strength.

ISBN No 978-81-986231-0-2

Underground stem based Enzyme as a natural source of oxygen production for increased microbial growth

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DP-43

Abstract
The catalase enzyme found in Solanum tuberosum commonly known as potato which is easily available around the indian kitchen is a high source of heme-containing catalase enzyme. The catalase enzyme is best known for rapidly decomposing hydrogen peroxide into oxygen and water, commonly known as catalase test. This involves fresh juice of potato when added with H_2O_2 releases oxygen vigorously than catalase degraded by boiling. This molecular oxygen released can be used for liquid microbial culture for many oxygen-consuming microbes especially yeast commonly known as Saccharomyces cerevisiae. Saccharomyces cerevisiae grow more with more oxygen moving from lag to log phase. It allows for aerobic respiration, once used the required oxygen they can consume oxygen with no detrimental effect. Growth is determined by measuring optical density(OD) in spectrophotometer, with higher values indicating higher cell density. The RB-flask was filled with 50 ml of fresh potato juice(PJ) and 50 ml of 6% H_2O_2 was added. The mixture was allowed to react and release oxygen, transferred with pipe to 50ml liquid microbial culture of yeast growing in sugar syrup. The same procedure was followed with boiled PJ as control maintaining the same temperature and incubation period of yeast, OD measured at OD_{600} was 2.56 compared to 2.64 for yeast grown from oxygen produced from fresh PJ by catalase reaction. Conducted aiming to grow yeast with minimal classroom setup in high schools and undergraduate level to growing it into large fermenters increasing biomass in form of cream, compressed and dry yeast useful for bakery and alcohol production. The enzyme is environment friendly releasing O_2, involves safer solvents over synthetic catalysts following Green chemistry principles.

Keywords: Catalase enzyme, hydrogen peroxide, Saccharomyces cerevisiae, Solanum tuberosum

ISBN No 978-81-986231-0-2

Exploring Plant Metabolites as Eco-Friendly Therapeutic Alternatives for Neurological Disorders

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DP-44

Abstract

Neurological disorders (NDs) encounter major health challenges around the world due to their intricate pathophysiology and limited medication. These disorders arise from the composite disruptions in neuronal signalling, neurotransmitter imbalance, oxidative stress along with neuroinflammation. Current drug targets focus on modulating neurotransmitter systems such as dopamine in Parkinson's disease, acetylcholine in Alzheimer's disease, and serotonin in depression. The main targets identified to treat NDs are GABA and NMDA receptors. Moreover, neuroinflammatory mediators, tau phosphorylation and β-amyloid aggregation are also auspicious goals for inhibition to overcome on these disorders. Available treatments continually provide only symptomatic relief but also causes adverse side effects, highlighting the need for safer and more effective alternatives. Medicinal herbs have gained increasing attention as potential neurotherapeutic agents because of their rich reservoir of bioactive chemical constituents. Several herbs used in traditional medicine to demonstrated neuroprotective, anti-inflammatory, antioxidant, and adaptogenic activity that modulate neurotransmitter activity, reduce neuroinflammation and enhance cerebral function. However, medicinal herbs are considered as a primary source of health care, largely due to the therapeutic effects of secondary metabolites. Numerous bioactive metabolites have been identified with their promising neuroprotective potential in recent researches. The recent reports scientifically validate the therapeutic role of phytochemicals as alternative treatments for neurological disorders, offering new possibilities for integrative and holistic healthcare approaches. Hence, the present research focussed on the compilation of promising secondary metabolites used to protect nervous system.

Keywords: Medicinal herbs, Neuroinflammation, GABA receptors, Bioactive metabolites

ISBN No 978-81-986231-0-2

Green Nanomedicine: Sustainable Synthesis and Therapeutic Applications of Plant-Based Nanoparticles

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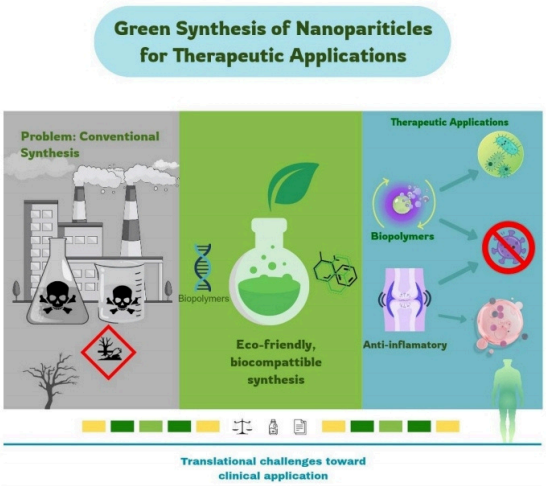
DP-45

Abstract



This literature survey/review article examines recent advancements in sustainable methods for synthesizing green nanoparticles and assesses their effectiveness in therapeutic applications. Nanoparticles are materials engineered at the nanoscale, typically within the range of 1–100 nm,
where their extremely small size imparts unique chemical, physical, magnetic, and electronic properties to various metals and non-metals.
Conventional industrial synthesis of nanoparticles
often relies on toxic chemicals, raising concerns about environmental and biological safety. To overcome these limitations, green nanotechnology has emerged as a sustainable approach that minimizes the use of hazardous substances in the
production of metallic and non-metallic nanomaterials. The green synthesis of nanoparticles using plants and biopolymers not only eliminates toxic reagents but also enhances cost-effectiveness,
biocompatibility, and eco-friendliness. These green nanomaterials exhibit remarkable therapeutic
potential, showing efficacy in cancer therapy, antimicrobial and antiviral treatments, anti-inflammatory applications, immunomodulation, and regenerative medicine. Despite their promising biomedical applications, the translation of nanomaterials into clinical use faces challenges such as safety validation, ethical considerations, and regulatory approvals. This research examines recent advancements in sustainable methods for synthesizing green nanoparticles and assesses their effectiveness in therapeutic applications.

keywords:-Green nanotechnology, Plant-based nanoparticles, green synthesis, Anticancer therapy, Biomedical applications.

ISBN No 978-81-986231-0-2

REGULATORY FRAMEWORK AND INTEGRATION OF GREEN POLICIES IN ECOTOXICITY BY ARTIFICIAL SWEETENERS

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DP-46

Abstract

Artificial sweeteners, also known as nonnutritive sweeteners or sugar substitutes, are used to reduce caloric intake, extend shelf life, and enhance taste. (Saccharin). Although these sweeteners are intended to address health problems, recent trends suggest a possible association with higher levels of obesity. Artificial sweeteners largely remain unchanged in the body, their consumption may contribute to lifestyle disorders such as weight gain and decreased food intake. After excretion in urine or feces, these chemicals enter city sewage and pass through wastewater treatment plants, where, due to the absence of specialized treatment, they remain unchanged and are discharged into the aquatic system.
To minimize the toxicity of artificial sweeteners, the Food Safety and Standards Authority of India (FSSAI) and other institues launched regulatory and green policy initiatives that align with Sustainable Development Goals. These measures include the National Green Chemistry Mission (NGCM)- Promote green chemistry in India for sustainable chemical and industrial production. Green technologies (ozone, pulsed electric field, ohmic heating, photosensitization, ultraviolet radiations, high-pressure processing, ultrasonic, nanotechnology) , Eat Right India (FSSAI)-Improve public health and promote sustainable, safe, and nutritious food practices, eco-labeling and green certifications, waste management and pollution control policies, as well as biotechnology and R&D support. These actions are intended to reduce the potential harm artificial sweeteners pose to health and the environment.

Keywords: Artificial sweeteners, Green policies, Lifestyle disorder, Ecotoxicity

ISBN No 978-81-986231-0-2

Biowaste to Bioplastics: Hydrolysis of Papaya Peel for PHA Production

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DP-47

Abstract

The increasing environmental burden of non-biodegradable plastics necessitates the exploration of sustainable alternatives.

Objective:
This study aims to utilize papaya peel biowaste as a renewable, low-cost carbon substrate for bacterial polyhydroxyalkanoate (PHA) production.

Methodology:
Papaya peel waste (Carica papaya), selected for its high carbohydrate content, was subjected to controlled bacterial hydrolysis at varying substrate concentrations (2%, 4%, and 6%) and incubation durations to enhance sugar release. The quantification of the liberated reducing sugars was performed using a 3,5-dinitrosalicylic acid (DNSA) assay, with glucose as the standard reference. Spectrophotometric measurements at 540 nm were used to determine the concentration of reducing sugars in the hydrolysed samples. The data obtained were analysed to identify optimal hydrolysis conditions for maximum substrate conversion efficiency. Hydrolysate will be utilised as feed for PHA production by Bacillus species.

Result:
Preliminary observations revealed substantial sugar liberation from papaya peel hydrolysates, validating their potential as an effective medium for PHA-producing bacteria. The findings demonstrate a viable and sustainable approach to integrate biowaste valorisation with microbial biopolymer synthesis, contributing to eco-friendly bioplastic production strategies.

Keywords:
Papaya peel, Biowaste valorization, Reducing sugars, DNSA assay, Polyhydroxyalkanoates (PHAs), Hydrolysis, Sustainable bioplastics.

ISBN No 978-81-986231-0-2

An Integrated Data Science Pipeline for Biological and Environmental Insights: AI-Driven Trend Detection Aligned with Ecological and Sustainable Development Goals

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DP-48

Abstract

The main objective of this work is to develop a comprehensive data science pipeline for the collection, integration, and analysis of biological, ecological, and environmental datasets to support ecological goals and the Sustainable Development Agenda. The system aims to enable data-driven insights that contribute to sustainable growth and environmental preservation. The methodology involves gathering data from governmental websites using web scraping techniques and custom-developed tools, along with accepting experimental or observational data from independent sources. A variety of AI techniques, such as cloud-based platforms and locally optimized models tailored for ecological research and SDGs, are implemented for analytical processing. The results indicate that the proposed pipeline facilitates improved pattern recognition, comparative analysis, and predictive evaluation for ecological and environmental sustainability. Its modular and adaptive framework supports extensions such as automated reporting and real-time environmental monitoring.

Keywords: Data Science, Ecological Goals, Sustainable Development Goals (SDGs), Environmental Monitoring, AI Analytics, Sustainability.

ISBN No 978-81-986231-0-2

Green Chemistry & the Sustainable Development Goals

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DP-49

Abstract

This study focuses on developing and analyzing eco-friendly polymer-MOF hybrid systems within the framework of Green Chemistry and the Sustainable Development Goals (SDGs). A commercially obtained CuVA bio-MOF, containing a biocompatible copper center and vanillic acid linker, was conjugated with thermoresponsive polymers: poly(N-isopropylacrylamide) (PNIPAM) and poly(N-vinylcaprolactam) (PVCL) in different concentrations .

Objectives:
To compare the thermoresponsive behavior of PNIPAM and PVCL upon interaction with Cu–VA MOF and evaluate their biocompatibility, stability, and LCST modulation for sustainable material applications.

Methodology:
Polymer-MOF conjugates were prepared in water and characterized using UV–Vis spectroscopy, fluorescence spectroscopy, and dynamic light scattering (DLS).

Results:
The hybrids exhibited stable polymer-MOF interactions and temperature-dependent transitions, with PVCL showing higher biocompatibility and lower toxicity than PNIPAM. The work demonstrates a green, sustainable approach to smart-material design aligned with SDG 3, SDG 9, and SDG 12.

Keywords: Green chemistry, PVCL, PNIPAM, Cu-VA bio-MOF, LCST, Smart materials

ISBN No 978-81-986231-0-2

Engineering Living Biosensors: Integrating Bio-Computing Principles for Sustainable Environmental Monitoring

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DP-50

Abstract

Industrial and agricultural pollutants contribute a significant role in global environmental degradation. Traditional detection technologies often face high cost , non-biodegradable, and energy - intensive . This study explores the development of living biosensors that utilise bio-computing principles for eco-friendly pollutant detection that is aligning with the goal of green chemistry and sustainable development to a greater extent .

The objective talks about a conceptual framework for microbial biosensors capable of performing complex biology computation to detect heavy metals and other organic toxins through gene circuit logic . Engineered microbial strains were modelled with synthetic promoters that triggers a visible response much like green fluorescence and colour change detections . The mechanism replicates digital computation within a biological context , enabling real-time , self-sustaining detection without heavy electronic components .

The proposed model demonstrates that bio-computing can be a game changer in the detection of unknown pollutants in more efficient ways , as they are biodegradable , self- replicating , and low-energy alternatives to traditional chemical and electronic detectors. They offer a scalable with addition of sustainable solution for environmental monitoring and industrial waste management

ISBN No 978-81-986231-0-2

From Silicon to Sustainability, 2D FETs as Building block for Green Electronics

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DP-51

Abstract

The continuous advancement of field-effect transistors (FETs) has reshaped the electrical performance and energy efficiency of modern semiconductor devices. This study looks at how the electrical characteristics of contemporary FET designs, such as FinFETs, Gate-AllAround (GAA) Nanosheet FETs, and 2D-material-based FETs, are changing. The primary objectives are to identify the critical factors that influence electrical efficiency, such as threshold voltage, subthreshold swing (SS), drain-induced barrier lowering (DIBL), and power-delay product (PDP), and to examine how latest advancements in devices promote environmentally conscious design.

The methodology involves reviewing comparative performance data and experimental trends reported across recent nanoscale transistor studies. Emphasis is placed on electrical parameter analysis rather than structural modeling, evaluating improvements in current drive, leakage reduction, and power optimization under advanced technology nodes. Results indicate that GAA and 2D FETs demonstrate superior gate controllability, lower leakage currents, and reduced dynamic power consumption, supporting sustainable low-voltage operation. Additionally, the ntegration of eco-friendly channel materials, such as transition metal dichalcogenides (TMDs) and graphene, reduces process-related carbon footprint and toxic waste generation. Overall, the findings highlight that the emerging trends in FET electrical behavior enable highspeed, low-power device performance and also align with global efforts toward green and energyefficient semiconductor technology for AI, IoT, and edge applications.

Keywords: FinFET, GAA,, Low Power Devices, Sustainability, Eco-efficient semiconductor

ISBN No 978-81-986231-0-2

Green Synthesis of ZnO Nanoparticles for Application in Photocatalysis and Cosmetics

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DP-52

Abstract

The objective of this research was to develop ZnO nanoparticles (NPs) for future use in cosmetics by employing a green method approach using various plant extract as a stabilizing and reducing agent. As-synthesized NPs were characterized by XRD to determine their crystalline structure, SEM to analyze morphology and UV-Vis spectroscopy to verify their optical characteristics. The as-synthesized metal oxide NPs were found favorable physicochemical properties for photocatalysis and cosmetic compositions. The technique and characterization validate the stability and successful development of the nanoparticles, proving that employing plant extract for their green synthesis is feasible. This strategy illustrates how metal oxide NPs made from plants can be used into cosmetics and photocatalysis of industrial waste water to support sustainability.

Keywords: Green Synthesis, Nanoparticles, Zinc Oxide, Cosmetics, Photocatalysis.

ISBN No 978-81-986231-0-2

Synthesis of biodiesel using waste cooking oil with sulfonated walnut biochar as a catalyst

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DP-53

Abstract

The primary objective was to achieve sustainable production of biodiesel via transesterification of waste cooking oil using a highly acidic, heterogeneous solid catalyst from waste walnut shells. This approach promotes both renewable energy generation and waste minimization, aligning with Green Chemistry principles. Walnut shells were converted to biochar via pyrolysis at 400°C. The resulting carbonaceous material was sulfonated using concentrated sulfuric acid to anchor strong acidic −SO3H groups, creating the sulfonated WSBC catalyst. The catalyst's structure and functional groups were verified by FTIR, XRD, and SEM analyses. The catalyst was tested in the transesterification of WCO with methanol, and reaction conditions were optimized. The sulfonated walnut shell biochar proved to be a highly effective, reusable solid acid catalyst, eliminating the need for corrosive liquid acids. Optimized conditions—5 wt% catalyst concentration, 12:1 methanol-to-oil molar ratio, and 60°C temperature—resulted in a maximum biodiesel yield of 90%. Characterization confirmed the preservation of the biochar's porous structure and the successful incorporation of catalytic −SO3H sites. The final biodiesel quality met general international standards, demonstrating the method's potential for sustainable, industrial-scale biofuel production from two distinct waste streams.

Keywords: Walnut Shell, Sulfonated Biochar, Waste Cooking Oil, Transesterification, Biodiesel.

ISBN No 978-81-986231-0-2

Role of Artificial Intelligence and Machine Learning in Accelerating Green Chemistry

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DP-54

Abstract

Objectives:
The primary objectives of this study are:-
(1) To review the application of AI/ML models in predicting the toxicity and environmental impact of novel molecules, facilitating a "benign-by-design" approach.
(2) To investigate how machine learning accelerates the discovery and design of efficient, selective, and sustainable catalysts.
(3) To demonstrate the utility of AI in optimizing chemical reaction pathways to maximize yield while minimizing waste and energy consumption.

Methodology: This work is based on a systematic review of contemporary peer-reviewed literature, industry case studies, and conference proceedings. The methodology involves analyzing computational strategies, including Quantitative Structure-Activity Relationship (QSAR) models, generative algorithms for catalyst design, and reinforcement learning for process optimization, and their real-world applications.

Results: The findings confirm that AI/ML models are significantly enhancing the accuracy and speed of predictive toxicology, reducing the need for extensive animal testing. In catalysis, machine learning has proven effective in rapidly screening vast libraries of potential materials to identify novel, earth-abundant catalysts. Furthermore, AI-driven platforms for reaction optimization have demonstrated quantifiable success in reducing solvent usage, lowering energy inputs, and improving atom economy, thus bridging the gap between computational theory and practical, sustainable chemical manufacturing.

ISBN No 978-81-986231-0-2

Sustainable Remediation of Microplastics in Aquatic Ecosystems

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DP-55

Abstract

The Aim of the study is to evaluate the extent of microplastics (MP) contribute to waste water ecosystems and determine different kinds of sustainable and environment-friendly methodologies capable of efficiently removing MPs from river and wastewater systems. This study combines and examines data from major rivers all over the world which includes the Thames (UK), the Rhine (Europe), and the Yangtze (China), that have been found to have MP concentrations of more than 84,000 particles per m^3 and the discharge of up to 10 tonnes annually into marine systems. Four major polymer types were found to be predominant in the rivers: polyethylene (PE), polypropylene (PP), polystyrene (PS), and polyethylene terephthalate (PET). While the verified conventional wastewater treatment plant (WWTP) technologies, such as primary sedimentation, secondary biological treatment, and tertiary filtration, also carried out the evaluation of efficacious treatment by advanced sustainable alternatives that were represented by the following: biochar-based adsorption, coagulation–flocculation using natural coagulants (chitosan, moringa seed extract), nanomaterial-assisted membrane filtration, and biopolymer systems from agricultural waste. The study found that Plant-based adsorbents like banana peel biochar, rice husk biochar, coconut coir, and dried algal biomass (Chlorella/Spirulina) were used to treat microplastics. The adsorbents were washed, dried, and pyrolyzed or biologically activated. Batch adsorption or column experiments were used to treat the contaminated water, resulting in 73–97% microplastic removal.

Keywords: Microplastics, Aquatic Ecosystems, Sustainable Remediation, Biochar Adsorption, Coagulation–Flocculation, Nanomaterials, Wastewater Treatment, Green Chemistry

ISBN No 978-81-986231-0-2

Integrating Green Processes for Sustainable Industrial Development: A Multisectoral Perspective

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DP-56

Abstract

The escalating environmental challenges and depletion of natural resources have necessitated the global transition toward sustainable and eco-efficient technologies. Green processes represent a strategic framework that minimizes environmental impacts by optimizing resource utilization, reducing hazardous emissions, and promoting renewable feedstocks across industrial sectors. In the energy sector, these processes incorporate biofuels from biomass and animal waste, hydrogen-based energy systems, and renewable power sources such as solar, wind, and hydroelectric energy to decrease fossil fuel dependency and greenhouse gas emissions. Within the chemical and pharmaceutical industries, the principles of green chemistry and biocatalysis reduce toxic waste generation, optimize solvent selection, and enhance the sustainability of drug synthesis. The agricultural sector benefits from the integration of biofertilizers, biopesticides, and precision farming methods that sustain productivity while preserving soil and ecosystem health. In the waste management domain, green technologies facilitate waste-to-energy conversion, recycling, and the valorization of industrial by-products. Furthermore, the food, textile, construction, and healthcare industries are increasingly employing biodegradable materials and circular economy models to mitigate their ecological footprints. Collectively, these advancements demonstrate that the implementation of green processes across sectors not only safeguards environmental integrity but also promotes economic resilience and supports long-term sustainable development.

Keywords:
Green chemistry, sustainable development, renewable energy, biocatalysis, waste valorization, circular economy.

ISBN No 978-81-986231-0-2

From Leaf to Wrap: Extraction and Application of Aloe Vera Gel in Packaging and Coating

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DP-57

Abstract

Aloe vera gel offers a sustainable packaging solution due to its biocompatibility and antimicrobial properties. This study developed and improved bioactive, biodegradable films and coatings from fresh aloe vera gel using green chemistry principles. The gel was extracted, optimized for temperature, and purified to remove aloin. Resulting films and coatings were tested for tensile strength, moisture resistance, and antimicrobial effectiveness. The aloe vera-based films were transparent, flexible, and effectively prevented spoilage, suggesting a non-toxic, eco-friendly alternative to synthetic packaging. This work highlights a green processing method that reduces chemical and energy use while enhancing the practical application of aloe vera biopolymer films.

Keywords:
Aloe vera gel, Bioactive packaging, Anti-microbial coating, Green Chemistry

ISBN No 978-81-986231-0-2

Harnessing Nature via Nature-Driven Nanotechnology: Greener synthesis of Silver and Iron Sulfide Nanoparticles from Phyto and Myco extracts

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DP-58

Abstract

Nanoparticle biosynthesis is thought to offer opportunities for a wide range of biological uses. The green process of turning biological waste into utilizable products gaining attention due to its economical and eco-friendly approach in recent years. This project explored the ability of plants and fungal extract to the greener synthesis of non-toxic, stable, small-sized Silver and Iron Sulphide nanomaterials without any toxic reducing agent utilizing the phytochemical components present in its structure. The plants extracts and fungal extract we used exhibits medicinal properties, so the biosynthesis of Silver and Iron Sulphides nanomaterials using these extracts may leads to the good results in the biomedical domain, especially in cancer treatment. NMs may now be made using three different methods, including chemical, physical, and biological ones. Unlike conventional chemical or physical methods, this greener synthesis avoids hazardous materials, requires no heating, and is cost-effective. In this research nano sized Silver and Iron Sulfide nanomaterials were successfully synthesized via chemical precipitation method. However, different routes and methods have been developed to synthesize the nanomaterials; such as solvothermal process, polyol mediated process, microbial synthesis, hydrothermal synthesis, sulfurization of hematite nanowires and chemical precipitation method. The nanomaterials synthesized can be probed as potential therapeutic agents for various biomedical applications. Characterization was done via Dynamic Light Scattering (DLS) for particle size and UV-Vis spectrophotometry for optical properties. Future work includes studying their catalytic activity and biomedical applications in collaboration with microbiology and biomedical science departments.

KEYWORDS:
Iron Sulphide Nanomaterials, Silver Nanomaterials, Characterisation, Biomedical Domain, Cancer Treatment.

ISBN No 978-81-986231-0-2

Biodegradable Polymers for Sustainable PCBs

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DP-59

Abstract

The printed circuit board (PCB), serving as an intermediary between physical components and intricate electrical designs, physically supports and connects various electronic devices for constructing sophisticated systems. Among all commonly used substrates for both insulation and structural integrity within printed circuit boards, FR4, which is a composite of fibreglass reinforced in a polymer matrix, is unique and used on a large scale[1]. It exhibits high strength and rigidity, high melting point and low moisture absorption, which makes it perfect for PCB designing[1]. However, with rising global e-waste levels, the disposal of PCBs poses significant challenges, as they are harmful to the environment, difficult to recycle, and resource-intensive. Conventional methods for recycling components in PCBs often exhibit poor efficacy due to demanding procedures like thermal treatments and intense pressures. Thus, eco-friendly alternatives such as polylactic acid (PLA) and polyhydroxybutyrate (PHB) are explored in this work. These two polymers are not only 100% biodegradable and compostable but also easy to mold and print, and are resistant to many organic solvents[1,2]. However, these two biopolymers find application in low-power circuits owing to their low melting points of about 130–180 ◦ C for PLA, and 170–180 ◦ C for PHB, respectively, so they cannot withstand the high-temperature soldering process (up to 260 ◦ C)[1,4]. Thus, these polymers lack adequate thermal insulation, resulting in diminished structural integrity and increased susceptibility to moisture ingress relative to standard FR-4 substrate material. This review involves a comparative analysis based on existing research studies focusing on the mechanical and thermal performances of PLA and PHB. The objective of this study is to show that by combining PLA and PHB with additives such as cellulose nanocrystals to improve thermal resistance[2,4], along with fibres like jute or hemp for enhanced tensile properties[3] and glass/carbon fibres for increased stiffness and reduced water absorption[3], this composite material could serve as an environmentally friendly substitute for conventional FR-4 circuit boards in applications requiring significant electrical conductivity.

Keywords: Polylactic acid (PLA), Polyhydroxybutyrate (PHB); Printed Circuit Boards (PCBs), flame-retardant-4 (FR4)

ISBN No 978-81-986231-0-2

Biochar-Based Green Catalyst Derived from Banana Peel/Walnut Shell for Effective Water Treatment

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DP-60

Abstract

The discharge of toxic dyes and organic pollutants into water bodies has become a serious environmental issue, necessitating a sustainable and efficient remediation method. In present study, biochar-based green catalysts were synthesized from banana peel and walnut shell, two abundant agricultural wastes, through controlled pyrolysis.
These pollutants, prevalent in wastewater from industries such as textiles, leather, paper and electroplating pose significant environmental and health risk. The obtained biochars were acid –activated to enhance surface functionality, porosity, and active sites. The physicochemical properties of the prepared catalyst were characterized using FTIR, BET, and SEM analyses, confirming the development of highly porous structure with abundant oxygen-containing functional groups. The presence of hydroxyl (-OH), carboxyl (-COOH), and carbonyl (-C=O) functional groups enhances their ability to bind pollutants through adsorption mechanisms.
This study demonstrates that banana peel and walnut shell-derived biochars can serve as efficient, low–cost, and environmentally benign catalysts for wastewater treatment. The findings highlight the dual advantage of biowaste valorization and green environmental remediation, offering a sustainable approach for addressing water pollution challenges.

Keywords: Biochar, Green catalyst, Banana peel, Walnut shell, Acid activation, Dye degradation, adsorption, valorization, wastewater treatment

ISBN No 978-81-986231-0-2

The role of green marketing strategies in promoting sustainable chemistry-based products. Bridging academia, industry and consumer awareness

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DP-61

Abstract

Sustainability and green chemistry are currently high on global developmental agenders, but the widespread adoption of the two is largely dependent on how successfully they are marketed. The study looks at the green marketing strategies used for promoting products and processes thriving from green chemistry. Essentially the focus is to bring innovations from science to industries for acceptance in the market. In this paper we have analyzed the factors of consumer awareness, eco-labeling, and company social responsibility initiatives and their influence towards purchasing patterns and brand loyalty. Case studies have also been presented from FMCG and pharmaceutical industries under which green chemistry is marketed by companies. The research reveals transparent communication, third party certifications, and consumer-centric campaigns to be prime contributors towards trust and acceptance of eco-friendly products. Challenges in Premium Pricing Consumer skepticism stemming from greenwashing, coupled with limited knowledge about green products, are being discussed alongside the antagonistic countermeasures. The study emphasizes the need for inter-academic, industry, and green-marketing-campaign collaboration not only to highlight environmental benefits but simultaneously to provide a direct value proposition for consumers. Green chemistry should, therefore, take advantage of scientific innovation and strategic marketing to gain greater prominence and thereby influence the undertaking of the United Nations Sustainable Development Goals. The research shows that integration of sustainability into marketing is not just propriety but a potent creator of competitive edge and long-term consumer engagement.

Keywords: Green marketing, green chemistry, consumer behavior, sustainable development, academia, Industry collaboration.

ISBN No 978-81-986231-0-2

Harmonizing Health and Environment: The Role of Regulatory Frameworks in Integrating Green Concepts into the Pharmaceutical Industry

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DP-62

Abstract

Objectives
This abstract aims to:
1. Analyse the mechanisms through which major regulatory bodies (e.g., FDA, EMA, ICH) currently encourage or enforce the application of green principles in drug development.
2. Promote green policies.
3. Challenges and benefits of implementing these concepts.
4. Ensure product quality and accessibility, while using green adoption

Methodology
This qualitative study examines academic literature, regulatory guidelines, industry reports, and pharmaceutical case studies. It uses analysis to explore policy documents and implementation strategies, identifying barriers like costs, regulatory complexity, as well as best practices for green policies.

Results
Regulatory frameworks of food and drug agencies and environmental protection agencies, controls processes for drugs development and packaging and waste handling. However, inconsistent global regulations and pharmaceutical exemptions are causing difficulties. The incentives (e.g., "greener" tendering, streamlined approvals) are more effective than harsh penalties.

Conclusions
Adopting green policies in the pharmaceutical sector require global regulatory framework that promotes innovation.

Keywords
Green Concepts, Regulatory Frameworks, Pharmaceutical Industry, Sustainable Development Goals (SDGs), Waste Minimization.

ISBN No 978-81-986231-0-2

Biomass Derived Activated Carbon for Photocatalysis of Organic Dyes: A Sustainable Approach

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DP-63

Abstract

Rapid Industrialization and resulting generation of hazardous pollutants have become a great concern to protect human health and ensure environmental sustainability. Among these pollutants, organic dyes being used in various industries are particularly harmful. Due to complex structures, these dyes are difficult to degrade and pose a serious threat to the environment. It therefore becomes important to design effective methodology and efficient materials for degradation of organic dyes. In recent years, conversion of biomass waste into useful carbonaceous materials is attracting attention to various applications ranging from energy to the environment. Excellent physicochemical properties including tunable morphology, good conductivity, porosity, high surface area and naturally abundant nature make them potential candidates for photocatalytic applications. The present paper highlights the recent progress in valorization of plant-based biomass in activated carbon for the photocatalytic degradation of organic dyes. The work discusses the advancements in synthesis protocols, characterization, and activation of biomass derived carbon materials using different activating agents. The effect of biomass precursors, activation methods, and influencing factors such as temperature, pH, initial dye concentration, and photocatalyst concentration on the photocatalytic efficiency of activated carbon are also discussed. Further, potential applications of activated carbon for photocatalysis of organic dyes are systematically reviewed and analyzed.

Keywords: Activated Carbon; Photocatalysis; Water Remediation; Biochar; Organic Dyes

ISBN No 978-81-986231-0-2

PVDF intergrated SnS_2,$SnSe_2$ and their heterostructures (SnS2/SnSe2) based nanocomposties for enhanced piezocatalyitc and photocatalytic dye degradation

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DP-64

Abstract

In recent years it has been observed that piezocatalysis has gained wide attention since it can directly convert mechanical energy from the environment. Industrial and synthetic dyes are the root cause of rapid rise in water contamination and chemical environmental pollution which makes it unsafe for human use and consumption. Due to this, there is a dire need for sustainable water purification methods. In this study, we focus on Tin based 2D dichalcogenides materials such as SnS_2, $SnSe_2$ and their heterostructures (SnS_2/$SnSe_2$) for dye degradation in water treatment applications using piezocatalysis. These materials and their heterostructure were initially prepared in powder form and were synthesised using hydrothermal method. PVDF films incorporated with varying weight percentages of synthesized SnS_2,$SnSe_2$ and their heterostructures (SnS_2/$SnSe_2$) powder were prepared using a drop casting method. The enhanced beta phase formation and structural analysis was confirmed through FTIR spectroscopy. We confirmed the formation of electroactive beta phase in PVDF using FTIR spectroscopy for the heterostructures which was maximum and was found to be 76 % . Along with that, the structural and morphological inclusion of SnS_2, $SnSe_2$ and their heterostructures was confirmed using X-ray diffraction (XRD) pattern. These films will be subjected to ultrasonic treatment and will demonstrate piezocatalytic degradation of dyes like Methylene Blue and Rhodamine B. Therefore, this comparative study provides insights into making environmental friendly piezocatalytic materials for self powered waste water treatment applications.

Keywords: Piezocatalysis, Tin Chalcogenides (SnS_2, $SnSe_2$), PVDF Composites, Dye Degradtion

ISBN No 978-81-986231-0-2

Advancing Eco-Efficient Processes Across Pharmaceutical, Fragrance, and Agrochemical Sectors

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DP-65

Abstract
Growing environmental concerns and the urgent need for sustainable industrial operations have accelerated the adoption of green methodologies across the pharmaceutical, perfumery, and agrochemical sectors. Green chemistry provides a foundational framework for designing processes that minimize waste generation, reduce toxicity, enhance energy efficiency, and promote the use of renewable and biodegradable resources. In the pharmaceutical industry, eco-efficient strategies such as solvent-free synthesis, biocatalysis, microwave-assisted reactions, and flow chemistry improve atom economy, shorten reaction times, and significantly reduce hazardous by-products. These innovations not only improve process safety but also align with regulatory requirements for sustainable drug development.
The perfumery sector is transitioning from conventional solvent-based extraction toward environmentally benign techniques, including supercritical fluid extraction, ultrasonic extraction, and enzymatic biotransformation. These methods yield higher product purity, lower volatile organic compound emissions, and reduce overall environmental impact. Similarly, the agrochemical industry is integrating biodegradable pesticides, bio-based formulations, precision delivery systems, and green nanotechnology to maintain crop productivity while safeguarding soil, water, and ecosystem health. The use of controlled-release formulations and microbial-based pesticides further enhances sustainability and reduces resistance development.
Collectively, these industries are moving toward circular economy models and sustainable production systems that optimize resource utilization, lower carbon footprints, and comply with global environmental regulations. The adoption of life cycle assessment (LCA) and green metrics enables better evaluation of process sustainability. Overall, the key principles, recent technological advancements, and future prospects of green methodologies highlight their pivotal role in transforming traditional industrial practices into cleaner, safer, and more resilient systems that support long-term sustainable development.

Keywords:
Green chemistry, sustainable technologies, biocatalysis, green extraction, bio-based formulations, environmental stewardship.

ISBN No 978-81-986231-0-2

Study of sustainable biosorbents from plant residues for Pharmaceutical Water Pollution Mitigation

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DP-66

Abstract

Pharmaceutical contaminants in water bodies have become a pressing environmental concern due to their potential toxicity and bioaccumulation. The work aims to explore activated carbon derived from agricultural wastes as an eco-friendly, cost-effective, and potent biosorbents for removal of various pharmaceutical contaminants from water. The main objectives were to derive activated carbon from plant residues through slow pyrolysis. The study focussed on production methods, physiochemical properties and characterisation through various techniques like FTIR and BET. The agricultural wastes were dried, grinded and sieved to obtain a fine powder. The powder was then oven dried and subjected to slow pyrolysis. Batch adsorption experiments were conducted at different concentrations, pH, and time intervals. The samples were characterised through FTIR and BET for further analysis. The findings revealed that the agricultural waste activated carbon worked considerably well in removing pharmaceutical contaminants and further in pollution mitigation.

Keywords: Activated carbon, pharmaceutical contaminants, pollution mitigation, biosorbents

ISBN No 978-81-986231-0-2

Biofuel – The Future of Green Air

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DP-67

Abstract

Maximum bio-fuels cast-off as transport fuel however, they will also be used for heating and electric power generation. Gaseous fuels made from biomass that are used directly as a fuel or can be altered to liquid fuels may meet the requirements that are used by administration offices that retail and practice befouls. Typical words used for various kinds of bio-fuels varies between government offices and inducement programs, industries, marketing cell efforts and other areas of cataloguing term biofuels can precede the type of and the usage of fuel with Bio i.e., Biodiesel or Bio jet, other terminology used are “Alternative”, “Clean”, ‘Advanced”, “Green”, “Renewable”, “low Carbon Emission”, “Sustainable.

ISBN No 978-81-986231-0-2

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ISBN No 978-81-986231-0-2

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