PROCEEDINGS OF 3RD INTERNATIONAL CONFERENCE

INNOVATION IN SCIENCE AND TECHNOLOGY FOR SUSTAINABLE DEVELOPMENT 3.0 (ISTSD 3.0-2026)

12th - 14th March 2026 (Hybrid Mode)

ISBN: 978-93-47587-07-8

Maharishi University of Information Technology, Lucknow, Uttar Pradesh, India

Jointly Organised by

Maharishi School of Sciences & Maharishi School of Pharmaceutical Sciences

Maharishi University of Information Technology, Lucknow, Uttar Pradesh, India

National Collaborators

National Environmental Science Academy (NESA), New Delhi, India

International Collaborators

Glorious Vision University, Ogwa, Edo State, Nigeria, West Africa

Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka

International Strategic Centre for Agri-Food Development (ISCAD), Uzbekistan

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Bhumi Publishing, Kolhapur, Maharashtra, INDIA

3rd International Conference

on

"Innovation in Science and Technology for Sustainable Development 3.0-2026 (ISTSD 3.0-2026)"

Organised by: Maharishi School of Sciences & Maharishi School of Pharmaceutical Sciences

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Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka

International Strategic Centre for Agri-Food Development (ISCAD), Uzbekistan

12th - 14th March 2026

About the Conference

The 3rd International Conference on Innovation in Science and Technology for Sustainable Development (ISTSD 3.0–2026) will be held in hybrid mode from 12–14 March 2026, jointly organized by MUIT Lucknow and leading national and international institutions from India, Nigeria, Sri Lanka, and Uzbekistan. Set against pressing global challenges—such as climate change, biodiversity loss, food and water insecurity, public health issues, digital divides, and energy disruptions—the conference aims to promote interdisciplinary and international collaboration. Aligned with key UN Sustainable Development Goals (SDGs), ISTSD 3.O–2026 will serve as a global platform for academics, researchers, industry leaders, policymakers, and practitioners to advance innovative, scalable, and inclusive solutions. Adopting a "3.O" approach, the conference emphasises digital transformation, green and circular economy models, sustainable agri-food systems, and inclusive technologies to bridge the gap between scientific innovation and real-world impact, fostering a resilient and sustainable future.

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Highlights of the Conference

- Technical Sessions & Knowledge Sharing
- Plenary & Invited Lectures
- Scientific Presentations
- Conference Proceedings
- Industry & Research Showcase
- Awards & Recognition
- Networking & Collaboration

Themes of the Conference

The ISTSD 3.O will cover a wide range of interdisciplinary themes that emphasize innovation, sustainability, and future-ready solutions, with special focus on the role of biological sciences in achieving global goals. The scope of this conference includes but is not limited to the following:

- **Theme 01:** Climate Change, Biodiversity and Environmental Sustainability (SDG 13, SDG 15)
- **Theme 02:** Sustainable Agriculture, Food Systems and Blue Economy (SDG 2, SDG 12, SDG 14)
- **Theme 03:** Clean Energy, Green Technologies and Circular Economy (SDG 7, SDG 9, SDG 12)
- **Theme 04:** Water Resources, Sanitation and Waste Management (SDG 6, SDG 11)
- **Theme 05:** Health, Pharmaceutical Sciences and One Health Approach (SDG 3)
- **Theme 06:** Digital Transformation and Emerging Technologies for SDGs (SDG 9, SDG 17)
- **Theme 07:** Sustainable Cities, Infrastructure and Disaster Resilience (SDG 11, SDG 9)
- **Theme 08:** Education, Policy, Governance and Partnerships for Sustainable Development (SDG 4, SDG 16, SDG 17)

Call For Abstract

All the participants and presenters for oral and poster presentations are requested to submit an Abstract of about 300 words through email *info.istsd2026@gmail.com.

Abstract Submission Guidelines

- **Length:** Maximum 300 words
- **File format:** MS Word (.doc/.docx)
- **Font:** Times New Roman
- **Title:** Capital, Bold, Font size 14
- **Author(s):** Bold, presenting author underlined (Font size 12)
- **Affiliation:** Complete institutional address with email of corresponding author
- **Alignment:** Title & Author details center aligned
- **Keywords:** Italics, Bold, Font size 10 (maximum 5 keywords)
- **Text:** Justified, single line spacing, margins of 0.5 inch on all sides

Proceedings & Publications

- All accepted abstracts will be published in the Conference Souvenir (with ISBN).
- Selected peer-reviewed, high-quality research papers will be recommended for publication in special issues of internationally reputed journals, published by leading global publishers such as Taylor & Francis, Springer, Bentham Science, Tech Science Press, and MDPI, focusing on emerging themes in sustainability, technological advancement, and innovation.
- Some selected full-length papers may also be considered for book chapter publication with Taylor & Francis, following standard peer-review and publication norms.
- The high-quality papers will be accepted till 5th March 2026.

Scan Now to apply

IMPORTANT DATES

Conference Dates	12th - 14th March 2026
Last date of Abstract submission	28th February 2026
Notification for Acceptance	2nd March 2026
Last date for Registration (without abstract)	10th March 2026

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ISCAD The International Strategic Center for Agri-Food Development

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About the Organizers

Maharishi University of Information Technology

Maharishi University of Information Technology (MUIT), Lucknow, Uttar Pradesh, India, established under the MUIT Uttar Pradesh Act No. 31 of 2001 [Notification No. 573 dated 06 October, 2001], is a premier institution dedicated to providing quality education across a diverse range of disciplines. The university offers undergraduate, postgraduate, and doctoral programs in fields such as Science, Engineering, Management, Humanities, Commerce, Pharmacy, Law, Animation, Journalism & Mass Communication, and more. MUIT's vision is to transform the potentiality of each student into actuality and the full unfoldment of their mental potential through Creative Intelligence, enhancing employability and entrepreneurship potential. The mission focuses on facilitating education and training to help students grow into complete individuals who are physically enduring, emotionally mature, intellectually enlightened, aesthetically developed, morally sound, and spiritually inclined. The university's infrastructure supports interactive learning, with classrooms equipped with smart boards and digital projectors, fostering a dynamic learning environment. Additionally, MUIT emphasizes the development of life skills and provides career counseling to guide students in their personal and professional growth. MUIT's commitment to academic excellence and holistic development makes it a leading institution in the region, preparing students to meet the challenges of the modern world.

National Environmental Science Academy, New Delhi

The National Environmental Science Academy (NESA), New Delhi, India is a national-level organization dedicated to creating environmental awareness and promoting sustainable solutions. Conceived in 1984 by the late Prof. T. R. C. Sinha and registered under the Societies Act XXI of 1860 in 1988, NESA has been actively engaged in advancing environmental science and conservation initiatives. Headquartered in New Delhi, the Academy fosters environmental stewardship through the organization of international and national conferences, seminars, symposia, workshops, training programs, lectures, and scholarly publications. These activities aim to sensitize stakeholders and encourage scientific discourse on contemporary environmental challenges. NESA has been guided by several distinguished leaders, including Dr. K. C. Bose, Dr. B. S. Attri, and Padmabhushan Dr. S. Z. Qasim, a renowned marine scientist and former Secretary, Department of Ocean Development. Currently, Prof. Altaf Ahmad of the Department of Botany, Aligarh Muslim University, Aligarh, Uttar Pradesh, India is the President of National Environmental Science Academy, New Delhi, India

Glorious Vision University, Ogwa, Edo State, Nigeria, West Africa

Glorious Vision University (GVU), formerly Samuel Adegboyega University (SAU), is a leading Christian faith-based university in Africa established by The Apostolic Church, Nigeria (LAWNA Territory), with its main campus in Ogwa, Edo State and a branch campus in Lagos, Nigeria's economic and cultural hub. Officially recognized and 100% accredited by the National Universities Commission (NUC), Government of Nigeria, GVU is committed to holistic education with a mission focused on excellence in academics, entrepreneurship, and ICT-based professional certification. The University comprises four colleges—Basic, Applied and Health Sciences; Humanities; Management and Social Sciences; and Law—offering diverse undergraduate and postgraduate programs (PGD, M.Sc./M.A., and Ph.D., except Nursing Science) across disciplines including Microbiology, Computer Science, Biochemistry, Nursing Science, Management, Social Sciences, Humanities, and Law. GVU actively promotes academic and professional development through international conferences, seminars, science exhibitions, and invited lectures, with a vision to produce graduates distinguished by academic excellence, professional competence, moral integrity, and social responsibility.

Sabaragamuwa University of Sri Lanka, Belihuloya, Sri Lanka

Sabaragamuwa University of Sri Lanka (SUSL), located in the scenic environs of Belihuloya, is a rapidly growing multidisciplinary higher education institution recognized for its academic excellence, research innovation, and strong industry linkages. Established to address emerging national needs, the University offers diverse programs through faculties of Agricultural Sciences, Applied Sciences, Management Studies, Technology, Computing, Geomatics, Social Sciences and Languages, and Graduate Studies, supported by modern laboratories, field-based training, and a student-centered learning environment. SUSL actively promotes impactful research through initiatives such as Annual Research Sessions, competitive research grants, and specialized research centers, while its Centre for Open and Distance Learning (CODL) expands access to higher education via external degree and professional development programs. With a strong commitment to sustainability, community engagement, and quality assurance, SUSL plays a vital role in producing skilled graduates who contribute meaningfully to national and global development.

International Strategic Centre for Agri-Food Development (ISCAD), Uzbekistan

The International Strategic Centre for Agri-Food Development (ISCAD) was established by Presidential Decree in December 2021 under the Ministry of Agriculture of Uzbekistan. It serves as a national think tank and scientific hub dedicated to advancing research, strategic planning, and innovation in the agri-food sector. ISCAD plays a key role in developing evidence-based agricultural policies, improving research coordination, and strengthening the scientific foundations of national food security and sustainability programs. The Centre conducts multidisciplinary research on food safety, food security, climate change mitigation, soil health, and agricultural economics,

integrating modern scientific methods and data-driven analysis. It also leads large-scale national assessments, such as nutrition and food system studies, and supports projects aimed at agricultural mechanization, value chain development, and digital agriculture. Through these initiatives, ISCAD bridges science, policy, and practice, creating a platform where researchers, policymakers, and practitioners collaborate to design innovative solutions for sustainable agriculture. By promoting international partnerships and fostering scientific excellence, ISCAD strengthens Uzbekistan's position as a regional leader in agricultural research, innovation, and evidence-based policymaking.

About the Schools

The **Maharishi School of Sciences** at Maharishi University of Information Technology (MUIT) offers a wide spectrum of programs, including undergraduate (B.Sc. Hons.), postgraduate (M.Sc.), and doctoral (Ph.D.) degrees across disciplines such as Zoology, Botany, Physics, Chemistry, Mathematics, and Biotechnology. These programs are structured to promote analytical thinking and a profound understanding of both natural and formal sciences. Emphasizing research-driven learning, the curriculum equips students with the knowledge and skills needed to tackle contemporary scientific challenges.

Established in 2019, the **Maharishi School of Pharmaceutical Sciences** at MUIT strives to set high standards in pharmaceutical education. The school offers programs such as B. Pharm, D. Pharm, M. Pharm, and MPH, preparing graduates to contribute effectively to community health and the broader healthcare sector. Its curriculum combines a strong theoretical foundation with hands-on practical training. Both schools feature well-equipped infrastructure, smart classrooms, and state-of-the-art laboratories essential for advanced education and scientific research.

About the Conference

The 3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD3.0–2026)", jointly organized by the Maharishi School of Sciences and Maharishi School of Pharmaceutical Sciences, Maharishi University of Information Technology, Lucknow; the National Environmental Science Academy (NESA), New Delhi; Glorious Vision University, Ogwa, Edo State, Nigeria; Sabaragamuwa University of Sri Lanka (SUSL); and the International Strategic Centre for Agri-Food Development (ISCAD), Uzbekistan, will be held in hybrid mode from 12–14 March 2026. Against the backdrop of the current global SDG scenario, marked by climate emergencies, rising temperatures, extreme weather events, biodiversity decline, food and nutritional insecurity, water stress, public health challenges, post-pandemic economic recovery, digital divides, and geopolitical disruptions impacting energy and supply chains, the conference seeks to foster interdisciplinary and international collaboration to generate innovative, scalable, and inclusive solutions. Aligned with the United Nations Sustainable Development Goals (SDGs)—particularly SDGs 2 (Zero Hunger), 3 (Good Health and Well-being), 6 (Clean Water and Sanitation), 7 (Affordable and Clean Energy), 9 (Industry, Innovation and Infrastructure), 11 (Sustainable Cities and Communities), 12 (Responsible Consumption and Production), 13 (Climate Action), and 17 (Partnerships for the Goals)—ISTSD3.0–2026 is envisioned as a global platform for academicians, researchers, innovators, industry leaders, policymakers, and practitioners. The conference adopts a next-generation "3.0" approach that integrates multidisciplinary research, digital transformation (AI, IoT, data-driven solutions), green and circular economy models, sustainable agri-food systems, and inclusive technologies, with the goal of bridging the gap between scientific innovation and real-world impact, thereby accelerating progress toward a resilient, equitable, and sustainable global future.

Highlights of the Conference

- **Technical Sessions & Knowledge Sharing:** Interactive sessions on diverse domains of science and technology with a focus on sustainability and global challenges.
- **Plenary & Invited Lectures:** Talks by eminent international and national experts highlighting emerging trends, innovative research, and policy frameworks.
- **Scientific Presentations:** Oral and poster presentations by faculty, researchers, industry professionals, and students showcasing innovations and discoveries.
- **Conference Proceedings:** Publication of conference proceedings with ISBN, ensuring global academic visibility.
- **Industry & Research Showcase:** Exhibition of sustainable technologies, innovative tools, and solutions from industries, startups, and research institutions.
- **Awards & Recognition:** Best paper and poster awards across disciplines, along with Junior, Young, and Senior Scientist Awards to encourage excellence in research.
- **Networking & Collaboration:** Opportunities to build academic, industrial, and international collaborations for sustainable innovations.

Themes of the Conference

The ISTSD 3.O will cover a wide range of interdisciplinary topics under the mentioned themes that emphasize innovation, sustainability, and future-ready solutions in achieving global goals. The scope of this conference includes but is not limited to the following:

Theme 01: Climate Change, Biodiversity and Environmental Sustainability (SDG 13, SDG 15)
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- Some selected full-length papers may also be considered for book chapter publication with Taylor & Francis, following standard peer-review and publication norms.
- The high-quality papers will be accepted till 5th March 2026.
- **Guidelines for Publication :** https://docs.google.com/document/d/1cXOyFR50YyUir_nYvOsepvEI54pAj32ykruykTSoUNc/edit?usp=sharing

Guidelines for Presentations

Instructions for Poster Presentation: A poster should be prepared in such a way that the delegates are able to quickly read and grasp the idea. Hence, these should be visually appealing and legible. The contents should be easily readable.

- A poster should be of 3 ft x 5 ft in portrait orientation.
- Ensure the title is prominent at the top, followed by author names and affiliations.
- Organize content into sections: Introduction, Methods, Results, Conclusion.
- Posters will be displayed in the designated poster area throughout the conference.
- Mounting materials (e.g., tape or pins) will be provided.
- Poster number and spot will be assigned; please ensure your poster is displayed at the correct location.

Instructions for Oral Presentations: PowerPoint presentations will be made by the presenting author in a pertinent Scientific Session. Time duration for each presentation will be 5 min., including discussions, if any.

- Slide Preparation: Use Microsoft PowerPoint (.ppt/.pptx) or PDF, ensuring your slides are in widescreen (16:9). Aim for a maximum of 10 slides, including title and conclusion, utilize large, legible fonts and high-contrast colors to enhance readability.
- Presenters should submit their slides before their scheduled session to the technical team in both the format (ppt and pdf).
- Test your presentation with the technical team before the session to avoid last-minute issues.
- Please adhere strictly to your time slot to ensure smooth transitions between speakers.

The presenters should be available as per their sequence, failing which they would be disqualified.

Conference Awards and Honors

The Organizing Committee of ISTSD 3.O-2026 will confer the following awards during the conference:

1. ISTSD-2026 Best Oral (First, second and third) Presentation Award
2. ISTSD-2026 Best Poster (First, second and third) Presentation Award
3. ISTSD-2026 Best Abstract (Only one in each conference themes) Award
4. ISTSD-2026 Best Paper (Only one in each Theme of the conference) Award
5. ISTSD-2026 Best Innovation Award (UG/PG students only for Innovative Ideas or Models)
6. ISTSD-2026 Scientist & Research Excellence Award *
   - Junior Scientist Award: Eligibility criteria - Below 35 years.
   - Young Scientist Award: Eligibility criteria - Below 45 years
   - Woman Scientist Award: Eligibility criteria - Below 45 years
   - Scientist of the Year Award: Eligibility criteria - Above 45 years
   - Distinguished Scientist Award: Eligibility criteria - Above 50 years
   - Research Excellence Award: Eligibility criteria - Above 30 years with good publications

NOTE:

1. All attendees (participants) will receive participation certificates, subject to a minimum of 60% attendance and submission of the Feedback Form.
2. All presentations will be judged on parameters including adherence to time, verbal engagement with the audience, depth of content, and clarity of communication. The winners of all categories will be awarded during the valedictory function.

*Applicants will have to send their updated CV showcasing all publications and achievements, however, nomination will be done by our research committee and Jury members after screening based on their scientific contributions in the field.

Important Dates

Conference Dates	:	12th - 14th March 2026
Last date of Abstract submission	:	28th February 2026
Notification for Acceptance	:	02nd March 2026
Last date for Registration (without abstract)	:	10th March 2026

Registration

All participants should pay the registration fee and then register online using the Registration Link below:

https://forms.gle/ddcBEi2iKa4vpj839

Registration QR Code:

Registration Fee:

Category	Fee (Indian Delegates) INR (₹)	Fee (Foreign Delegates) USD($)	Fee (Foreign Collaborators) USD($)
Faculty	1000	15	10
Ph.D. Scholar	800	10	08
PG Student	600	08	05
UG Student	500	06	05
Industry Person	2000	22	-
Only participation (Without abstract) for all categories	500	05	05
Junior Scientist Award	2500	28	28
Young Scientist Award	3500	40	40
Woman Scientist Award	4000	45	45
Research Excellence Award	4500	50	50
Scientist of the Year Award	5000	55	55
Distinguished Scientist Award	6000	65	65

Participants/Delegates can make payment of the Registration Fee by these two modes:

Through Bank Transfer:
Bank Name- Yes Bank
A/C Number- 143288700000100
IFSC Code- YESB0001432
Branch- Yes Bank Ltd. First Floor F 7 DDA Market Dallupura Vasundhara Enclave, Delhi, 110096

OR

Through UPI ID: yespay.bizs.biz174688.ter1@yesbankltd

The last date of registration with the registration fee: 10th March 2026

ACCOMMODATION AND TRANSPORT

The participants should make their arrangements for stay and transportation. The organizing committee will guide or facilitate accommodation in nearby hotels if contacted in advance. Interested participants may email their requirements regarding the accommodation to info.istsd2026@gmail.com

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Organizing Secretary
- **Dr. Gaurav Saxena,** Joint Secretary, NESA, New Delhi, and Assistant Professor, Department of Life Science, Mandsaur University, Madhya Pradesh, India
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- **Mrs. Soumya Srivastava,** MSOPS, MUIT

How to Reach

Lucknow is well connected to all major cities in the country by air, railways and roadways. Maharishi University of Information Technology (MUIT), Lucknow is located on Sitapur Road (NH-30) and is easily accessible from Chaudhary Charan Singh International Airport (≈30 km) and Lucknow Junction/Charbagh Railway Station (≈20 km) by taxi, cab, or city transport.

About the City: Lucknow, the capital of Uttar Pradesh (India), is situated on the banks of the River Gomti in the historic Awadh (Oudh) region. Renowned for its rich cultural heritage, the city flourished as a major center of art, literature, music, and architecture during the 18th and 19th centuries under the patronage of the Persian-influenced Shia Nawabs. Famous for its refined tehzeeb (etiquette), Nawabi culture, beautiful gardens, poetry, classical music, and exquisite cuisine, Lucknow is widely known as "The City of Nawabs." It holds a special place in Indian history and is popular among scholars and students of South Asian culture. The sacred city of Ayodhya is located approximately 135 km from Lucknow. During the conference period, temperatures generally range from 12°C to 25°C. Further information about Lucknow is available at www.up-tourism.com.

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Proceedings of International Conference on Innovation in Science and Technology for Sustainable Development 3.O (ISTSD-2026)

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Proceedings of 3rd International Conference on Innovation in Science and Technology for Sustainable Development 3.O (ISTSD-2026)

Editors

Dr. Sneha Verma, Dr. Nidhi Srivastava, Prof. RGU Jayalal, Dr. Gaurav Saxena, Dr. Kingsley Erhons Enerijiofi

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PREFACE

It is with great pride and enthusiasm that we present the Proceedings of the **"3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.O (ISTSD 3.O - 2026)"**, scheduled from **12th to 14th March, 2026**, organized by the Maharishi School of Sciences & Maharishi School of Pharmaceutical Sciences, Maharishi University of Information Technology, Lucknow in collaboration with National Environmental Science Academy (NESA), New Delhi; Sabaragamuwa University of Sri Lanka, Sri Lanka; International Strategic Centre for Agri-Food Development, Uzbekistan and Glorious Vision University, Nigeria, West Africa.

The collection reflects the shared dedication of researchers and scholars to finding innovative solutions that improve human life and protect the environment. As technology and science evolve rapidly, these proceedings highlight how essential new ideas are for achieving global sustainability goals.

The conference covers diverse fields from life and agricultural sciences to chemistry, physics, and engineering, all focused on turning research into real-world solutions. We explored critical themes including climate resilience, sustainable food systems, clean energy, and water management. Discussions also spanned pharmaceutical breakthroughs under a "One Health" approach, digital transformation, and the need for disaster-resilient cities. By connecting academic theory with strong policy and governance, we aimed to build the partnerships necessary for a truly sustainable future.

We were joined by a diverse group of speakers, international delegates, students, and scientists from around the world. Through their presentations and the exchange of new ideas, participants worked together to push the boundaries of their respective fields and contribute to the event's central theme.

The response to the conference was excellent, with over 200 registrations and submissions. After the rigorous review, the best abstracts were selected for publication and presentation. We are also grateful to our distinguished national and international speakers for sharing their expertise and enriching the experience for everyone.

The proceeding is intended to be a helpful resource for anyone working to advance science and technology. We believe the research and practices documented here will inspire new discussions and lead to further progress in sustainable development.

It has been an honor to host the event and facilitate such productive interactions. We hope the conference sparks long-term collaborations that result in meaningful research and positive changes for society.

Finally, we want to thank all our contributors, participants, and organizers. Your hard work is what makes the continuous advancement of science and technology possible.

Editors

ACKNOWLEDGEMENT

We are thankful to everyone who has directly or indirectly contributed to bringing this document to its wholeness. We express our heartfelt gratitude to our Hon'ble Chancellor (Shri Ajay Prakash Shrivastava), Hon'ble DG (Prof. (Gp. Capt.) O. P. Sharma), Hon'ble Vice Chancellor (Prof. B. P. Singh), Hon'ble Registrar (Dr. Girish Chimmwal) for their continued guidance, encouragement and motivation in all our endeavours. We are immensely thankful to FO (Shri Varun Shrivastava) and Sr. AO (Dr. Rajesh Singh) for their unconditional support in providing all facilities and resources, including financial support, to bring out the proceedings. We are hugely thankful to all our Dean-Academics (Dr. Neeraj Jain), Dy Dean-Academics (Dr. Kalyan Acharjya), Dean-MSOS (Dr. Nishant Kumar), Dean- MSOPS (Dr. Pavan Kumar Kushwaha), Dy. Dean-MSOS (Dr. Kanchan Awasthi) and Dy. Dean- MSOPS (Dr. Nidhi Srivastava) and all the faculty members for their support and encouragement throughout the making of these Proceedings. We are deeply grateful to our esteemed speakers and participants, who contributed significantly to this Conference and the Proceedings. Their contribution is most valuable and highly encouraging. Last but not least, we are thankful to our publisher for their patience and support in the timely delivery of the Proceedings in its current form as you are perusing it now.

We want to express our deepest gratitude to everyone who showed their efforts and hard work in making this event a reality. A special thank you goes to our Scientific and International Convenors, whose leadership was really important: Prof. Altaf Ahmad (President, NESA, New Delhi), Dr. Kingsley Erhons Enerijiofi (Glorious Vision University, Nigeria), and Prof. Dilfuza Egamberdieva (National Research University, Uzbekistan). Their expertise provided the academic foundation for everything we achieved here.

We also want to recognize the tireless efforts of our Organizing Secretaries, Dr. Gaurav Saxena (Mandsaur University & NESA) and Dr. Adriel Ezoken (Glorious Vision University, Nigeria), for their seamless coordination and dedication behind the scenes.

Finally, this conference would not have been possible without the synergy of our valued partners. We are honored to have collaborated with the National Environmental Science Academy (NESA), New Delhi, as our national collaborator, alongside our international partners: Glorious Vision University (Nigeria), Sabaragamuwa University of Sri Lanka, and the International Strategic Centre for Agri-Food Development (ISCAD), Uzbekistan. Your collective support is what drives the continuous advancement of science and technology for a sustainable future.

About The Editors

Dr. Sneha Verma is presently serving as an Assistant Professor at Maharishi University of Information Technology, Lucknow. She is a distinguished academician specializing in fish reproductive biology, breeding, and toxicology, with over 13 years of research experience and 8 years of teaching expertise. She earned her doctoral degree from Babasaheb Bhimrao Ambedkar Central University, Lucknow. Dr. Verma has made significant scholarly contributions, including more than 25 research publications, 1 project, 4 patents, and 6 authored books. Her academic excellence has been recognized with several prestigious honors, including two gold medals and the Young Scientist Award.

Dr. Nidhi Srivastava is a Professor of Pharmaceutics at the Maharishi School of Pharmaceutical Sciences. She completed her Ph.D. in Novel Drug Delivery Systems from Jawaharlal Nehru University, New Delhi, in 2019. With over 11 years of research and 5 years of teaching experience, she has published 30+ research papers and book chapters, holds three Indian patents, and has secured ₹62 lakhs in research funding. She is a recipient of the CSIR-SRF (2011), Women Scientist Award (2017), and Outstanding Research Paper Award (2022), and has participated in more than 30 conferences.

Prof. R. G. Udeni Jayalal is a Professor in Lichenology and Forestry at the Faculty of Applied Sciences, Sabaragamuwa University of Sri Lanka. He holds a PhD in Lichenology and an MSc in Forestry and Environmental Sciences, specializing in lichen taxonomy and biodiversity conservation. His research primarily explores the use of lichens as bioindicators for environmental quality and air pollution. An established academic with extensive publications in international journals, Prof. Jayalal's work integrates molecular biology and plant biotechnology to address critical issues in forest ecology and environmental sustainability.

Dr. Gaurav Saxena is an environmental microbiologist and Assistant Professor in the Department of Life Science, Faculty of Life Sciences, Mandsaur University, Madhya Pradesh, India, where he also serves as Placement Coordinator. His expertise includes microbial ecology, bioremediation, wastewater treatment, and metagenomics. He has published extensively, earning over 4,400 citations with an h-index of 28. He is the recipient of the STE Water Award (2023) and multiple Young Scientist honors. Dr. Saxena has edited and authored several internationally published books, supervised numerous postgraduate and doctoral scholars, and actively contributes as an editor, reviewer, and academic leader in environmental sciences.

Dr. Kingsley Erhons Enerijiofi is an Associate Professor of Environmental and Public Health Microbiology, Glorious Vision University (formerly Samuel Adegboyega University), Ogwa, Nigeria. He obtained his PhD in Environmental and Public Health Microbiology from the University of Benin, Nigeria. With over 12 years of teaching and research experience, Dr. Enerijiofi has made significant contributions to the fields of environmental microbiology and public health. Dr. Enerijiofi has authored more than 90 scientific papers and book chapters indexed in Scopus and Web of Science. He also serves as President of the Nigerian Bioinformatics and Genomics Network and as Adjunct Faculty at Saveetha University, India.

About The University

Maharishi University of Information Technology

The Maharishi University of Information Technology (MUIT) was established under MUIT Uttar Pradesh Act No. 31 of 2001 Notification No. 573 dated 06 October, 2001. His Holiness Maharishi Mahesh Yogi Ji was the first Chancellor of the University. Presently, Shri Ajay Prakash Shrivastava is the Chancellor of the University. It has developed phenomenally since its inception to be recognized as a premier University in the country today. It offers Bachelor, Master and Doctoral programmes in one of the widest range of disciplines, including Science, Commerce, Management, Humanities, Pharmacy, Engineering, Animation, Media, Law and Enrichment Courses. The goal for every student is enlightenment the systematic development of full potential from within. This is the key to true fulfilment in daily life and any career.

Motto

"From Potentiality to Actuality through Creative Intelligence"

"भावातीत चेतना से समृद्धि"

This is the motto of our university. Every individual is being educated and trained to grow into a complete individual who is physically enduring, emotionally mature, intellectually enlightened, aesthetically developed, morally sound and spiritually inclined.

Vision

The vision of MUIT is to transform the potentiality of each student into actuality and the full unfoldment of their mental potential through Creative Intelligence. Enhancing the employability and entrepreneurship potential is the thrust focus in the vision of MUIT.

Mission

The Mission of the MUIT is to facilitate the process of education and training to let each student grow into a complete individual who is physically enduring, emotionally mature, intellectually enlightened, aesthetically developed, morally sound and spiritually inclined.

Transcendental Meditation

Creative intelligence is centered on Transcendental Meditation (TM), a straightforward process that helps you connect with your inner self to unlock your full potential. This technique is natural and effortless, allowing the mind to settle into a state of deep calm and "restful alertness". Regular practice ideally twenty minutes twice a day offers significant physical and mental health benefits, particularly for brain function, heart health, and stress reduction. At MUIT, this practice is an essential part of daily life for every student, faculty, and staff member, helping everyone tap into the creative energy they already possess.

About the School

Maharishi School of Sciences

The Maharishi School of Sciences at Maharishi University of Information Technology (MUIT) offers a wide spectrum of programs, including undergraduate (B.Sc. Hons.), postgraduate (M.Sc.), and doctoral (Ph.D.) degrees across disciplines such as Zoology, Botany, Physics, Chemistry, Mathematics, and Biotechnology. These programs are structured to promote analytical thinking and a profound understanding of both natural and formal sciences. Emphasizing research-driven learning, the curriculum equips students with the knowledge and skills needed to tackle contemporary scientific challenges.

Maharishi School of Pharmaceutical Sciences

Established in 2019, the Maharishi School of Pharmaceutical Sciences at MUIT strives to set high standards in pharmaceutical education. The school offers programs such as B. Pharm, D. Pharm, M. Pharm, and MPH, preparing graduates to contribute effectively to community health and the broader healthcare sector. Its curriculum combines a strong theoretical foundation with hands-on practical training. Both schools feature well-equipped infrastructure, smart classrooms, and state-of-the-art laboratories essential for advanced education and scientific research.

MESSAGE

Shri Ajay Prakash Shrivastava

Hon'ble Chancellor
MUIT

Innovation & Science & Technology go hand in hand.

Innovation leads to more & more ideas and a scientific approach gives these ideas a practical standing.

Sustainable Development is the need of the hour, any development which does more harm in the long run than benefits in the short-term can never be sustainable and thus can't be long-term.

It is very important that Creativity, Innovation, Science & Technology and Sustainability meet together.

I wish all the best to the conglomerate of thinkers who have come together for this conference and wish that this conference becomes the medium to bring about the transition from mere Development to Sustainable Development, where we don't just talk about Sustainable Businesses and Sustainable Development but also Sustainable Thinking, Sustainable Ideas and above all Sustainability of the Self through expansion of consciousness.

Jai Guru Dev

Ajay Prakash Shrivastava

Chancellor,
Maharishi University

MESSAGE

Prof. (Group Capt.) O. P. Sharma

Founder Director General
MUIT

It gives me immense pleasure to extend my warm greetings to all participants, researchers, academicians, and industry experts attending the *International Conference on Innovations in Science and Technology for Sustainable Development*.

In today's rapidly evolving world, the pursuit of scientific and technological innovation plays a crucial role in addressing global challenges such as climate change, resource depletion, environmental degradation, and sustainable economic growth. Conferences like this provide an invaluable platform for scholars and professionals to exchange ideas, present pioneering research, and collaborate on solutions that contribute to a more sustainable and resilient future.

The theme of this conference highlights the importance of integrating cutting-edge scientific research with practical technological advancements to promote sustainability across diverse sectors. By bringing together experts from different disciplines and regions, the conference fosters meaningful dialogue and encourages the development of innovative strategies that can positively impact society and the environment.

More importantly the focus ought to be on individual; personal and organizational sustainability with reference to SUSTAINABLE GOALS as promulgated by the UN in consideration of accelerated advancement of AI all over.

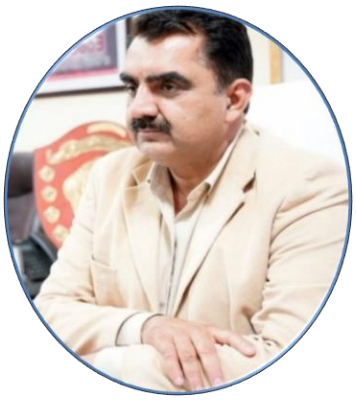
I extend my best wishes to all participants for productive deliberations and a rewarding academic experience.

Patron

MESSAGE

Prof. (Dr.) Bhanu Pratap Singh

Vice- Chancellor,
MUIT



It gives me immense pleasure to extend my warm greetings to all the distinguished dignitaries and participants of the *International Conference on Innovation in Science and Technology for Sustainable Development*. This conference brings together scholars, researchers, faculty members, students, and thought leaders from across the globe, creating an excellent platform to exchange ideas, share innovative solutions, and work collectively towards building a sustainable future.

In today's rapidly evolving world, where technological progress is accelerating and the need for sustainable development is more urgent than ever, the role of science and technology becomes extremely important. Innovations in these fields not only help address current global challenges but also pave the way for a more inclusive, responsible, and sustainable future for generations to come. This conference reflects the spirit of interdisciplinary collaboration and global cooperation, emphasizing the importance of using scientific knowledge and technological advancements to achieve the United Nations Sustainable Development Goals (SDGs). At Maharishi University, we strongly believe in fostering a culture of curiosity, research, and innovation. Through our academic programs, research initiatives, and collaborations with national and international institutions, we continuously strive to empower our students and faculty to contribute meaningfully to society and sustainable development.

I would also like to express my sincere appreciation to all the eminent speakers, panelists, and participants for being a part of this important event. Your commitment to knowledge, innovation, and research plays a vital role in shaping solutions for a better and more sustainable world. I sincerely hope that this conference will encourage meaningful discussions, inspire new ideas, and build long-lasting collaborations among researchers and institutions. Together, we can take significant steps toward advancing science and technology for the benefit of humanity and the planet.

On behalf of the entire university community, I wish you all a highly successful, productive, and enriching experience at this prestigious conference.

Vice Chancellor
Maharishi University

MESSAGE

प्रो. मुकेश पाण्डेय
कुलपति
Prof. Mukesh Pandey
Vice-Chancellor

बुन्देलखण्ड विश्वविद्यालय, झाँसी
BUNDELKHAND UNIVERSITY
JHANSI - 284 128 U.P. (INDIA)
State University of U.P.

NAAC A++ Accredited, PM-USHA (MERU), NIRF Ranked, ISO:9001-2015 Certified

Message from the Vice Chancellor

It gives me immense pleasure to extend my warm greetings to the organizers, participants, and distinguished guests of the **3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD3.0-2026)". I commend Maharishi University of Information Technology, Lucknow (Uttar Pradesh), National Environmental Science Academy, New Delhi, Glorious Vision University, Nigeria, Sabaragamuwa University of Sri Lanka, Sri Lanka, and International Strategic Centre for Agri-Food Development, Uzbekistan**, for jointly organizing this important international forum in hybrid mode from 12-14 March 2026. Such collaborative initiatives bring together intellectual resources from across the world and create opportunities for meaningful dialogue and knowledge exchange.

The global community is presently confronting with unprecedented challenges including climate change, biodiversity loss, water scarcity, food and nutritional insecurity, public health crises, and the pressing need for sustainable economic growth. In this context, the global framework of the United Nations**Sustainable Development Goals (SDGs)** provides a comprehensive roadmap for balancing environmental protection, social well-being, and economic development. Scientific innovation and technological advancement play a crucial role in accelerating progress toward key goals such as clean energy, sustainable agriculture, resilient infrastructure, responsible consumption, and climate action.

For a rapidly developing nation like India, the integration of science, technology, and sustainability is not only a necessity but also a strategic opportunity. India's commitment toward sustainable developmentthrough initiatives in renewable energy, digital transformation, green infrastructure, and sustainable agriculturedemonstrates the importance of research-driven solutions in addressing environmental and societal challenges. Universities and research institutions must therefore act as catalysts in promoting interdisciplinary research, innovation, and knowledge dissemination aligned with national and global sustainability priorities.

The theme of ISTSD3.0-2026 is highly relevant as it emphasizes next-generation approaches that integrate multidisciplinary science with emerging technologies such as artificial intelligence, data-driven systems, and circular economy models. These innovations hold great promise in strengthening sustainable agri-food systems, improving environmental management, and developing inclusive technologies that benefit society at large.

I am confident that this conference will inspire insightful discussions, promote collaborative research networks, and generate innovative ideas that will contribute significantly to global sustainability efforts. I extend my best wishes to the organizers for the successful conduct of ISTSD3.0-2026 and to all participants for productive deliberations and impactful outcomes.

Prof. Mukesh Pandey
Vice Chancellor

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MESSAGE

Dr. Uttam Kumar Sarkar

Former Director
ICAR-NBFGR

It is with great honour and anticipation that I extend a warm welcome to all attendees of the "**3rd International Conference on "Innovations in Science and Technology for Sustainable Development 3.0 (ISTSD 2026)"**, organized by the Maharishi School of Science and the Maharishi School of Pharmaceutical Sciences, Maharishi University of Information Technology (MUIT), Lucknow Campus, in collaboration with the National Environmental Science Academy, New Delhi; Glorious Vision University, West Africa; Sabaragamuwa University of Sri Lanka; and ISCAD, Uzbekistan. The conference will be hosted at the MUIT campus in Lucknow from **March 12–14, 2026.**

This conference comes at a pivotal time when the conservation and sustainable management of our natural resources—including soil, water, forests, and biodiversity—have become increasingly critical. The theme of this conference, focusing on the interconnectedness of interdisciplinary sciences and professional education with the Sustainable Development Goals (SDGs) in the context of climate change and emerging global challenges, is both timely and highly significant.

As we come together to exchange knowledge and insights, the deliberations on existing scientific knowledge and innovative technologies aimed at mitigating the impacts of climate change and enhancing sustainable agricultural productivity are expected to be both enlightening and transformative. Our collective goal is to strengthen scientific understanding and develop effective strategies for the sustainable management of our valuable natural resources.

I am particularly optimistic about the potential outcomes of this conference. The discussions and exchanges of ideas will not only generate advanced knowledge but also contribute to the development of policy support systems essential for the improved management and conservation of terrestrial and aquatic genetic resources.

I appreciate the efforts and dedication of the organizing committee in bringing together experts, researchers, academicians, and practitioners from diverse disciplines. I am confident that this conference will serve as an excellent platform for meaningful dialogue, collaboration, and innovation.

To all delegates and participants, I hope this conference provides opportunities for learning, networking, and inspiration. May the knowledge and insights gained from these deliberations guide us toward building a more sustainable, resilient, and environmentally responsible future.

Let us work together toward our shared goal of conserving natural resources for the prosperity of agriculture, biodiversity, and the global environment, ensuring a sustainable future for generations to come.

I look forward to productive and insightful discussions.

Best regards,

(U. K. Sarkar)

MESSAGE

National Environmental Science Academy
(Registered Under Society Act XXI of 1860)
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E-mail: infonesa88@gmail.com; nesapublications@gmail.com

10.03.2026

Message

It gives me immense pleasure to extend my warm greetings to all participants of the **3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD3.0-2026)"**, being organized in hybrid mode from **12–14 March 2026**. This conference is a collaborative initiative of **Maharishi University of Information Technology, Lucknow**, **National Environmental Science Academy (NESA), New Delhi**, **Glorious Vision University, Nigeria**, **Sabaragamuwa University of Sri Lanka**, and the **International Strategic Centre for Agri-Food Development (ISCAD), Uzbekistan**. Such international collaborations reflect a shared commitment to addressing the global challenges of sustainable development through innovation, interdisciplinary research, and technological advancement.

In the present era, the integration of scientific innovation with sustainable practices has become essential for safeguarding environmental resources and ensuring long-term societal well-being. Conferences like ISTSD3.0 provide an excellent platform for researchers, academicians, industry experts, and students from across the globe to exchange ideas, present their latest findings, and build collaborative networks aimed at advancing science and technology for a sustainable future.

I am confident that the deliberations, keynote lectures, technical sessions, and interactive discussions during this conference will significantly contribute to generating innovative solutions for pressing environmental and technological challenges. The participation of distinguished scientists and scholars from diverse disciplines will undoubtedly enrich the academic and research environment of this event.

On behalf of the **National Environmental Science Academy**, New Delhi, India, I congratulate the organizing institutions and committees for their dedicated efforts in hosting this important international scientific event. I extend my best wishes for the grand success of ISTSD3.0-2026 and hope that the outcomes of this conference will contribute meaningfully toward achieving sustainable development goals worldwide.

I wish all participants a highly productive and intellectually rewarding conference.

(Prof. Altaf Ahmad)
President
National Environmental Science Academy
Professor, Department of Botany
Aligarh Muslim University, Aligarh, U.P.

MESSAGE

National Environmental Science Academy
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10.03.2026

Message

It is a privilege to extend my warm greetings and best wishes to all participants of **Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD3.0-2026)**, being held from **12-14 March 2026** in hybrid mode. This important international conference, jointly organized by **Maharishi University of Information Technology, Lucknow (UP) India**, **National Environmental Science Academy (NESA) New Delhi, India**, **Glorious Vision University, Nigeria, West Africa**, **Sabaragamuwa University of Sri Lanka, Sri Lanka**, and the **International Strategic Centre for Agri-Food Development, Uzbekistan**, reflects a strong global commitment to advancing innovation-driven solutions for sustainable development.

At a time when the world faces pressing challenges such as climate change, biodiversity loss, water scarcity, and food insecurity, collaborative and interdisciplinary scientific efforts are more important than ever. The vision of this conference aligns closely with the **United Nations Sustainable Development Goals (SDGs)**, particularly those related to food security, clean water, sustainable energy, climate action, and global partnerships.

By bringing together scientists, researchers, innovators, policymakers, and industry leaders, **ISTSD3.0-2026** provides a valuable platform for sharing knowledge, fostering collaboration, and exploring transformative technologies such as artificial intelligence, data-driven solutions, and green innovations. I am confident that the discussions and collaborations during this conference will contribute meaningfully toward building a more sustainable, resilient, and inclusive future.

I congratulate the organizing institutions for their vision and dedication in creating this global forum and wish the conference great success.

G Saxena

(Dr. Gaurav Saxena)
Organizing Secretary
ISTSD 3.0-2026

MESSAGE

Dr. Girish Chimmwal
Hon'ble Registrar
MUIT

It gives me immense pleasure to know that the Maharishi School of Science and Maharishi School of Pharmaceutical Sciences in collaboration with national (National Environmental Science Academy (NESA), New Delhi) and international university (Sabaragamuwa University of Sri Lanka, Sri Lanka; International Strategic Centre for Agri-Food Development, Uzbekistan Glorious Vision University, Nigeria, West Africa is organizing the International Conference on "Innovation in Science and Technology for Sustainable Development 3.O-(ISTSD-2026)" at Maharishi University of Information and technology, Lucknow. Such academic events provide an excellent platform for researchers, academicians, industry experts, and students from different parts of the world to share their knowledge, innovative ideas, and recent advancements in their respective fields.

International conferences play a vital role in promoting academic excellence, interdisciplinary collaboration, and global networking. They encourage participants to exchange scientific insights and discuss contemporary challenges and opportunities in research and development. I am confident that this conference will significantly contribute to the dissemination of knowledge and inspire young researchers to pursue innovative research.

I sincerely appreciate the efforts of the organizing committee, faculty members, and students who have worked diligently to make this event possible. I also extend my warm welcome to all the distinguished speakers, delegates, and participants.

I wish the conference great success and hope that the deliberations and outcomes will lead to meaningful academic and research collaborations in the future.

Best Regards

MESSAGE

Professor R.G.U. Jayalal

Department of Natural Resources
Sabaragamuwa University of Sri Lanka
Sri Lanka

It is with great warmth and sincerity that I extend my greetings to everyone gathered for the Third International Conference on Innovation in Science and Technology for Sustainable Development (ISTSD-3) at Maharishi University, India.

As a Professor in the Department of Natural Resources at Sabaragamuwa University of Sri Lanka, I have had the privilege of working closely with issues that directly connect science, technology, and sustainability. Through teaching, research, and field engagement, I am constantly reminded that sustainable development is not just an academic theme, it is a shared commitment to safeguarding our planet and uplifting communities.

We are living in a time when innovation must be guided by responsibility. The environmental and societal challenges we face demand not only technical expertise, but also empathy, collaboration, and forward thinking. Conferences like ISTSD-3 are important because they create space for meaningful conversations, where experienced researchers and young scholars alike can exchange ideas, challenge perspectives, and inspire one another.

I deeply appreciate the dedication of the organizers, speakers, and participants who have come together to make this event possible. Your collective efforts reflect a genuine commitment to building solutions that are both innovative and sustainable.

May the discussions held here spark new partnerships, encourage bold ideas, and lead to research that makes a tangible difference in the world around us. I am confident that the knowledge shared during this conference will contribute positively to shaping a more resilient and sustainable future.

With sincere best wishes for the success of ISTSD 3.o- 2026.

Best Regards

MESSAGE

Dr. Neeraj Jain

Dean- Academics
MUIT Lucknow Campus

Jai Guru Dev!

I convey my greetings and best wishes to all our readers through this Proceedings of the "International Conference on Innovation in Science and Technology for Sustainable Development 3.0" (ISTSD 3.O). The conference serves as a dynamic platform for academicians, researchers, industry experts, and students to exchange ideas, share research insights, and deliberate on emerging innovations that contribute to sustainable development.

In the contemporary era, innovation in science and technology plays a pivotal role in addressing global challenges such as climate change, resource management, environmental sustainability, and inclusive economic growth. Conferences like this encourage interdisciplinary dialogue and collaborative research that can lead to meaningful solutions for these pressing issues.

I am delighted to note that the conference has attracted high-quality research contributions from scholars across various institutions and disciplines. The papers included in these proceedings reflect rigorous research, innovative thinking, and practical approaches toward achieving sustainable development through scientific and technological advancements.

I sincerely congratulate the organizing committee for their dedicated efforts in successfully organizing this academic event and compiling these valuable proceedings. I also extend my appreciation to all authors, reviewers, and participants whose contributions have made this conference a meaningful intellectual endeavor.

I am confident that the ideas and findings presented in these proceedings will inspire further research, promote collaboration, and contribute significantly to the advancement of knowledge in the field of sustainable development.

I wish the conference great success and hope that it continues to serve as a catalyst for innovation and academic excellence.

Best Regards

MESSAGE

Dr. Nishant Kumar

Dean
MSOPS, MUIT

I am delighted that the Maharishi School of Sciences and the Maharishi School of Pharmaceutical Sciences are organizing the **3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD 3.0–2026),"** scheduled from **12–14 March 2026.** I am delighted that a comprehensive Souvenir is being published to commemorate this significant global gathering.

In today's challenging global landscape, the theme of this conference is both urgent and highly relevant. By adopting a next-generation "3.0" approach that integrates multidisciplinary research, artificial intelligence, and green economy models, our shared goal is to align with the United Nations Sustainable Development Goals (SDGs) and bridge the critical gap between scientific innovation and real-world impact.

This event stands as a powerful testament to global collaboration. I extend my profound gratitude to our esteemed national and international co-organizers for their partnership in creating this vital platform for academicians, industry leaders, and policymakers.

I extend my heartiest congratulations to the organizing committee for their tireless efforts, and I warmly welcome all participating delegates. I wish the conference grand success and hope these deliberations pave the way toward a resilient, equitable, and sustainable future.

Best Regards

MESSAGE

Dr. Pavan Kumar Kushwaha

Dean
MSOPS, MUIT

It is with great pleasure and immense pride that I extend my warmest greetings to all the participants of the 3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.0 – ISTSD 2026", being held at Maharishi University of Information Technology, Lucknow.

This conference serves as a significant platform that brings together eminent scholars, researchers, academicians, and industry professionals from diverse disciplines. It provides a valuable opportunity to exchange ideas, share innovative research, and explore new perspectives that promote sustainable development through advancements in science and technology.

I would like to take this moment to express my sincere gratitude to our esteemed Chancellor, whose vision and continuous encouragement inspire excellence in education and research at our university. I am equally grateful to our respected Vice Chancellor, whose dynamic leadership fosters an environment of innovation, collaboration, and academic growth. My heartfelt thanks also go to our Director General for their strategic guidance and encouragement, and to the Registrar for their constant administrative support and dedication in ensuring the successful organization of this event.

I would also like to acknowledge the remarkable efforts of the Convener and the entire organizing committee, whose dedication and hard work have made this conference possible. I extend my sincere appreciation to all our distinguished speakers and participants for contributing their valuable expertise and insights.

In today's rapidly evolving world, the integration of science, technology, and sustainability is more important than ever. Conferences like this play a vital role in encouraging interdisciplinary dialogue and generating solutions that can positively impact society.

I am confident that the research presentations, discussions, and collaborations emerging from this conference will inspire new ideas, strengthen academic networks, and pave the way for innovative strategies that support sustainable development.

I wish all the participants a highly productive, enlightening, and successful conference.

Thank you and best wishes to everyone.

Best Regards

MESSAGE

Dr. Sneha Verma

Convenor, ISTSD 3.0-2026

MSOS, MUIT

It is my great pleasure to welcome all delegates, speakers, researchers, and participants to the **3rd International Conference on "Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD 3.0–2026)"**, being organized in hybrid mode from **12–14 March 2026**. The conference is jointly hosted by Maharishi University of Information Technology, Lucknow, in collaboration with National Environmental Science Academy, New Delhi; Glorious Vision University, Nigeria; Sabaragamuwa University of Sri Lanka; and International Strategic Centre for Agri-Food Development, Uzbekistan. This collaborative platform brings together scholars, researchers, and professionals dedicated to advancing sustainable development through scientific innovation and interdisciplinary collaboration.

The contemporary world faces numerous interconnected challenges, including climate change, biodiversity loss, water scarcity, food insecurity, and emerging public health concerns. Addressing these global issues requires integrated approaches that combine scientific research, technological advancement, and collaborative international efforts. The framework of the United Nations Sustainable Development Goals (SDGs) provides an important roadmap for achieving inclusive and environmentally responsible development.

For a rapidly developing nation like India, sustainable progress increasingly relies on the effective integration of science, technology, and forward-looking policies. Innovations in renewable energy, environmental biotechnology, climate-resilient agriculture, and digital technologies are opening new pathways for sustainable growth. In this context, ISTSD 3.0–2026 serves as an international forum for knowledge exchange, academic dialogue, and collaborative exploration of innovative solutions to sustainability challenges.

As the Convenor, I hope this conference will foster meaningful discussions, strengthen global partnerships, and inspire researchers and young innovators to contribute actively toward building a sustainable and resilient future. I express my sincere gratitude to all organizing partners, speakers, participants, and the university administration for their valuable support in making this conference a successful academic endeavor.

Best Regards

.MESSAGE

Dr. Nidhi Srivastava

Convenor, ISTSD 3.0-2026

MSOPS, MUIT

It is a matter of great privilege and honour to welcome all distinguished dignitaries, eminent scientists, academicians, industry experts, research scholars, and students to the 3rd International Conference on Innovation in Science and Technology for Sustainable Development 3.0 (ISTSD-2026) organized by Maharishi School of Pharmaceutical Sciences and Maharishi School of Pharmaceutical Sciences (MSOS & MSOPS), Maharishi University of Information Technology, Lucknow.

The theme of the conference, "Innovation in Science and Technology for Sustainable Development 3.0", reflects the growing need to integrate scientific advancements with sustainable practices to address the complex challenges faced by society today. In an era characterized by rapid technological transformation, interdisciplinary research and innovation play a crucial role in developing sustainable solutions that promote environmental stewardship, economic growth, and social well-being. ISTSD-2026 aims to provide a global platform where ideas converge, knowledge is exchanged, and collaborative research initiatives are fostered to drive meaningful progress.

The conference brings together leading researchers, innovators, and policymakers from across the world to deliberate on emerging developments in science, technology, and pharmaceutical research that contribute to sustainable development. The plenary lectures, keynote addresses, and technical sessions are designed to stimulate intellectual discourse, encourage innovative thinking, and inspire young researchers to explore transformative scientific solutions for global challenges.

The enthusiastic participation of delegates from diverse academic and research backgrounds highlights the importance of collective efforts in advancing science for the benefit of humanity. I am confident that the deliberations and discussions during ISTSD-2026 will not only enrich academic understanding but also strengthen international collaborations and promote translational research for sustainable impact.

I extend my heartfelt gratitude to all distinguished speakers, organizing committee members, reviewers, and participants for their invaluable contributions in making this conference a reality. I also sincerely acknowledge the continuous guidance and support of the university leadership and administration.

I hope that this conference will catalyze innovative ideas, productive collaborations, and meaningful scientific advancements that contribute to a sustainable and prosperous future.

I wish the conference a grand success and a rewarding academic experience for all participants.

Best Regards

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SAR-GUIDED DERIVATIVES OF INDOLE DERIVATIVES AS SELECTIVE COX-2 INHIBITORS

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Abstract

Inflammation is a complex biological response implicated in numerous acute and chronic disease conditions, necessitating the continuous search for safer and more effective anti-inflammatory agents. The indole nucleus is a privileged heterocyclic scaffold widely distributed in natural products and synthetic compounds with diverse pharmacological activities. Owing to its planar structure, electron-rich aromatic system, and ability to participate in hydrogen bonding, indole plays a crucial role in modulating biological targets associated with inflammation. Structure-activity relationship (SAR) studies have demonstrated that the indole core is essential for anti-inflammatory activity, influencing key pathways such as cyclooxygenase (COX) inhibition, suppression of pro-inflammatory cytokines, and modulation of nitric oxide production. Subtle changes in the indole framework, including substitutions on the benzene or pyrrole ring, significantly affect lipophilicity, receptor binding affinity, and overall biological response. The presence of the indole moiety enhances interaction with inflammatory mediators through π–π stacking, hydrophobic interactions, and hydrogen bonding, contributing to improved pharmacological profiles. Anti-inflammatory evaluation studies highlight the importance of the indole scaffold in reducing edema, inhibiting enzyme activity, and downregulating inflammatory signaling pathways. These findings emphasize the indole nucleus as a versatile and promising pharmacophore in anti-inflammatory drug research. Overall, SAR insights related to indole provide valuable guidance for the rational design and optimization of novel anti-inflammatory agents with enhanced efficacy and reduced adverse effects.

Keywords: Structure–Activity Relationship (SAR), Anti-Inflammatory Agents, Indole Moiety.

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PHAGE THERAPY VS ANTIBIOTIC RESISTANCE: MECHANISTIC INSIGHTS AND FUTURE PERSPECTIVES

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Abstract

Antibiotic resistance has become a major global health concern due to the overuse and misuse of antibiotics. *Staphylococcus aureus, Escherichia coli,* and *Klebsiella pneumoniae* are the major threats to bacterial resistance against many drugs. Bacteriophage (Phage) therapy has re-emerged as a potential biological strategy to combat resistant infections. Phages are quite specific and target-selective, which keeps the normal microbiota healthy. Phages can also penetrate biofilms and replicate at the site of infection, a crucial attribute that increases their effectiveness in disease treatment. Phage-antibiotic synergy has been observed, wherein sublethal antibiotic concentrations augment phage effectiveness and hinder the emergence of resistance. They are targeting bacterial surface receptors directly, and overcoming common bacterial resistance mechanisms such as; β-lactamase production, efflux, and changes in the antibiotic target site. Nowadays, research is going on to modify Phages and endolysins from them that are more stable, better at killing bacteria, and able to target a wider range of bacteria. Phage therapy can be very useful to treat UTI (urinary tract infections), RTI (respiratory tract infections), wounds that don't respond to many medications, and infections that are linked to biofilms. Future research will focus on developing genetically modified Phages and using CRISPR Cas technology to make them more effective and specific. Scientists are also working on creating standardised phage banks and preparing customised Phage mixture based on quick bacterial identification test. Compassionate-use cases and early-phase clinical studies have shown promising safety and efficacy results in controlled environments.

Keywords: Antibiotic Resistance, Bacteriophage, Biofilm.

MONITORING ATMOSPHERIC AIR QUALITY: USING THE LICHEN *LEPRARIA* SP. AS A BIOLOGICAL INDICATOR IN AVISSAWELLA, SRI LANKA

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Abstract

Airborne Microplastics (AMPs) can be easily ingested by human cells. With increasing industrialization and urbanization, these particulate matters have become a serious concern for public health and the ecosystems. Using epiphytic lichens as bio-indicators is a cost-effective and reliable method to identify contamination levels. Therefore, this study investigated the potential of the Lepraria sp. as a biological indicator. A stratified random sampling design was used for sampling based on land use. Within the Avissawella field site, two types of sampling sites were selected (industrial site, n=10 and traffic site, n=10). The Labugama-Kalatuwawa Forest Reserve served as the control site (n=10). The collected lichen samples were removed from their substrate, and acid digestion was conducted on both lichen and bark samples. A Nile Red Dye Test was conducted for the counting of Microplastics. These were identified using a Stereo microscope and the Hot Needle Test, and were categorized based on shape, color, and size. A total of 78.49% (Total Mean of three sites = 6.93) AMPs particles were identified in Lichen, and 21.51% AMPs particles (Total Mean of three sites = 1.90) were identified in bark. This revealed a significant difference between bark and lichen values ($p < 0.001$). A one-way ANOVA test revealed a statistically significant difference in mean Microplastics counts of lichen ($p < 0.005$) and bark ($p < 0.001$) among the three sites. Post-hoc comparisons using the Games–Howell test revealed that mean Microplastics counts in lichen from industrial sites (11.8) were significantly higher than those from control sites (0.7, mean difference = 11.10, $p = 0.002$), and Microplastic counts in bark from industrial and traffic sites were statistically similar. This research clearly demonstrates a pollution gradient across sites (Industrial > Traffic > Control) and the severe degradation of atmospheric air quality in the Avissawella industrial zone through a pioneering biomonitoring approach utilizing Lepraria sp. as a bio-indicator.

Keywords: Airborne Micro-plastics, Epiphytic Lichens, Industrialization, Nile Red Dye Test.

RAINFALL IMPACT ON SOIL EROSION AND SEDIMENT DYNEMICS IN TEA PLANTATIONS: INTERMEDIATE AND WET ZONES OF SRI LANKA'S WALAWE RIVER BASIN

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Abstarct

Soil erosion is a serious threat on the sustainability of agriculture particularly in hilly rain-fed tea-producing areas in Sri Lanka. In Walawe River Basin, tea is grown in the wet and intermediate regions that have uneven rainfall distribution. High intensity precipitation often causes surface runoff and soil displacement. The objective of the present research is to compare the spatial variations of rainfall and annual soil loss, soil erosion potential and sediment export of tea lands in the Intermediate and the Wet Climatic Zones of Walawe River Basin in year 2024. Spatial patterns were measured systematically using the InVEST Sediment Delivery Ratio (SDR) model along with GIS. The model used twelve input datasets, raster data including the Digital Elevation Model (DEM), Land Use/Land Cover (LULC) map, Soil erodibility (K factor) and Rainfall erosivity (R factor) and a vector representation of watershed boundaries. The wet zone recorded a precipitation of 2264.1 mm (2178.1-2378.1 mm) on average and the intermediate zone had a mean of 2257.6 mm (2124.8-2413.8 mm). The mean annual soil loss was 25.3 t/ha/yr in the wet zone and 28.3 t/ha/yr in the intermediate zone. The average sediment delivery ratio was 4.5 t/ha/yr in the wet zone and 5.8 t/ha/yr in the intermediate zone where the export of the sediment was higher. The wet zone and intermediate zone had mean soil erosion potentials of 259.4 t/ha/yr and 291.3 t/ha/yr, respectively, indicating a greater soil erosion potential in the latter. The analysis showed that the wet and intermediate areas of the Walawe Basin exceeded 2,200 mm of rain in 2024. However, despite similar levels of rainfall, tea plantations in the intermediate region had higher rates of soil detachment and erosion potential indicating that topographic slope and land-use management have a stronger effect on erosion processes as compared to rainfall itself.

Keywords: Walawe Basin; Soil Erosion; GIS; InVEST; Tea

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RELATIVE GROWTH DYNAMICS OF COMPOSITE ENTIRE ALGEBROIDAL FUNCTIONS OVER PADIC FIELDS: PERSPECTIVES OF BIOMODELING AND MATHEMATICAL BIOSYSTEMS

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Abstract

The primary objective of this paper is to investigate the comparative growth behaviour of the composition of two k-valued entire algebroidal functions through the lens of p-adic analysis. Emphasis is placed on examining their growth in terms of generalized relative growth indicators. Specifically, we aim to characterize the growth rates of such functions based on the framework of *generalized relative order* (α, β), where α *and* β are non-negative continuous functions defined on $(-\infty, \infty)$. This approach not only extends classical growth theories but also provides a broader perspective on the asymptotic analysis of p-adic entire algebroidal functions. The present study focuses on the comparative growth behaviour of the composition of two k-valued entire algebroidal functions within a p-adic analytical framework, with particular emphasis on potential applications in biomathematical modeling. Many complex biological systems—such as hierarchical genetic regulatory networks, multiscale population interactions, and tree-structured evolutionary processes—naturally exhibit ultrametric or p-adic type structures. Motivated by these parallels, we investigate growth dynamics using generalized relative growth indicators. AMS Subject Classification (2010): 30D30,30D35. 12J25, 46S10

Keywords: Entire Algebroidal Function, Growth, P-Adic Entire Function, Generalized Relative Order (A, B).

NANOPARTICLES FOR TOPICAL DRUG DELIVERY IN THE MANAGEMENT OF SKIN DISORDERS

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Abstract

Nanomaterials (NMs) have garnered significant interest across diverse scientific and industrial sectors owing to their customizable composition and ease of surface modification. They are increasingly incorporated into a wide array of consumer goods such as sunscreens, wound dressings, textiles, coatings, electronics, pharmaceuticals, and cosmeceuticals. When applied topically, nanoparticle (NP)-based systems enhance the delivery of active compounds by facilitating deeper skin penetration, enabling sustained release, and enabling precise targeting at cellular and subcellular levels. These nano formulations have promise in advancing dermatological care, transdermal therapies, diagnostic imaging, and even needle-free vaccination methods. This review explores recent progress in nanotechnology driven formulations designed to prevent and manage various skin ailments, including melanoma, acne, alopecia, vitiligo, psoriasis, and aging-related conditions. Despite the skin's natural barrier function posing a considerable challenge to NP absorption, pathological states such as inflammation or cancer can compromise this barrier, potentially allowing for improved NP uptake.

Keywords: Acne, Alopecia, Psoriasis, Nanoparticle, Skin.

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HISTOLOGICAL ALTERATION IN THE GILLS OF THE FOOD FISH *CHANNA PUNCTATUS* UNDER THE STRESS OF CHROMIUM OXIDE NANOPARTICLES (NPS)

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Abstract

Chromium is a trace element essential for human health and well-being. As a result of numerous anthropogenic activities, its contamination, particularly in the form of hexavalent chromium (VI), has increased in both terrestrial and aquatic ecosystems in recent decades. It is a highly hazardous heavy metal that occurs naturally and is commonly employed in industrial processes. The main causes of nanoparticle toxicity, also known as nanotoxicity, are their minuscule size and high surface-to-volume ratio, which enable them to interact with cells and pass through biological barriers. Because of their amazing, remarkable, and astounding qualities that set them apart from bulk materials, nanoparticles (NPs) are in high demand across a wide range of applications. Chromium levels in aquatic habitats typically vary from 1-10 µg/L, which is highly hazardous. Higher concentrations of chromium in aquatic ecosystems can cause accumulation in fish and have a negative impact on consumer health. The approach of this study is to evaluate the histological variations in the gills of test animal by exposing Chromium oxide nanoparticles sub-lethal concentration ($1/10^{th}$) of 96h LC_{50}. Gills of Fish are not only the respiratory organs, moreover helps regulating excretory needs. In the general structure of control gills the lamella part is clearly seen without any harmful degenerative forms. While in exposed gill structure Haemorrhage in the primary and secondary Gill lamellae are clearly shown, epithelial cell degeneration and necrosis, distortion of the secondary lamellae, rupture of epithelial cells, etc. were some of the histopathological abnormalities that were seen after 7, 14, 21 & 28 days of exposure period of the toxicant. Regular monitoring of Physico-chemical parameter viz., Temperature, pH, Dissolved Oxygen, Alkalinity, Chloride, and Total Hardness after each exposure period along with control.

Keywords: Chromium Oxide (VI), Nanoparticles, Nanotoxicity, Histology, Physico-Chemical.

ESTABLISHMENT OF CONTROLLED LABORATORY BREEDING METHODS FOR NILE TILAPIA (*OREOCHROMIS NILOTICUS*)

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Abstract

Fish species experimentation and sustainable aquaculture depend on the conception of reliable breeding methods. The goal of the current study was to establish and record Nile tilapia natural breeding in controlled laboratory settings. Mature male and female (2M:2F) broodstock were kept in experimental tanks with the right environmental conditions, such as ideal temperature (26°C to 27.5°C), pH (8.1-8.4), dissolved oxygen (>5 mg/l), and feeding conditions. Instead of using hormonal induction, the fish were left to spawn naturally. Fertilised eggs were incubated using the typical maternal mouthbrooding process of the species, and spawning behaviour was noted. After 28 days (19th Dec 2025 to 16th Jan 2026), the fry are released by the female. Healthy fry were successfully removed from the breeding tank and released following a predetermined incubation period. The fry's survival and early growth were tracked to assess the breeding process's effectiveness. The experiment showed that, with the right environmental conditions and broodstock management techniques, tilapia can successfully breed naturally in lab settings. This method offers an easy, economical, and sustainable way to produce fry for aquaculture and experimental research. The results of this study could help tilapia culture systems manage their broodstock better and use controlled breeding techniques.

Keywords: Aquaculture, Laboratory breeding, tilapia fry, Maternal mouthbrooding, Broodstock management.

AGRICULTURE ACTIVITIES INFLUENCING THE SANDFLY ECOLOGY IN THE GANGETIC PLAINS OF INDIA

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Abstract

Sandflies are crucial carriers of a number of diseases, such as sandfly fever and leishmaniasis. Their interactions with humans and ecological adaptation make them a salient public health priority. Sandflies have demonstrated exceptional environmental adaptation, which affects disease transmission patterns and population dynamics. Their habitats and activities are changing because of factors counting urbanization, climate change and agricultural activities in regions. Sandfly populations depend on temperature, humidity, and the availability of breeding places for survival and growth, which affects how they spread diseases. Agricultural activities are not the direct cause for increased vectors, but agriculture alters micro-habitats (via flora, livestock, irrigation patterns, and water retention) which influence sites where sandflies dwell and spawn. Soil containing organic matter and fissures or those affected by irrigation or agriculture, are better suited for sandfly larvae. Ideal breeding areas include cattle ranches, crop margins, and irrigation locations. In extensive studies of Bihar, cattle enclosures accounted for 46% of total captures, followed by houses (30%) and peri-domestic vegetation (24%). In farms, sandflies proliferate due to an abundance of organic waste and moisture. In cattle sheds, 81% of blood-fed sandflies tested positive for human blood, while 60% had fed on bovines, indicating frequent "host-switching". Agricultural workers are more susceptible to bites while they are outside between dawn and evening, when sandflies are most active. The number of sandflies can be temporarily reduced by using insecticides, but resistance evolves. Insecticide resistance makes control efforts more difficult. Climate change affects the distribution and active period of sandflies. It is still very difficult to balance pest management with environmental sustainability. Reducing sandfly habitats near farms can be achieved by crop rotation and habitat management. The habitats and distribution of sandflies can be changed by land alteration for agriculture. It is crucial to comprehend their ecology in order to prevent and control disease.

Keywords: Ecology, Sandflies, Agriculture, Micro-Habitats, Host-Switching.

EXPLORING NATURAL COMPOUNDS AS MULTI-ENZYME INHIBITORS FOR CANCER THERAPY: A COMPUTATIONAL STUDY

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Abstract

Cancer becomes a major global health challenge, driven by complex signalling networks, chronic inflammation, and the growing problem of resistance to current treatments. In this study, we investigated the anticancer potential of 50 naturally occurring secondary metabolites, including alkaloids, flavonoids, and terpenoids, by examining their ability to inhibit six clinically relevant cancer-associated enzymes: phosphoinositide 3-kinase, hyaluronidase, ribonucleotide reductase, ornithine decarboxylase, thymidylate synthase, and mitogen-activated protein kinase. A structure-based molecular docking approach was used to evaluate binding interactions and drug-likeness properties of these compounds. Among the screened metabolites, baicalein, apigenin, chrysin, gingerol, morindone, and acacetin demonstrated strong binding affinities along with favourable pharmacological characteristics. Notably, baicalein and apigenin consistently showed high performance across multiple targets, suggesting their ability to effectively interact with several oncogenic proteins at once. The observed multi-target inhibitory potential highlights a promising strategy for improving anticancer efficacy while potentially reducing treatment limitations associated with single-target drugs. Overall, these findings provide a strong basis for further experimental validation and optimization of these natural metabolites as safer and more effective multi-target anticancer candidates.

Keywords: Natural Secondary Metabolites, Multi-Target Anticancer Compounds, Baicalein, Apigenin.

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PREPARATION AND ASSESSMENT OF ONDANSETRON MICROEMULSION FOR TRANSDERMAL APPLICATION

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Abstract

Transdermal drug delivery systems have emerged as an effective alternative to conventional oral and parenteral dosage forms due to their ability to bypass first-pass metabolism, enhance patient compliance, and provide controlled drug release. Ondansetron, a selective serotonin ($5\text{-}HT_3$) receptor antagonist widely used in the prevention and treatment of chemotherapy-, radiotherapy and surgery-induced nausea and vomiting, is associated with limitations such as low oral bioavailability and variable systemic exposure. These drawbacks highlight the need for an alternative delivery system to improve therapeutic performance. The aim of the present study was to prepare and evaluate an ondansetron-loaded microemulsion for transdermal application to enhance drug permeation, achieve sustained drug release, and improve patient compliance. Microemulsions were formulated using appropriate oils, surfactants, and co-surfactants selected based on solubility studies. Pseudo-ternary phase diagrams were constructed to identify suitable microemulsion regions and optimize formulation composition. The developed formulations were evaluated for physicochemical parameters including droplet size, polydispersity index, pH, viscosity, and thermodynamic stability. *In-vitro* drug release studies were conducted to assess release behaviour, while ex-vivo skin permeation studies were performed to evaluate transdermal delivery efficiency. Skin irritation studies were carried out to confirm formulation safety. The optimized ondansetron microemulsion exhibited nanosized droplets, uniform distribution, good physical stability, enhanced skin permeation, and sustained drug release compared to conventional formulations. No significant skin irritation was observed. The developed ondansetron microemulsion represents a promising, patient-friendly, and sustainable transdermal drug delivery system with potential to improve therapeutic efficacy and patient compliance.

Keywords: Ondansetron, Microemulsion, Transdermal Drug Delivery, *In-vitro* Evaluation, Sustainable Pharmaceutical Technology.

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PREPARATION AND CHARACTERISATION OF MACROPOROUS POLYVINYL ALCOHOL (PVA) BASED HYDROGELS RECENTLY USED IN SUSTAINABLE CITIES, INFRASTRUCTURE AND DISASTER RESILIENCE

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Abstract

PVA based hydrogels, focusing on their excellent used in Sustainable Cities, Infrastructure and Diaster Resilience due to their ecofriendly, nontoxic and super hydrophilic properties and application's in sustainable materials,waste reduction and infrastructure water treatment and purification,disaster resilience fire safety,enviromental,and industrial safety oil-water separation.The PVA based hydrogels has prepared significantly both Physical and Chemical Crosslinking Method such as Freeze Thaw (F/T) and Free Radical Initiator KPS to create interconnected pores for high flux Oil_Water separation. The prepared hydrogels were characterized using Fourier Transformations Infrared Spectroscopy (FTIR) which confirmed OH group Super hydrophilic hydrogen bonding. X_Rays Diffractometry (XRD) were used to analysis showed that prepared PVA hydrogels excellent the Amorphous thin layer films and Differential Scanning Calorimetry (DSC) melting temperature of the peak indicates that contact between PVA chains and Acrylamide melting temperature. Prepared PVA based Cryogels promising for providing a sustainable material.

Keywords: Polyvinyl Alcohol Based Hydrogels, Environmental Monitoring, Oil-Water Separation, FTFR, FTIR, DSC, X-RD, Industrial Safety Oil/Water Separation.

DOI: https://doi.org/10.5281/zenodo.19104882

ASSOCIATION OF *CYPS* POLYMORPHISM WITH COPD IN A NORTH INDIAN POPULATION

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Abstract

Chronic obstructive pulmonary disease (COPD) is a common and debilitating disorder in many parts of the world and is the fourth leading cause of death. Although cigarette smoking is the most important risk factor, only 10% of chronic heavy smokers develop symptomatic COPD, suggesting that genetic factors are likely important determinants. *CYPs* are involved in the metabolic activation of many inhaled xenobiotics present in tobacco smoke. *CYP1B1 and CYP2E1* are involved in the production of reactive oxygen species (ROS), which may initiate alveolar lipid peroxidation, an indication of increased oxidative stress. Thus, they may be involved in the pathogenesis of COPD. This study aimed to evaluate association of *CYP1B1* rs1056836 (G/C) and *CYP2E1* 96-bp insertion/deletion (I/D) polymorphisms with COPD susceptibility in North Indian population. Genotypic, allelic, and carriage rate analysis of both variants were performed in 300 subjects (150 controls and 150 COPD cases) using Polymerase Chain Reaction-Restriction Fragment length Polymorphism (PCR-RFLP) and PCR, respectively. Statistical analysis was performed using GraphPad-Prism software. A statistically significant association was found for the "CC" genotype of the *CYP1B1 (*G/C) polymorphism with increased risk of COPD development when compared to healthy controls (OR: 1.873, 95% CI: 1.065 to 3.222; P= 0.0277*). Consistently, the "C" allele frequency was significantly higher in COPD cases (54.7%) compared with controls (44.3%) (OR: 1.514, 95% CI: 1.098 to 2.098; P=0.0114). The "DD" polymorphism of the *CYP2E1* 96-bp was significantly associated with an increased risk of disease when compare controls (OR: 2.640, 95% CI: 1.511 to 4.576; P= 0.0004***). And the "D" allele frequency was significantly higher in COPD cases (57%) as compare to controls (39.3%) (OR: 2.045, 95% CI: 1.474 to 2.818; P=<0.0001). The findings of this study suggest that *CYP1B1(rs1056836)* (G/C) and *CYP2E1* 96-bp polymorphism may play role in the development of COPD in the North Indian population.

Keywords: COPD, CYP1B1, CYP2E1, PCR-RFLP, Xenobiotics.

THE TWIN TRANSFORMATION IN INDUSTRY: SMART ENERGY

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Abstract

The relationship between Affordable and Clean Energy and Industry, Innovation, and Infrastructure has grown from a set of separate targets to a unified "Smart Energy" operational framework. Based on recent research, the physical infrastructure of the energy transition—grids, pipelines, and factories—is totally dependent on digital intelligence to operate at scale. We contend that SDG 9 is the "nervous system" that lets the "muscle" of SDG 7 to function, with pilot projects in 2025 indicating that AI-balanced grids can accept 60% more renewable loads without destabilizing.ML systems can now anticipate solar irradiance and wind patterns with hyperlocal accuracy, allowing grid operators to balance supply and demand in real time. This minimizes the demand for fossil-fuel "peaker plants" while increasing the utilization of green electrons. Modern grid centres use Digital Twin technology to represent and mimic grid stress situations before they occur, so preventing blackouts. While electricity powers houses, Green Hydrogen (H2) is critical to achieving SDG 9 for heavy industry (steel, shipping, and chemicals). 2025 has seen the advent of "Hydrogen Valleys"—co-located industrial zones where renewable energy (SDG 7) produces hydrogen on-site to power industries (SDG 9). This eliminates transportation losses and establishes a closed-loop renewable energy ecosystem. In industries such as fertilizer and steel production, Green H2 substitutes natural gas not solely as a fuel but also as a chemical feedstock, completely eliminating carbon from the end product.

Keywords: Clean Energy, SDG 7, SDG 9, Green Technology.

SUSTAINABLE DRUG DISCOVERY: ISOLATION OF QUERCETIN AS A NOVEL ANTI- TUBERCULAR AGENT

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Abstract

Drug resistance complicates treatment strategies for tuberculosis (TB), which continues to be a significant global health issue. The exploration of natural products as alternative therapies offers a sustainable approach to drug discovery. Onion peel, which is a type of agro-waste, has a lot of quercetin, a flavonoid with many different pharmacological properties. Using onion peel not only values waste, but it also helps achieve goals for sustainable development. The current study sought to extract quercetin from red onion peel and assess its anti-tubercular efficacy, thereby merging innovation in pharmaceutical chemistry with sustainable resource utilisation. To get quercetin, red onion peels were first extracted with a solvent and then purified using chromatography. We used UV-Visible spectroscopy, FTIR, and NMR analysis to figure out what the compound was. Standard susceptibility tests were used to check for anti-tubercular activity in vitro against the Mycobacterium tuberculosis H37Rv strain. Preliminary molecular docking studies were used to learn more about how things work. The isolated quercetin showed strong activity against M. tuberculosis, which means it could be a good starting point for making drugs that fight tuberculosis. Spectroscopic characterisation verified the compound's purity and identity. Docking studies showed that it might interact with important mycobacterial enzymes, which supports its biological importance. Using onion peel as a source material shows a new way to turn waste into wealth. Quercetin extracted from onion peel exhibits significant anti-tubercular properties and signifies a sustainable advancement in pharmacological research. This study emphasises the significance of amalgamating natural product research with green chemistry principles to tackle global health issues. Additional research, encompassing in vivo studies and clinical validation, is necessary to ascertain its therapeutic potential.

Keywords: Quercetin, Onion Peel, Sustainable Drug Discovery, Natural Products, Anti-Tubercular Activity.

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FORMULATION OPTIMIZATION OF PROGUANIL HYDROCHLORIDE TRANSDERMAL PATCH FOR MALARIA TREATMENT

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Abstract

Malaria is a mosquito-borne infectious disease that affects vertebrates and Anopheles mosquitoes. Human malaria causes symptoms that typically include fever, fatigue, vomiting, and headaches. To develop a sustained release transdermal patch and use the factorial design for optimization of proguanil hydrochloride using a natural polymer like chitosan and a hydrophilic polymer like HPMC. Transdermal drug delivery can be efficiently used for active agents which cause severe gastric irritation and undergo rapid first pass metabolism; hence the transdermal patches of Proguanil Hydrochloride were prepared by using combination of chitosan and HPMC along with Dibutyl phthalate as a plasticizer.

Keywords: Chitosan, HPMC, Proguanil HCl, Solvent Evaporation Method.

INTERPLAY BETWEEN MICROBIAL DYSBIOSIS AND IMMUNE CELL MIGRATION IN MAFLD PATIENTS WITH FUNCTIONAL DYSPEPSIA

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Abstract

Metabolic dysfunction-associated fatty liver disease (MAFLD) is one of the most predominant chronic liver diseases across the globe, determined by obesity, insulin resistance, and metabolic syndrome. In corresponding, functional dyspepsia (FD) is a common gut-brain disorder interaction, characterized by consistent upper GI symptoms without physical abnormalities. Although these two situations are clinically distinct, emerging evidence suggests that they share primary pathophysiology that remains poorly understood. They include altered gut microbiota, intestinal barrier dysfunction, and compromised immune response along the gut-liver axis. MAFLD dysbiosis shows reduced microbial diversity and short-chain fatty acid producing bacteria, while increased pro-inflammatory taxa. They promote intestinal permeability, microbial products translocation into portal circulation, and hepatic immune response. Similarly, FD exhibits low-grade inflammation, dysbiosis, and immune cell infiltration, suggesting immune-microbial interactions. Immune cell trafficking between the gut and liver signifies a critical link connecting microbial alteration to systemic and hepatic inflammation. Innate and adaptive immune activation drives MAFLD progression and may influence FD related gut dysfunction. Furthermore, shared risk factors such as metabolic dysfunction, obesity and chronic low-grade inflammation promote their coexistence. This review summarizes current evidence on dysbiosis and immune cell trafficking in MAFLD, highlighting overlapping mechanisms in FD. Detailed study of these shared pathways may improve detection, clinical management, and research targeting gut-microbiota-immune axis. To the best of our knowledge this is among the first reviews integrating linking MAFLD and FD via dysbiosis and immune cell trafficking.

Keywords: MAFLD, Functional Dyspepsia, Dysbiosis, Immune Trafficking, Gut-Liver Axis.

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ROLE OF ARTIFICIAL INTELLIGENCE IN PERSONALIZED THERAPY FOR ULCERATIVE COLITIS

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Abstract

Ulcerative colitis (UC) is an inflammatory bowel disease of the colon with varied responses to conventional therapies, thus requiring personalized approaches. Artificial intelligence (AI) has revolutionary uses in personalizing the management of UC based on the analysis of large amounts of data from genomics, proteomics, endoscopic images, laboratory values, and patient data to predict outcomes. The advanced machine learning (AML) algorithms are very effective in predictive analytics, including tools for predicting responses to biologics, such as anti-TNF agents, with a success rate of over 85%, performing traditional analyses. Innovative causal AI methods show the existence of differences in treatment effects, for instance, optimizing UC trials by giving preference to biomarkers like fecal calprotectin rather than visual endoscopes, thus improving response rates. Computer-assisted endoscopy has an accuracy of 95-97% in evaluating tissue inflammation. For targeted therapies, AI applies network pharmacology to determine effective combinations and individual risk profiles, including flare alerts from wearable devices, through continuous monitoring. Pathway analysis focuses on mechanisms like IL-23/Th17, which particular herbs (e.g., curcumin) target, integrating with natural remedy research for UC. However, there are still challenges, such as the fragmentation of data sources and model bias, but federated networks could help with secure large-scale use. Future large-scale studies will work towards the integration of AI in practical tools, which could lower ineffective treatments by 40% and enhance quality of life. Ultimately, AI makes it possible for patient-centric UC management, which quickly applies lab results to provide relief.

Keywords: Ulcerative Colitis, Artificial Intelligence, Personalized Therapy, Machine Learning, Precision Medicine, Inflammatory Bowel Disease.

FORMULATION AND DEVELOPMENT OF NANOPARTICLES-BASED DRUG-DELIVERY SYSTEM FOR MULTIDRUG-RESISTANT TUBERCULOSIS

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Abstract

MDR-TB remains a global health crisis characterized by resistance to first-line drugs like isoniazid and rifampicin. Conventional treatment is hindered by poor bioavailability, severe systemic toxicity (nephrotoxicity and hepatotoxicity), and low patient compliance due to prolonged regimens. Conventional therapeutic regimens are limited by poor patient compliance, systemic toxicity, and inadequate drug concentration at infection sites. The present study focuses on the formulation and development of a dual-drug-loaded nanoparticle-based delivery system aimed at achieving synergistic antibacterial efficacy and controlled drug release for the effective management of MDR-TB. Biocompatible polymeric nanoparticles were designed using biodegradable polymers such as poly(lactic-co-glycolic acid) (PLGA) and chitosan through a solvent evaporation technique. Two anti-TB agents—one hydrophilic (e.g., ethambutol) and one lipophilic (e.g., moxifloxacin)—were co-encapsulated to enhance intracellular drug accumulation and minimize resistance development. Formulation parameters including polymer-to-drug ratio, surfactant concentration, and stirring speed were optimized using a Quality by Design (QbD) approach and response surface methodology (RSM). Thus, nanotechnology offers multiple benefits in treating chronic human diseases by site-specific, and target-oriented delivery of medicines. However, inadequate knowledge about nanostructures toxicity is a major worry and undoubtedly warrants further research to improve the efficacy with higher safety to enable safer practical implementation of these medicines. Therefore, cautiously designing these nanoparticles could be helpful in tackling the problems associated with their use. Considering the above facts, this aims to report different nano based drug delivery systems, significant applications of natural compound-based nanomedicines, and bioavailability, targeting sites, and controlled release of nano-drugs, as well as other challenges associated with nanomaterials in medicines.

Keywords: Multidrug-Resistant Tuberculosis, Biocompatible Polymeric Nanoparticles, Quality By Design, Response Surface Methodology.

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PROTACS THERAPY IN THE TREATMENT OF CANCER

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Abstract

A novel approach to cancer treatment called proteolysis targeting chimaeras (PROTACs) challenges our understanding of how to inhibit the activity of enzymes. They break down the proteins that enzymes are meant to function on, not the enzymes themselves. Oncogenic proteins are the target of the majority of conventional anticancer medications. However, PROTAC utilizes the cell's natural ubiquitin-proteasome system to eliminate and destroy the undesirable proteins. Basically, PROTACs are molecules with two ligands that are connected by a chemical linker. One ligand binds to the target protein, while the other pulls in an E3 ubiquitin ligase. PROTACs help the target protein get ubiquitinated by bringing these two parts closer together. This tells the 26S proteasome to break down the protein. The emergence of oral drugs, tissue-specific E3 ligase recruiters, and next-generation designs like as light-controlled and covalent PROTACs are some recent developments in PROTAC research. Early clinical trials are currently being conducted to show the safety and antitumor efficacy of a number of PROTAC compounds that target androgen receptors, oestrogen receptors, and other kinases. PROTACs may be able to treat blood malignancies, solid tumours, and cancers that require hormones to proliferate in a clinical setting. They are an effective technique in precision oncology because they can enhance the number of druggable targets, decrease off-target effects, and circumvent drug resistance. Their ability to assist patients and achieve positive outcomes in the clinic is likely to improve with additional research and advancements.

Keywords: Target Protein, Proteolysis, Cancer.

ARTIFICIAL INTELLIGENCE-DRIVEN PHARMACOGENOMICS IN DRUG-INDUCED NEPHROTOXICITY: INTEGRATING MOLECULAR MECHANISMS WITH CLINICAL TRANSLATION

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Abstract

Drug-induced nephrotoxicity represents a critical barrier in contemporary therapeutics, often necessitating dose reduction or discontinuation of essential medications and, in severe cases, precipitating end-stage renal disease and escalating healthcare costs. Common nephrotoxic agents—including cisplatin, aminoglycosides, nonsteroidal anti-inflammatory drugs, and calcineurin-targeting immunosuppressants—exert renal injury through converging yet mechanistically distinct pathways. Central mechanisms involve oxidative stress, mitochondrial dysfunction, transporter dysregulation, and maladaptive inflammatory signalling. However, susceptibility to renal injury is not uniform; rather, it reflects substantial interindividual variability shaped by pharmacogenomic determinants. Polymorphisms in renal transporters such as SLC22A2 influence intracellular drug accumulation and toxicity, while genetic variation in detoxifying enzymes including GSTP1 and SOD2 alters redox balance and cellular resilience. Inflammatory mediators, particularly TNF-α, further modulate injury severity by amplifying immune activation and tubular damage. Despite expanding mechanistic insight, translation into predictive clinical tools remains limited. Emerging advances in artificial intelligence (AI) offer a transformative opportunity to bridge this gap. By integrating genomic, transcriptomic, and clinical datasets, machine learning and deep learning algorithms can model complex gene–drug and environment–gene interactions, enabling early prediction of nephrotoxic risk and identification of novel vulnerability markers. Importantly, explainable AI frameworks enhance interpretability and clinical trust, facilitating transparent decision support. This review synthesizes molecular mechanisms, pharmacogenomic predictors, and AI-driven strategies, highlighting a paradigm shift from reactive management toward proactive, risk-stratified prevention. Within the framework of computationally empowered personalized medicine, nephrotoxicity prevention evolves into a patient-centred, precision-based approach that integrates biological insight with advanced analytics to safeguard renal health while preserving therapeutic efficacy.

Keywords: Nephrotoxicity, Pharmacogenomics, Polymorphism, Artificial intelligence (AI), Precision Medicine etc.

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FERROPTOSIS–URIC ACID AXIS IN AMINOGLYCOSIDE-INDUCED NEPHROTOXICITY AND OTOTOXICITY AMONG CARDIAC PATIENTS: ROLE OF NRF2/GPX4-MEDIATED OXIDATIVE STRESS

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Abstract

The aminoglycosides cannot be replaced when treating severe gram-negative infections particularly in cardiac patients with infective endocarditis or sepsis. Their clinical usefulness is, however, hampered by dose-limiting nephrotoxicity and ototoxicity which add up to a significant morbidity and treatment outcome. Evidence base is indicating that ferroptosis which is an iron-dependent, lipid peroxidation-mediated form of regulated cell death is one of the key processes involved in aminoglycoside-induced organ injury. The accumulation of aminoglycosides of proximal tubular hair cells of the kidney and the cochlear hair cells unbalances the iron homeostasis, depletes glutathione (GSH), glutathione peroxidase 4 (GPX4), and enhances the generation of reactive oxygen species (ROS), resulting in ferroptotic damage. Recent publications also mention that uric acid as a traditional antioxidant has dual regulating levels: on the one hand, in physiological levels, uric acid suppresses the formation of oxidative stress, on the other hand, NADPH oxidase-dependent ROS production enhances the ferroptotic susceptibility, and hyperuricemia, typical of cardiac comorbidities, on the other. This ferroptosis-uric acid axis has selective therapeutic control that promises good chances of toxicity prevention. Protective efficacy has been demonstrated on preclinical models with iron chelators, ferroptosis inhibitors (ex: ferrostatin-1, liproxstatin-1), antioxidants, Nrf2 activators, and uric acid modulators (allopurinol, febuxostat). The complex of ferroptosis biomarkers, accurate dosing, and metabolic profiling might enable not only determining the at-risk patients having cardiac diseases but also offer personalized treatment. These two sets of elucidation of ferroptosis-uric acid interaction would be the foundation on which the mechanistic framework of redefining aminoglycoside pharmacotoxicology and achieving safer and precision-based antimicrobial treatment would be established.

Keywords: Aminoglycoside poisoning, Ferro oxidation, GPX4 and lipid oxidation, Reactive oxygen species (ROS), Translational pharmacology etc.

LEVERAGING DIGITAL TRANSFORMATION AND SUSTAINABLE PARKING SOLUTIONS FOR POLLUTION REDUCTION AND EMPLOYMENT CREATION

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Abstract

Urban congestion and vehicular pollution present significant barriers to achieving Sustainable Development Goals (SDGs), specifically SDG 9 (Industry, Innovation, and Infrastructure) and SDG 17 (Partnerships for the Goals). This study investigates how digital transformation and emerging technologies can redefine urban parking strategies to mitigate these issues. The core concept involves relocating parking facilities to outer urban areas, thereby reducing traffic congestion and pollution within city centers. This approach is coupled with the provision of small, eco-friendly public transport or shared vehicles for last-mile connectivity, significantly lowering vehicle emissions and fuel consumption. Encouraging walking for short distances further enhances environmental benefits and public health. Such strategic placements also foster employment opportunities in peripheral zones across sectors like facility management, security, and vehicle maintenance, stimulating local economic activity. Digital parking systems, including online reservation platforms, are crucial for optimizing space utilization and minimizing vehicle idling time. These systems leverage IoT and Big Data to offer real-time availability, routing, and efficient space allocation, improving user experience and resource efficiency. Furthermore, blockchain technology ensures transparent payment systems and strengthens public-private partnerships, directly supporting SDG 17. This integration of sustainable urban planning and digital innovation provides a scalable framework for infrastructural advancement, environmental sustainability, and socioeconomic growth, contributing to multiple SDGs simultaneously.

Keywords: Sustainable Parking, Pollution Reduction, SDG 9, SDG 17, Digital Transformation

PHYTOPHARMACEUTICALS TARGETING OXIDATIVE STRESS AND INFLAMMATION IN DRUG-INDUCED HEPATOTOXICITY

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Abstract

Around the world, acute liver failure and post-marketing drug withdrawal are still primarily caused by drug-induced hepatotoxicity (DIH). More and more data points to oxidative stress and inflammation as the primary, interconnected processes causing hepatocellular damage after being exposed to substances like paracetamol, anti tubercular medications, chemotherapy, and antiretroviral. Apoptosis or necrosis is the result of inflammatory cascades triggered by nuclear factor-κB (NF-κB), the NLRP3 inflammasome, and pro-inflammatory cytokines. These cascades are triggered by excessive reactive oxygen species generation, mitochondrial dysfunction, lipid per oxidation, and the depletion of endogenous antioxidants. Due to their multitarget mechanisms and advantageous safety profiles, phytopharmaceuticals—standardized, bioactive preparations derived from plants have become intriguing hepatoprotective candidates in this context. The preclinical and clinical data on phytopharmaceuticals that alter inflammatory signaling and oxidative stress in DIH are rigorously assessed in this study. Important plant sources are examined with a focus on their molecular mechanisms, such as Phyllanthus species, *Camellia sinensis* (epigallocatechin gallate), *Glycyrrhiza glabra* (glycyrrhizin), *Curcuma longa* (curcumin), and *Silybum marianum* (silymarin). These substances stabilise mitochondrial function, restore glutathione homeostasis, inhibit NF-κB-driven cytokine production, and strengthen endogenous antioxidant defences by activating the Nrf2/ARE pathway. Additionally, hepatocellular damage is lessened through the regulation of the MAPK, TLR4, and apoptotic signalling pathways. The lack of large-scale trials, regulatory heterogeneity, bioavailability issues, and variability in phytochemical composition impede the translation of promising experimental data into clinical practice. Improvements in systems pharmacology techniques, nanoformulation tactics, and phytochemical standardisation present chances to maximise therapeutic efficacy and repeatability. Collectively, phytopharmaceutical represent a mechanistically rational and potentially adjunctive strategy for preventing and mitigating DIH. Rigorous clinical validation, harmonized regulatory framework and mechanistic biomarker-driven studies are warrented to integrate these agents into evidence-based hepatoprotection paradigm.

Keywords: Hepatotoxicity, Oxidative Stress, Inflammation, Mitochondrial Dysfunction, Lipid Per Oxidation, NLRP3 Inflammasome.

CHEMICAL COMPOSITION, ANTIBACTERIAL, ANTIOXIDANT AND IN-SILICO ACTIVITIES OF *CLINOPODIUM UMBROSUM* (M. BIEB.) K. KOCH. ESSENTIAL OIL FROM THE KUMAUN REGION OF UTTARAKHAND, INDIA

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Abstract

The objective of this study is to assess chemical composition, antibacterial, antioxidant and molecular docking properties of essential oil of *clinopodium umbrosum* which belongs to Lamiaceae family. The plant was collected from Pindari region of Uttarakhand, India. The essential oil of plant extracted by hydro-distillation using a Clevenger-type apparatus and the oil was analyzed by GC-MS technique. A total 37 compounds were identified and the major compounds were Piperitone epoxide <-cis-> (42.60%), Limonene (14.95%), Germacrene-D (9.88%), Trans-Beta- caryophyllene (4.26%), carvenone (3.01%), Piperitenone oxide (2.18%) and Beta-bourbonene (2.79%). The essential oil tested for antibacterial activity by disc diffusion method against three Human (*P. mirabilis, S. aureus* and *P. aeruginos*) and two plant pathogenic bacteria (*X. oryzae* and *R. solanacearsum*). The oil exhibited concentration-dependent antibacterial activity, with minimum inhibition zones ranging from 6.00 ± 0.00 to 8.3 ± 0.57 mm. The antioxidant activity of the essential oil was evaluated using DPPH and H_2O_2 scavenging assays. In the DPPH assay, the essential oil exhibited an IC_{50} value of 18.65 µL/mL, compared to 15.43 µL/mL for BHT, indicating slightly lower but comparable radical scavenging activity. In the H_2O_2 assay, the essential oil showed an IC_{50} of 21.09 µL/mL, whereas ascorbic acid demonstrated a stronger activity with an IC_{50} of 13.41 µL/mL. The molecular docking study against the target proteins ETA and DDL identified δ-cadinene, β-bourbonene, germacrene D, cis-β-copaene, and β-selinene as strong binders, with binding affinities ranging from −6.1 to −7.8 kcal/mol. These interactions highlight *C. umbrosum* essential oil as a promising source for drug discovery, particularly for antimicrobial and antioxidant therapeutics and broader pharmacological applications.

Keywords: *Clinopodium umbrosum,* Essential Oil, Clevenger Apparatus, Antibacterial, Antioxidant and In-Silico Potential.

CIRCULATING HSA-MIR-30B-5P, CAT GENE EXPRESSION, AND RS7943316 (A/T) POLYMORPHISM IN TYPE 2 DIABETES MELLITUS: A BIOMARKER-BASED APPROACH

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Abstract

Type 2 Diabetes Mellitus (T2DM) is a progressive, incurable polygenic metabolic disorder. The currently favoured hypothesis says that oxidative stress leads to insulin resistance (IR), β-cell dysfunction, impaired glucose tolerance (IGT), and ultimately T2DM. Furthermore, it is believed that therapies aimed at reducing oxidative stress would benefit T2DM patients and also those at risk. This study aimed to investigate the CAT gene rs7943316 (A/T) polymorphism, the expression of the CAT gene, and their association with hsa-miR-30b-5p to assess their potential as biomarkers for T2DM. The *CAT* gene rs7943316 (A/T) polymorphism was analyzed in controls (N=75) and T2DM cases (N=115) by PCR-RFLP, using the HinfI restriction enzyme. *CAT* gene expression was quantified by qPCR, and its relationship with different rs7943316 genotypes was examined. Expression of hsa-miR-30b-5p was also assessed in 45 T2DM cases, 20 pre-diabetic subjects, and 40 control (non-diabetic) subjects by qPCR and compared with *CAT* gene expression. Compared to controls, T2DM cases showed higher frequencies of the 'AT' and 'TT' genotypes of *CAT* rs7943316, both significantly associated with increased risk of T2DM (p=0.0006 and 0.0002; OR=3.47 and 6.95). *CAT* gene expression (1.11±0.03) was significantly downregulated in T2DM patients (P<0.0001), but no significant variation was observed among different rs7943316 genotypes. hsa-miR-30b-5p expression was also significantly reduced (0.69±0.1, P<0.0001) in T2DM patients compared to controls, and its downregulation was consistent with the reduced *CAT* expression. ROC analysis demonstrated strong diagnostic potential, with an AUC of 0.9793 for controls vs. diabetics and 0.9875 for prediabetes vs. diabetics (both P<0.0001).

Keywords: Type 2 Diabetes Mellitus (T2DM), CAT Gene, Rs7943316 Polymorphism, Hsa-Mir-30b-5p, Prognostic Biomarker, Gene Expression.

ASSESSMENT OF THE DIVERSITY AND ABUNDANCE OF TRUE MANGROVES AND ASSOCIATED LICHENS IN THE MANGROVE ECOSYSTEM – DUMMALA MODARA CANAL, SRI LANKA

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Abstract

Mangroves are one of the most productive ecosystems that support biodiversity, enhance coastal resilience, sequester carbon, support local economies and life styles. Despite the ecological services provided, mangroves are undergoing degradation in Sri Lanka. Mangrove plants also host lichens, yet their diversity has not been properly investigated. A study was therefore conducted to assess the diversity and the abundance of true mangroves and their associated lichen species in Dummala Modara Canal in Kalutara District in Sri Lanka. Six locations of which three were undisturbed (L1, L2, L3) and three were disturbed (L4, L5, L6) by human activities were surveyed with belt transects of varying lengths and widths. Lichens were recorded using a 20 cm ×20 cm grid on a transparent sheet, which was placed at the breast height (1.3m). Both true mangrove and lichen species were identified with standard keys and volumes of Flora of Ceylon. Diversity indices were calculated for both true mangroves and lichen species separately. A total of 7 true mangrove species belonging to 5 families were recorded, with Rhizophora apiculata being the most abundant. A total of 19 Mangrove associate species were also recorded belonging to 16 families. Undisturbed sites (L2, L3) exhibited an overall higher species richness, however, L5, a disturbed location, recorded the highest Shannon-Wiener (H'=1.3778) and Simpson diversity (D= 0.7160) values among all sites. A total of 61 lichen species were recorded belonging to 13 genera, with Cryptothecia being the most abundant genera. Undisturbed sites exhibited an overall higher lichen species diversity compared to disturbed sites. L2, an undisturbed location, recorded the highest Shannon- Wiener diversity (H'= 2.1428) and Simpson diversity (D= 0.8449) for manglicolous lichens. *Bruguiera gymnorhiza* supported the highest lichen species diversity and southward facing sections of the trees recorded the highest lichen species diversity. While the location-wise beta diversity of true mangrove species was recorded as 4.99, lichen species had 2.55 beta diversity value. These findings as baseline information can support future environmental monitoring, habitat restoration and management strategies for conserving mangrove ecosystems in Sri Lanka.

Keywords: Mangrove Diversity, True Mangroves, Lichen Diversity, Dummala Modara Canal, Belt Transect.

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REVIEW OF GREEN AND SUSTAINABLE PHARMACY ECO-FRIENDLY DRUG MANUFACTURING

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Abstract

Although being essential to world health, the pharmaceutical business contributes significantly to environmental deterioration due to its high energy consumption, widespread use of hazardous solvents, and production of chemical waste. Drug effectiveness and patient safety are given priority in conventional manufacturing methods, but ecological sustainability. The idea of "green pharmacy" has become a revolutionary strategy to guarantee environmental responsibility in medicine development and manufacture as the globe struggles with climate change, resource depletion, and tighter environmental restrictions. Green pharmacy incorporates sustainable engineering, eco-friendly technology, renewable resources, and green chemistry concepts into pharmaceutical development, manufacturing, and distribution. The FDA, EMA, WHO, and Indian authorities' regulatory frameworks are also emphasized as important forces behind the promotion of sustainable medication production methods. The benefits and drawbacks of green pharmacy are also covered in the study, with a focus on the need for funding, the development of a trained staff, and supportive legislative frameworks. In order to maximize environmentally friendly production methods, future perspectives call for the combination of artificial intelligence, digital twins, and green nanotechnology.

Keywords: Green Pharmacies, Environmentally Friendly Pharmaceuticals, Green Chemistry, Sustainable Drug Manufacturing, Biocatalysis, And Environmental Impact.

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ENHANCING PLANT-BASED BIOPLASTIC PRODUCTION THROUGH METABOLIC ENGINEERING OF GENETICALLY MODIFIED ORGANISMS

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Abstract

Conventional petroleum-based plastics exacerbate global environmental crises through persistent microplastic pollution and significant greenhouse gas emissions. This research evaluates the transformative potential of producing sustainable bioplastics from plant-derived feedstocks by utilizing genetically modified organisms (GMOs). We specifically analyze the metabolic engineering of robust microbial hosts, including *Cupriavidus necator*, *Pseudomonas* species, and *Escherichia coli*, to maximize the intracellular accumulation of polyhydroxyalkanoates (PHAs) and polyhydroxybutyrate (PHB). Our study details how the insertion of heterologous biosynthetic gene clusters and the optimization of carbon-flux pathways enable the efficient conversion of diverse agricultural residues—such as rice straw, jute cellulose, and cane molasses—into high-performance biopolymers. By fine-tuning enzyme expression and enhancing substrate uptake mechanisms, researchers significantly increase polymer titers and improve the thermal stability and mechanical flexibility of the resulting materials. Furthermore, we explore the revolutionary approach of "in planta" engineering, where crops are directly modified to synthesize designer starches and cellulose-based precursors. This method bypasses expensive industrial fermentation steps, drastically reducing manufacturing costs and energy consumption. The integration of GMO technology into plant-based bioplastic production provides a scalable, circular economy solution that transforms agricultural waste into value-added ecological assets. Our findings emphasize that these advancements allow the plastics industry to decouple from fossil fuel dependency while ensuring rapid biodegradability in natural environments. Ultimately, this work positions the Department of Botany at Maharishi University of Information Technology as a key contributor to the development of bio-based materials that safeguard global ecosystems

Keywords: Bioplastics, Genetically Modified Organisms, Metabolic Engineering, Polyhydroxyalkanoates (PHA), Sustainable Development, Plant-Based Feedstocks.

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AGRICULTURE, FOOD SYSTEMS AND BLUE ECONOMY

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Abstract

Sustainable agriculture, resilient food systems, and the blue economy are key pillars for achieving long-term environmental sustainability, food security, and inclusive economic growth. Sustainable agriculture focuses on increasing productivity while conserving natural resources, reducing chemical inputs, protecting soil health, and promoting climate-smart practices such as crop diversification, organic farming, precision agriculture, and efficient water management. These approaches help farmers adapt to climate change while reducing greenhouse gas emissions. Sustainable food systems ensure that food production, processing, distribution, and consumption remain environmentally friendly, economically viable, and socially equitable. Reducing food waste, improving supply chains, promoting local and seasonal foods, and strengthening nutritional security are essential components. According to Food and Agriculture Organization, transforming food systems is crucial to feed the growing global population sustainably by 2050. The blue economy emphasizes the sustainable use of oceans, rivers, and aquatic resources for livelihoods, food, and economic development while preserving marine ecosystems. Activities such as sustainable fisheries, marine renewable energy, eco-tourism, and coastal resource management contribute to economic growth without harming biodiversity. United Nations Environment Programme highlights that protecting marine ecosystems is vital for climate regulation, carbon storage, and global food security. Linking sustainable agriculture with the Blue Economy promotes regenerative systems in which land-based farming and aquatic resources support each other. These principles align with the global goals set by the United Nations: SDG 2 (Zero Hunger): End hunger, achieve food security, improve nutrition, and promote sustainable agriculture. SDG 12 (Responsible Consumption and Production): Do more and better with fewer resources, reducing waste, pollution, and environmental degradation. SDG 14 (Life Below Water): Conserve and sustainably use oceans, seas, and marine resources by 2030.

Keywords: Sustainable Agriculture, Sustainable Food Systems, Blue Economy, Food Security, Climate Resilience.

INVESTIGATION OF SOME BIOLOGICAL PROPERTIES OF *LEPRARIA SP.* IN THE AWISSAWELLA INDUSTRIAL ZONE, SRI LANKA

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Abstract

Most lichen species have been evaluated for their pharmaceutical potential. In this study, hexane, ethyl acetate, and methanol extractions of lichen *Lepraria sp.* were tested for various antioxidant activities including DPPH assay, reducing power, determination of total phenolic content (TPC), and total flavonoid content (TFC), and various cytotoxicity assays. A yellow compound was isolated through centrifugation from the ethyl acetate extraction. The methanol extraction gave the highest yield (11.142% w/w) while the hexane extraction (1.338% w/w) yielded the lowest. The yellow compound yielded 2% w/w. The FTIR analysis revealed that the isolated compound contains hydroxyl, aliphatic C-H, carbonyl, and sulfur groups. Ethyl acetate extraction (640.27 µg/mL) and methanol extraction (622 µg/mL) exhibited the lowest IC_{50}. The ethyl acetate showed the highest TPC (24.20 µg GAE/mg) and TFC (193.005 µg QE/mg) while the hexane extract showed the second-highest TPC (18.08 µg GAE/mg) and TFC (34.87 µg QE/mg). There was a strong positive correlation between TPC and TFC ($r = 0.808$, $p < 0.01$), but no significant correlation was found between DPPH and TPC ($r = 0.016$, $p = 0.967$) or TFC ($r = -0.261$, $p = 0.497$). All the extractions demonstrated very low reducing power compared with ascorbic acid. In the *Artemia salina* lethal toxicity test, the yellow compound showed medium toxicity with an LC_{50} of 106.50 µg/mL and non-toxicity was found in the ethyl acetate extraction with an LC_{50} of 1736.28 µg/mL according to Meyer Toxicity Category. However, the isolated yellow compound showed negative values compared with 0.5% Triton X-100 in the human RBC hemolysis test suggesting no hemolytic activity. These results indicate low antioxidant characteristics, whereas the yellow compound exhibited toxicity toward crustaceans but not mammalian blood. Therefore, further research can explore its potential for pesticidal, anticancer, and antimicrobial activities.

Keywords: Antioxidant Activity, Cytotoxicity, FTIR, Lichen Extract.

FORMULATION AND EVALUATION OF FAST DISSOLVING TABLETS OF PARACETAMOL (125 MG) USING BANANA POWDER BY CO-GRINDING TECHNIQUE

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Abstract

Paracetamol is a slightly water-soluble drug belonging to BCS Class IV and is widely used in the management of pain and fever. Due to its low solubility, enhancement of dissolution is required to improve its therapeutic effectiveness. In the present study, fast dissolving tablets of paracetamol (125 mg) were formulated using banana powder as a natural disintegrating agent by the co-grinding technique. Solid dispersions were prepared in different ratios of paracetamol to banana powder (1:0.25, 1:0.5, and 1:0.75). All formulations were prepared by the direct compression method, Pre-compression and post-compression parameters were evaluated, and the final formulation was selected based on in vitro dispersion time and dissolution profile. The optimized formulation showed dispersion time of less than 40 seconds. In vitro dissolution studies demonstrated more than 90% drug release within 25 minutes, which was faster than the marketed formulation, the study confirms that banana powder can be effectively used as a natural disintegrant to enhance the dissolution of Paracetamol in fast dissolving tablet formulations.

Keywords: Paracetamol, Fast Dissolving Tablets, Banana Powder, Co-Grinding Technique, Natural Disintegrant.

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IMPACT OF URBAN GROWTH AND ITS EFFECTS ON AIR QUALITY IN INDIAN TIER-II CITIES

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Abstract

Air pollution is a persistent environmental crisis in India, imposing pressure on public health and the environment. Rapid industrialization, urbanization, increased transport growth, and combustion activities worsen air pollution. The study used air quality observations from 52 monitoring stations across 10 tier-II cities in India from the Central Pollution Control Board (CPCB). The highest mean particulate matter (PM_{10}) concentration was recorded in Patna in 2023 and 2024, around 211.87 and 189.54 µg/m^3, followed by Faridabad (196.13 µg/m^3) and Ghaziabad (184.29 µg/m^3) in 2023, Whereas, in 2024, Ghaziabad recorded the second-highest PM_{10} concentration around ~174.22 µg/m^3, followed by Faridabad (170.36 µg/m^3). The percentage increase in PM_{10} was ~253.12%, ~226.88%, and ~207.15% above the NAAQ standard in Patna, Faridabad, and Ghaziabad in 2023, respectively. In 2024, the concentration shows a declining trend, although it remains above the standard. It was around 215.90%, 183.93%, and 190.37% respectively. The higher mean Nitrogen Oxides (NO_X) was observed in Navi Mumbai in 2023, at 71.71 µg/m^3. Ghaziabad had the highest annual mean NOx concentration of 53.64 µg/m^3 in 2024. Pune had the highest mean Sulfur Dioxide (SO_2) concentration of 49.42 µg/m^3 and 16.49 µg/m^3 in 2023 and 2024. Jodhpur had the lowest SO_2 concentration during both years. In Jodhpur, Ozone (O_3) shows greater variation than other gaseous pollutants. Most locations show a strong correlation between Carbon Monoxide (CO) and particulate matter, ranging from 0.5 to 0.9 in both years. Most of the pollution is received when the wind blows from the southeast direction in Kota, even in higher wind speeds (5 - 8 m/s). Overall, the study provides insights for developing city-specific air quality management strategies and for strengthening regulatory enforcement. These insights are particularly relevant to policymakers, environmental regulators, and authorities seeking to mitigate air pollution in Tier-II cities.

Keywords: Air Quality, Anthropogenic Activities, Urban Air Pollution, Tier-II Cities, Urban Growth.

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THE EFFECT OF DIFFERENT SEASONS IN THE REPRODUCTIVE ORGANS OF FISH- *CLARIAS BATRACHUS*

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Abstract

The different physiological processes of fish such as *Clarias batrachus* are highly influenced by environmental factors such as variations in temperature, light, and food availability. Understanding the underlying mechanisms that drive these responses is crucial for advancing our knowledge of fish biology, particularly in the context of reproduction. The aim of this paper is to study the effect of different seasons in the reproductive organs of fish *Clarias batrachus*. A systematic approach and consistent collection methods over the course of one full year, this research intends to provide insights into the reproductive biology of *Clarias batrachus* in relation to seasonal environmental variations. The results of this comprehensive analysis illustrate the strong seasonal modulation of gonadal parameters in *Clarias batrachus*. In particular, the increased height and nuclear and colloid diameters during the spawning season, potentially associated with increased metabolic demands during reproduction. In conclusion, the study on effect of different seasons in the reproductive organs of fish *Clarias batrachus* (also known as the walking catfish) provides valuable insights into the physiological adaptations of this species in response to environmental and seasonal variations. The gonads of *Clarias batrachus* also show marked seasonal variation in their morphology, with notable changes in size, cellular composition, and histological structure. These alterations are closely linked to the fish's reproductive cycle.

Keywords: *Clarias batrachus*, Gonads, Seasonal Changes, Spawning Season.

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EVALUATION OF LEAF LITTER DECOMPOSITION IN AGRICULTURAL AND FORESTED STREAMS IN TROPICAL SRI LANKA WITH SPECIAL REFERENCE TO CONTRIBUTIONS OF MACROBENTHOS.

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Abstract

Leaf litter decomposition is a key ecosystem process in stream environments and is significantly influenced by water quality and biological communities. The effect of such factors on leaf litter decomposition is poorly understood in tropical streams. This study analyzed the contribution of macroinvertebrates on leaf litter decomposition in an agricultural stream, Denagam Oya and pristine stream Hirikatu Oya, within the Samanalwewa catchment, in tropical Sri Lanka. Coarse-mesh (1cm) litter bags of dried *Terminalia arjuna* leaves (3g) were placed in each stream and retrieved after 10, 20, 30, 40, 50, and 60 days respectively. Water quality parameters were also measured during each sampling event. Macroinvertebrates colonizing- litter bags were identified, and litter decomposition was calculated using dry mass loss and ash-free dry mass (AFDM). Decay coefficient (k) and half–lives were calculated using an exponential decay model. Agricultural stream, Denagam Oya showed higher nutrient concentration (nitrate:0.27±0.36 mg/L; phosphate: 0.35±0.24 mg/L) compared with Hirikatu Oya (nitrate:0.14±0.06 mg/L; phosphate:0.17±0.07 mg/L). Macroinvertebrate taxa richness and Shannon diversity were significantly higher in leaf packs placed in Denagam Oya (16.17±5.94; 1.81± 0.29, respectively) than those in Hirikatu Oya (12.63± 4.18; 1.53±0.27). However, the proportion of Ephemeroptera, Plecoptera, and Trichoptera (EPT) taxa was higher in packs in Hirikatu Oya, indicating better ecological conditions in the forested stream. Leaf litter breaks down is higher in Hirikatu Oya, as shown by a higher decay coefficient (0.026± 0.01) and shorter half-lives (29.99±8.93 days) relative to Denagam Oya (k= 0.021±0.01; half -life=37.66±10.93 days). These findings emphasize that the litter decomposition in agricultural stream is mediated by greater macroinvertebrate diversity due to moderate nutrient enrichment, whereas forested streams enhance the efficiency of decomposition and more pollution–sensitive taxa. However, further research is needed to determine the other contributing elements, such as microbes on leaf litter breakdown in pristine and agricultural streams.

Keywords: Leaf litter decomposition, Macroinvertebrate, Stream

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EXPLORING ATTITUDE TOWARD THE GENE EDITING IN HUMAN EMBRYO USING CRISPR

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Abstract

CRISPR gene-editing technology has opened new possibilities in preventing inherited disease, but its application in editing human embryos has raised significant ethical and societal concerns. This research examines how different groups - such as Scientists, healthcare Professionals, policymakers, and the general public-perceive the use of CRISPR for germline modification. The study on recent surveys, academic publications, and global case examples to understand how opinions vary based on factors like education, culture values, and awareness of biotechnology. While many individuals view CRISPR as a promising tool for treating serious genetic conditions, long term risks and the potential misuse for enhancing traits. The controversial case of gene editing babies in China has further intensified scrutiny and shaped global opinion. Overall, the study highlighted ethical oversight before clinical use become acceptable.

Keywords: CRISPR-Cas9, 2. Human embryo gene editing, Genetic modification, Perception towards gene editing, Moral acceptability.

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TARGET GUIDED DELIVERY OF CURCUMIN: MOLECULAR PERSPECTIVE AND THERAPEUTIC ACTIVITIES

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Abstract

In the past few years, Turmeric or *Curcuma longa* (commonly referred to as "Turmeric") has gone from being an ordinary cooking spice to one of the most popular natural medicines in the world, with more than 200 active chemical components. Traditionally, the medicine has been used to exhibit antioxidant, anti-inflammatory, and antimicrobial effects. Unfortunately, however, the use of Turmeric in clinical settings is hampered by the problems created by conventional medicine. Most of the standard forms of Turmeric available today, whether in powdered form, capsule or as crude extracts, are not soluble in water, are quickly broken down in the body and ultimately have very poor bioavailability. To gain a therapeutic benefit from the consumption of turmeric, a patient must consume a very large amount of turmeric. The paper unveil showcase one to understand how turmeric has been used in clinical settings, along with other alternative methods of delivering turmeric to patients through new products. The new dosage formulation includes: nanoparticles and nanoemulsions (to help change the way that curcumin is absorbed in the body), liposomes and nanogels (to stabilize curcumin within the body) to help increase the potential for use of turmeric in the treatment of various diseases such as diabetes, cancer and infections resistant to multiple drugs. As a result, the use of these new and innovative drug delivery systems may establish turmeric as a viable option for treating a number of diseases.

Keywords: *Curcuma longa,* Novel Drug Delivery System, Pharmacological activity, Conventional formulations, Curcumin

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DESIGN AND DEVELOPMENT OF NOVEL INDOMETHACIN-7-AMINOCEPHALOSPORANIC ACID (7-ACA) HYBRID MOLECULES FOR THERAPEUTIC APPLICATION

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Abstract

The integration of multiple pharmacophores into a single molecular framework has emerged as a promising strategy in modern drug design to enhance therapeutic efficacy and reduce drug resistance. Indomethacin, a potent nonsteroidal anti-inflammatory drug (NSAID), is widely used for the management of pain and inflammation through cyclooxygenase (COX) inhibition; however, its prolonged use is associated with gastrointestinal and systemic side effects. Similarly, 7-aminocephalosporanic acid (7-ACA), the core nucleus of cephalosporin antibiotics, exhibits broad-spectrum antibacterial activity by inhibiting bacterial cell wall synthesis. Combining these two pharmacologically important moieties into a single hybrid molecule may provide synergistic therapeutic benefits. The present study aimed to design and develop novel indomethacin–7-aminocephalosporanic acid (7-ACA) hybrid molecules. The hybrid molecules were rationally designed by chemically linking indomethacin and 7-ACA to generate multifunctional compounds capable of dual pharmacological action. Molecular modelling and docking studies were performed to predict binding interactions with inflammatory (COX-2) and bacterial target enzymes. The synthesized hybrid compounds were characterized using appropriate analytical techniques to confirm their chemical structure and purity. *In-vitro* biological evaluations were carried out to assess anti- cancer and anti-diebetic activities. The developed indomethacin–7-ACA hybrid molecules demonstrated enhanced therapeutic potential compared to the individual parent drugs. The compounds exhibited promising anti-inflammatory activity along with significant antibacterial effects against selected microbial strains. The hybridization approach also suggested improved therapeutic efficiency and a possible reduction in drug resistance. The indomethacin–7-ACA hybrid molecules represent a novel and effective strategy for the development of multifunctional therapeutic agents. This pharmacophore hybridization approach offers significant potential for the treatment of inflammatory conditions associated with bacterial infections and aligns with current advances in innovative and sustainable pharmaceutical drug design.

Keyword: Indomethacin, 7-Aminocephalosporanic Acid, Hybrid Molecules, Anti-Cancer, Bacterial Infections.

IN-SILICO PREDICTION OF ANTI-INFLAMMATORY POTENTIAL OF PHYTOCONSTITUENTS FROM *CLERODENDRUM INFORTUNATUM* FLOWERS: MOLECULAR TARGET IDENTIFICATION, DOCKING STUDIES AND ADMET PROFILING

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Abstract

Inflammation is a multifactorial biological phenomenon regulated by complex crosstalk among enzymatic mediators, pro-inflammatory cytokines, oxidative stress pathways, and immune signalling cascades. Therapeutic strategies targeting a single inflammatory mediator often fail to provide sustained efficacy due to pathway redundancy and compensatory mechanisms. Therefore, multi-target modulation represents a promising approach for effective anti-inflammatory intervention. This study systematically investigates the anti-inflammatory potential of phytochemicals derived from the flowers of through an integrated *in-silico* framework. Phytochemical constituents were curated from the IMPPAT and molecular structures were retrieved from PubChem databases, respectively. SwissTargetPrediction Server was used to identify inflammation-associated proteins for target prediction. Fifteen key mediators were selected representing the arachidonic acid pathway (COX-1, COX-2, 5-LOX), pro-inflammatory cytokines (TNF-α, IL-1β, IL-6, IL-8), oxidative and nitric oxide signalling (iNOS, NADPH oxidase), immune and inflammatory enzymes (Phospholipase A2, TLR-4, PPAR-γ), and transcriptional regulators (NF-κB, IKKβ, JNK). Molecular docking was performed using PyRx to evaluate ligand protein binding affinities and interaction stability within active site residues. Several phytochemicals demonstrated favourable binding energies across multiple targets, indicating potential systems-level modulation of inflammatory pathways. Pharmacokinetic properties were assessed using ADMETlab 3.0, revealing acceptable drug-likeness parameters, oral bioavailability potential, and compliance with Lipinski' s rule of five. ProTox 3.0 program was used to predict favourable LD50 values and minimal organ toxicity risks. Collectively, this integrative computational investigation identified promising phytochemicals of *Clecodendrum infortunatum* flowers as potential multi-target anti-inflammatory leads, providing a rational basis for subsequent and validation toward novel phytotherapeutic advancements.

Keywords: Multi-Target Drug Discovery, Molecular Docking, Anti-inflammatory Targets, ADME and Toxicity Prediction.

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THE MICROGREEN-BASED STRATEGIES AGAINST VIRAL PANDEMICS (SARS-COV-2)

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Abstract

Viral pandemics such as COVID-19 have the importance of nutritional strategies in enhancing immune responses. Plant-based diets, particularly microgreens young seedlings of edible vegetables and herbs are recognized as nutrient-dense functional foods. They contain higher levels of vitamins (A, C, E, K, and B-complex) and essential minerals such as zinc, iron, and selenium, which support key immune functions. Microgreens are also rich in phytochemicals, including polyphenols, flavonoids, carotenoids, and glucosinolates, with antioxidant and anti-inflammatory properties that may modulate immune responses during viral infections. Recent studies highlight the potential antiviral and immunomodulatory effects of plant-derived compounds such as quercetin, curcumin, hesperidin, and epigallocatechin gallate against SARS-CoV-2. However, their clinical efficacy remains to be fully established. To review evidence on the antiviral and immunomodulatory properties of plant-derived compounds, assess their relevance in the context of SARS-CoV-2, and identify research gaps along with future directions for clinical validation. This review is based on a comprehensive analysis of published literature from scientific databases such as PubMed, Scopus, and Google Scholar. Relevant studies on microgreens, phytochemicals, immune function, and SARS-CoV-2 were selected using keywords including "microgreens," "phytochemicals," "COVID-19," "SARS-CoV-2," and "immune response." Peer-reviewed articles, experimental studies, and review papers published in recent years were prioritized. Data were critically evaluated to synthesize current knowledge on the nutritional and therapeutic potential of microgreens and plant-derived compounds. Emphasis was placed on studies reporting antiviral, antioxidant, and immunomodulatory effects. Current evidence suggests that microgreens provide a rich source of nutrients and bioactive compounds that may support immune function. However, most findings are based on in vitro and preclinical studies. Clinical validation is required to confirm their effectiveness against SARS-CoV-2. Microgreens and plant-derived phytochemicals show promising potential as complementary nutritional strategies to support immune health during viral pandemics. However, further well-designed clinical studies are essential to establish their safety, efficacy, and practical applications.

Keywords: Microgreens; Phytochemicals; SARS-CoV-2; COVID-19; Immune Response.

UFASOMES: EMERGING VESICULAR CARRIERS IN TOPICAL DRUG DELIVERY

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Abstract

Ufasomes are made of unsaturated fatty acids, especially oleic and linoleic acids, which are naturally occurring elements that are needed in various biological processes. Multiple and more sophisticated novel drug delivery systems (NDDS) are the current means of more regulated and focused medication dispensing. Vesicular drug delivery systems can help to maximise the processes in the body and the rate of drug excretion in order to increase the efficacy and patient compliance. New vesicular drug delivery systems such as liposomes, sphingosomes, cubosomes, ethosomes, niosomes, ufasomes and pharmacosomes, among others, have been invented. In this review, ufasomes will be considered as a vesicular drug carrier. Besides the active pharmaceutical ingredient (API), ufasomes are normally prepared by thin-film hydration reaction with different concentrations of cholesterol and surfactant. The given review article discusses the notion of ufasomes, their advantages and disadvantages, composition, methods of preparation, separation of unentrapped drugs, aspects that affect the ufasome formulation and characterisation, commercial preparations of ufasomes, and the latest knowledge about ufasome usage in drug delivery.

Keywords: Vesicular drug delivery system, Unsaturated fatty acid vesicles, Cosmetic applications.

OPTIMIZING TASK DECOMPOSITION IN AUTONOMOUS MULTI-AGENT SYSTEMS VIA HIERARCHICAL REASONING

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Abstract

The biggest problem with AI agents today is that they "lose the plot." When you give an agent a big, messy project, it usually starts off strong but eventually gets distracted by tiny details. Before you know it, the AI has forgotten what you actually asked for. My research introduces a new system called HEAL to fix this. Instead of letting one AI try to handle everything alone, HEAL (Hierarchical Evaluation and Action Loop) splits the job between a "Manager" and a "Worker." The Manager agent stays focused on the big picture and creates a plan. It then hands off specific chores to the Worker agent, who just handles the technical stuff. This keeps the AI from getting confused or overwhelmed. I put this system to the test against regular AI setups using 500 different business tasks, like digging through data or fixing bugs in code. The results were clear: HEAL was 14% more successful at finishing the work. Even better, it used 22% less energy (API tokens). This shows that if we want AI to handle real-world jobs, we don't need to make the AI bigger; we just need to give it a better. This way to stay organized makes AI much more reliable and cheaper for businesses to actually use.

Keywords: Autonomous Agents, Multi-Agent Systems, Hierarchical Planning, Task Decomposition, Token Efficiency, Manager-Worker Topology**.**

F-PGA CONTRACTIONS AS A MATHEMATICAL FRAMEWORK FOR DIGITAL TRANSFORMATION AND EMERGING TECHNOLOGIES SUPPORTING SUSTAINABLE DEVELOPMENT GOALS

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Abstract

This research paper develops a mathematical framework based on F-PGA contraction mappings to analyze stability, convergence and equilibrium behaviour in digital transformation system. We establish new fixed results for F-PGA contractions in complete metric spaces and illustrate their applicability to artificial intelligence systems, smart energy grids, sustainable infrastructure and climate modeling. The theoretical findings are supported rigorus proofs, numerical illustrations and application driven modeling. The study connects non-liner contraction theory with machine learning contraction theory with machine learning, smart cities, sustainable energy and climate analytics highlighting their relevance to SDGs 9.

Keywords: F-PGA contraction, Digital Transformation, Artificial Intelligence, Nonlinear Analysis.

MENTAL HEALTH AT WORKPLACE: A STRATEGIC FRAMEWORK FOR THEIR SUSTAINABILITY

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Abstract

Mental health is a universal issue critical not only to individual health and well-being but also to workplace sustainability and organization performance. Mental health has historically been a tabu subject in the workplace despite the role it plays. When it comes to both worker well-being an organizational performance the lack of attention from employers is a major oversight given the prevalence of mental health issues and their potential impact at workplace. Approximately 1 in 5 adults experience some degree of mental health concern each year. In 2019 and estimated 970 million people globally has a diagnosable mental health disorder, including 15% of working age adults. Mental health has emerged as a cornerstone of overall employee well-being and a primary determinant of organization success. Research indicates that poor mental health conditions, particularly depression and anxiety leads to the loss of an estimated 12 billion working days annually, costing the global economy roughly US $ 1 trillion in lost productivity. Safe and healthy work environment are not only a fundamental right but are also more likely to minimize tension and conflicts at workplace and improve staff retention work performance and productivity. Conversely a lack of effective structures and support at work, especially for those living with mental health conditions, can affect a person's ability to enjoy their and do their job well. This study shows that mental health and well-being strategies must be integrated into organization policies to build resilience, ensure sustainable performance and maintain workforce competitiveness.

Keywords: Workplace, Mental Health, Employee Well-Being, Productivity, Organizational Performance.

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THE INTER CONNECTED THREAT OF ANTIMICROBIAL-RESISTANCE: A ONE HEALTH PROSPECTIVE

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Abstract

The achievement of Sustainable Development Goal 3 (SDG 3) is increasingly threatened by the environmental feedback loops of antimicrobial resistance, where conventional pharmaceuticals persist in ecosystems long after human excretion. This paper proposes a novel paradigm in "Green" Molecular Engineering, shifting the pharmaceutical focus from mere clinical efficacy to a holistic One Health lifecycle. We introduce a framework for designing next-generation antibiotics that are engineered for high human bioavailability ensuring optimal therapeutic concentrations in the patient yet possess "environmental triggers" for rapid biodegradation once entering aquatic or soil ecosystems. This study shows how drugs can be programmed to degrade into non-toxic metabolites outside the human body, effectively neutralizing the selective pressure that drives the evolution of multi-drug-resistant pathogens in the environment. This strategy directly targets the "silent pandemic" of resistance by preventing strong pharmaceutical residues from re-entering the human food and water chains. Our finding indicates that incorporating ecological stability as a basic pharmacokinetic measure is a logistical requirement for securing human medical treatments. Finally, this study contends that the future of human health and the success of SDG 3 are dependent on a pharmaceutical transition from persistent chemical design to transient, environmentally friendly therapies. This unique technique provides a solid road map for ensuring the long-term usefulness of the global pharmacopeia while conserving the environmental determinants of human well-being.

Keywords: SDG3 Sustainable Development Goal 3, One Health, Green Pharmacy.

THE SOIL-WATER NEXUS: A CRITICAL LINK BETWEEN CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

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Abstract

A research article based that is presented in a form that is far more condensed than the one that was first published. The assessment of water and Soil quality through physicochemical and microbial analysis represents a critical interface between environmental health and public safety. This article synthesizes current knowledge on analytical methodologies, contamination indicators, and ecological interactions in water and Soil matrices. Analysis of recent literature reveals that integrated approaches combining physicochemical parameters (pH, dissolved oxygen, electrical conductivity, total dissolved solids, biochemical oxygen demand, chemical oxygen demand, heavy metals) with microbial indicators (Escherichia coli, total coliforms, fungi) provide the most comprehensive quality assessment. Advanced analytical techniques including metagenomics, principal component analysis, and water quality indices have enhanced our capacity to interpret complex environmental data. It should state the problem, which is the impact of climate change on Soil and water, the core argument, which is the interconnectedness of these resources, the main topics covered, which are the key impacts, treatment strategies, and challenges, and the overarching conclusion, which is the necessity of integrated solutions in order to achieve sustainable development.

Keywords: Water Quality Assessment, Soil Filtration, Physicochemical Analysis, Microbial Indicators, Biofilm, Schmutzdecke, Metagenomics, Principal Component Analysis.

LABORATORY-SCALE CULTIVATION OF A. PLATENSIS: GROWTH RESPONSE TO ALKALINE PH AND MODERATE ILLUMINATION

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Abstract

Growth Kinetics of Arthrospira (Spirulina) platensis Under Controlled Laboratory Conditions; Effect of Temperature, pH, and Light Intensity on the Batch Cultivation of Spirulina platensis; Laboratory-Scale Evaluation of Growth Performance in Arthrospira platensis; Optimization of Physicochemical Parameters for the Cultivation of Spirulina platensis; Assessment of Growth Dynamics of A. platensis at 30 °C and Alkaline pH; Influence of Controlled Physicochemical Conditions on the Growth Kinetics of Arthrospira platensis; Batch Cultivation and Spectrophotometric Monitoring of Spirulina platensis at 660 nm; Physicochemical Regulation of Growth in Arthrospira platensis During a 21-Day Batch Culture; Evaluation of Optical Density-Based Growth Analysis in Spirulina platensis; and Controlled Cultivation and Growth Characterization of Arthrospira platensis Under Optimized Environmental Parameters.

Keywords: Arthrospira, Physiochemical, Spectrophotometric, Growth Kinetics.

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RATIONAL DESIGN, SYNTHESIS, STRUCTURAL CHARACTERIZATION AND IN-SILICO MOLECULAR DOCKING STUDIES OF NOVEL BENZIMIDAZOLE DERIVATIVES AS POTENTIAL ANTI-TUBERCULAR AGENTS

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Abstract

Tuberculosis (TB) remains one of the world's most pressing health challenges, made even more serious by the rise of multidrug-resistant and extensively drug-resistant strains of *Mycobacterium tuberculosis*. Current treatments are often limited, which highlights the urgent need for new drugs with better effectiveness and fresh mechanisms of action. Benzimidazole, a versatile heterocyclic scaffold widely used in medicinal chemistry, has attracted attention because of its broad pharmacological potential — making it a strong candidate for antitubercular drug discovery. In this study, we designed and synthesized a series of novel benzimidazole derivatives and explored their potential against TB using molecular docking techniques. The compounds were prepared by condensing *o-phenylenediamine* with a variety of substituted aromatic aldehydes and carboxylic acids, giving rise to structurally diverse analogues. Each compound was purified and its identity confirmed through FT-IR, ^1H and ^13C NMR, and mass spectrometry. Docking experiments were then carried out to evaluate how these molecules interact with key TB target proteins, including enoyl-acyl carrier protein reductase (InhA) and DNA gyrase. Several derivatives showed encouraging binding energies and formed strong hydrogen bonds and hydrophobic contacts with critical amino acid residues in the active sites. Interestingly, compounds bearing electron-withdrawing groups or heteroaromatic substituents achieved higher docking scores than standard reference drugs. Our structure–activity relationship analysis revealed that the way substituents are arranged on the benzimidazole core plays a major role in determining binding strength and target selectivity. Taken together, these findings suggest that the newly designed benzimidazole derivatives hold real promise as antitubercular agents. Further biological testing, both in vitro and in vivo, will be essential to validate their potential. This integrated approach offers a solid foundation for advancing the development of next-generation TB therapies.

Keywords: Benzimidazole Scaffold, Tuberculosis, Antitubercular Agents, Orthophenylene Diamine.

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TRADITIONAL USE OF ANIMAL-BASED MEDICINE AMONG INDIGENOUS POPULATION OF WEST SIKKIM, INDIA

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Abstract

Zootherapy is the use of items produced from animals to treat human illnesses. The indigenous populations of the Sikkim Himalayan retain essential traditional knowledge, particularly about the utilization of flora and fauna, owing to their intimate relationship with nature. In addition to providing food for humans, animals are frequently utilized by the local peoples of West Sikkim for purposes including medicine and other associated services. In this investigation, population based cross-sectional study was conducted from March 2025 to June 2025 in selected rural areas of West Sikkim. Data was collected using a house-to-house survey method through semi-structured questionnaires and by personal interviews. In this study, a total of 35 individuals had participated aged between 35-95 years and a total of 35 species of animals were recorded. Among 35 species, a significant majority (51%) of the total species were recorded from Limboo community followed by Lepcha community (34%) and Bhutia community (15%). This study revealed that 28% of the species belongs to class mammalia followed by 20 birds (20%) and insects (20%). The study also showed that majority (65%) of the species were used through oral application and 35% of the species were used in topical application. Consequently, local traditional healers and practitioners often use animals and their products for various medical purposes, which we can bridge with modern discovery of new revolutionized pharmaceutical medicines. So, in order to maintain a long-term health of environment and local populations, the usage of animals and animal products should be balanced through various sustainable methods like conserving species that are used in ethnozoological practices, improving animal welfare by minimizing pollution and illegal hunting and thus preserving their cultural significance and promoting responsible interactions with local communities.

Keywords: Zootherapy, Pharmaceutical Medicines, Ethnozoological Practices, Animal Welfare.

LACCASE-MEDIATED BIOREMEDIATION OF DISTILLERY EFFLUENT BY *BACILLUS VELEZENSIS* HIM03: OPTIMIZATION OF PROCESS PARAMETERS, METABOLITE CHARACTERIZATION, AND ENVIRONMENTAL SAFETY EVALUATION

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Abstract

The sustainable treatment of distillery industry effluent (DIE) is hindered by its intense color, complex chemical composition, and inherent toxicity, making effective remediation essential for environmental protection and public health safety. In this study, we report for the first evidence of DIE bioremediation using a novel ligninolytic enzyme–producing bacterium, *Bacillus velezensis* HIM03. The strain demonstrated rapid and efficient detoxification within 144 hours, achieving substantial reductions in key pollution indicators: COD (84.03%), BOD (87.00%), TDS (74.99%), phosphate (69.27%), sulphate (63.17%), nitrate (71.01%), phenol (74.03%), and heavy metals including Zn (85.93%), Cu (78.57%), Mn (75.26%), Fe (66.00%), and Pb (72.73%). The isolate *Bacillus velezensis* HIM03 (GenBank Accession Number: OP659023) produced high levels of laccase, with peak activity of 6.18 IU/mL/min at 96 hours under optimized conditions (pH 8, 35 °C, 0.5% glucose and peptone as carbon and nitrogen sources, inoculum size 10 mL, and agitation at 120 rpm), reflecting its strong oxidative capacity for degrading recalcitrant coloring contaminants (RCCs). Structural and chemical analyses using FT-IR and GC-MS confirmed the breakdown and transformation of RCCs into simpler, non-toxic metabolites, indicating genuine detoxification rather than superficial decolorization. Phytotoxicity evaluation further demonstrated environmental safety, with 82% seed germination of *Phaseolus aureus* L. (mung bean) following irrigation with treated DIE, confirming a significant decline in residual toxicity. Overall, these findings highlight *Bacillus velezensis* HIM03 as a powerful bioremediation agent capable of regulatory-compliant pollutant removal, offering strong promise for its integration into economically viable, scalable, and sustainable treatment systems for DIE, in alignment with the UN Sustainable Development Goals on clean water, health, and environmental sustainability.

Keywords: *Bacillus velezensis* HIM03, Phytotoxicity Evaluation, Effective Remediation, Effective Remediation.

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CYBERSECURITY THREATS AND DEFENCE MECHANISMS

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Abstract

Today's digital world, cybersecurity faces many practical challenges. One of the biggest problems is that cyber threats are constantly changing. Attackers regularly develop new techniques, which makes it difficult for security systems to stay updated and provide full protection. Another major challenge is human error. Many security incidents happen because users are not fully aware of cybersecurity risks. Clicking on suspicious links, using weak passwords, or ignoring security guidelines often allows attackers to gain access to systems. Outdated software and unpatched systems also create serious security risks. When systems are not updated regularly, known vulnerabilities can be easily exploited by attackers, leading to data breaches and system failures. The increasing use of cloud computing, remote work, and interconnected networks has made IT infrastructure more complex. Managing security across multiple platforms and devices becomes difficult and requires constant monitoring. Detecting cyberattacks at the right time is another challenge. Traditional security tools may fail to identify advanced threats quickly, which increases the chances of data loss and financial damage. Protecting sensitive data and maintaining user privacy is also a growing concern. As data is stored and shared across different digital environments, ensuring confidentiality and preventing unauthorized access becomes more challenging. Finally, although modern technologies such as artificial intelligence help improve threat detection, their implementation requires skilled professionals and proper management, which is not always easily available.

Keywords: Defensive Security Strategies, Data Confidentiality, Cyber Attack Mitigation, Security Automation, Access Governance, Zero Trust Model.

FLORISTIC DIVERSITY AND ETHNOBOTANICAL IMPORTANCE OF ANACARDIACEAE IN NORTH-EAST INDIA

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Abstract

The study tells about the Anacardiaceae family diversification in the north eastern region of India (in parts of indo-burma diversity hotspot). The study contains the locality of various species of Anacardiaceae and also tells about the fruit type of all the species present in the region. The region contains diverse representation of Anacardiaceae because of its humid climate, varied topography and rich forest ecosystems. India has about 74 species in 24 genera of Anacardiaceae and northeast region contains roughly 30-35 species which mainly belong to *Mangifera*, *Buchanania*, *Holigarna* and *Spondias* genera. The study also indicate that all members of Anacardiaceae produce drupe fruits (fleshy mesocarp, hard stony endocarp).The review paper represents comprehensive tables of plant species categorised by locality in north eastern region and fruit type diversity. To synthesize available information on the diversity, taxonomy, distribution, ecological importance, economic value, ethnobotanical uses, and conservation status of the family Anacardiaceae in the North-Eastern region of India.

Keywords: Anacardiaceae, North-Eastern India, Biodiversity, Edible Fruits, Ethnobotany, Forest Ecology, Conservation, Sapindales.

A CROSS-SECTIONAL INVESTIGATION OF AWARENESS, PREVALENCE AND MOLECULAR LANDSCAPE OF B-THALASSEMIA CARRIERS

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Abstract

β-thalassemia is an inherited autosomal recessive hemoglobin disorder caused by mutations in the HBB gene on chromosome 11, leading to defective or absent β-globin chain synthesis. This imbalance results in ineffective erythropoiesis, hemolysis, chronic anemia, and severe clinical complications that often require lifelong blood transfusions and iron chelation therapy, creating substantial emotional and financial burdens for families and healthcare systems. Although carriers are usually asymptomatic, they play a key role in disease transmission as marriage between two carriers leads to 25% chance for their offspring to be thalassemic major. Assessing awareness and carrier status among youth is essential to promote early screening, genetic counselling, and informed reproductive choices, thereby supporting prevention and reducing the overall burden of β-thalassemia. A cross-sectional study was carried out with a sample size of 809. The inclusion criteria consisted of individuals aged 18-35 years and willing to provide informed consent. The exclusion criteria consisted of Individuals previously diagnosed with thalassemia major. The hypothesis was to check the prevalence, awareness, and molecular characterization of β-thalassaemic carriers. Data were collected using a bilingual (English–Hindi) Google Form distributed online and offline. A total of 727 survey forms were collected and the awareness levels accessed was very low. A prevalence of 1% was found across the 809 individuals screened. On completion of molecular characterization, 6 commonly prevalent mutations with specific region and ethnicity were found.

Keywords: β-thalassemia, Random Screening, HPLC, Survey, Sanger Sequencing

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BIOGENIC SYNTHESIS OF METALLIC NANOPARTICLES USING PLANT EXTRACT AND THEIR ANTIMICROBIAL AND ANTI BIOFILM POTENTIAL AGAINST MULTIDRUG RESISTANT BACTERIA

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Abstract

The rapid rise of antimicrobial resistance (AMR), particularly among multidrug-resistant (MDR) pathogens, poses a serious global health threat and necessitates the development of sustainable alternatives to conventional antibiotics. Green nanotechnology has emerged as a promising strategy, offering eco-friendly synthesis of metallic nanoparticles with potent antimicrobial potential and antibiofilm efficacy against clinically significant MDR microorganisms. Metallic nanoparticles were synthesized via a green approach employing plant extracts as natural reducing and stabilizing agents, thereby avoiding toxic chemicals and energy-intensive procedures. Nanoparticle formation and characterization were confirmed using UV–Visible spectroscopy, X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and transmission electron microscopy (TEM). The analyses revealed stable, crystalline, predominantly spherical nanoparticles within the nanoscale range, with antimicrobial activity was assessed using agar diffusion assays, minimum inhibitory concentration (MIC) determination, and biofilm inhibition studies against selected Gram-positive and Gram-negative MDR strains. Mechanistic insights suggest that antimicrobial action is mediated through disruption of cell membrane integrity, reactive oxygen species (ROS) generation, protein denaturation, and interference with nucleic acid function. Overall, the findings highlight the potential of green-synthesized metallic nanoparticles as sustainable and effective nano-antimicrobials to combat AMR. Future investigations should focus on in vivo validation, detailed toxicity assessment, and formulation development to facilitate clinical translation and integration into advanced antimicrobial therapies.

Keywords: Green Synthesis, Metallic Nanoparticles, Multidrug-Resistant Bacteria, Antimicrobial Resistance, Antibiofilm Activity, Reactive Oxygen Species, Nano-Antimicrobials.

IMPACT OF CLIMATE CHANGE AND ECOSYSTEM RESTORATION: A BRIEF REVIEW

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Abstract

Climate change has been marked as a biggest environmental issue seeking a lot of attention. Impacts are long lasting on the planet as well as environment. Though it is challenging to link specific weather occurrences to global warming but higher temperatures are expected to result in more significant impacts such as glacial retreat, artic shrinkage and global sea level rise. Many aquatic species have experienced major extinctions, which have linked to climate change such as mammals, fish corals and plants. Such changes pose a significant threat to both natural systems and human societies. One of the most alarming consequences of climate change is the loss of biodiversity. Many aquatic and terrestrial species have experienced population declines and extinctions that are closely linked to changing climatic conditions. Coral bleaching, ocean acidification, and habitat loss further accelerate ecological imbalance, threatening food chains and ecosystem stability. A growing threat to public health around the world, climate change is expected to have an impact on people's health in variety of ways including heat stroke, air pollution, food scarcity, spread of infectious disease outbreak. Global climate change has been a significant issue that has sparked concern throughout the world. The current study focuses on various facets of climate change, its impacts, explores mitigation, adaptation strategies and focuses on measures & necessity for raising awareness of the problem worldwide.

Keywords: Climate Change, Global Warming, Population Declines.

FLORISTIC VULNERABILITY AND THERMAL STRESS IMPACTS ON THREATENED PLANT TAXA OF THE NIMAR REGION, MADHYA PRADESH

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Abstract

The Nimar region, situated in the south-western part of Madhya Pradesh, India, represents an ecologically significant landscape dominated by tropical dry deciduous forest vegetation and rich floristic diversity. The region encompasses four districts, namely West Nimar (Khargone), East Nimar (Khandwa), Burhanpur, and Barwani. Extensive floristic surveys were conducted in the Nimar region during the period 2022–2025 to assess floristic vulnerability and the conservation status of rare, endangered, and threatened (RET) plant taxa under increasing environmental and thermal stress conditions. The present study documents 94 RET plant species belonging to 45 families, including 25 Vulnerable, 40 Endangered, 18 critically Endangered, and 11 Near Threatened taxa. The progressive decline in population size and distribution of these plant species is primarily attributed to anthropogenic pressures such as overgrazing, degradation and conversion of traditional grasslands, forest clearance for agricultural expansion, large-scale developmental projects, unsustainable extraction of plants for fuel wood and leaf harvesting, pollution, and disruption of natural pollination processes. These pressures, combined with rising thermal stress, are intensifying floristic vulnerability and threatening long-term ecosystem stability in the region. The study emphasizes the urgent need for climate-responsive conservation strategies, habitat protection, and restoration initiatives to ensure the survival of threatened plant taxa in the Nimar dry forest ecosystem.

Keywords: Floristic Vulnerability, Threatened Plants, Nimar Region, Plant Conservation, Dry Deciduous Forests.

QSAR-GUIDED DESIGN AND MOLECULAR MODELLING OF INDOLE DERIVATIVES FOR LUNG CANCER THERAPY

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Abstract

Quantitative Structure–Activity Relationship (QSAR) and molecular modelling studies were conducted on a series of indole scaffold–based compounds to identify the key molecular features influencing anticancer activity against lung cancer. A curated dataset of indole derivatives with reported inhibitory activity on the A549 human lung adenocarcinoma cell line was collected from published literature. Molecular structures were drawn and optimized using VLife Molecular Design Suite. A wide range of physicochemical, topological, and electronic descriptors was calculated, followed by descriptor selection to remove redundant and highly correlated variables. QSAR models were developed using appropriate regression methods by dividing the dataset into training and test sets. The statistical quality and robustness of the models were evaluated using standard validation parameters such as the coefficient of determination (R^2), cross-validated correlation coefficient (Q^2), and external predictive ability. The obtained models exhibited acceptable goodness of fit and predictive performance, indicating their reliability within the defined applicability domain. Key descriptors related to hydrophobicity, steric effects, and electronic distribution were found to significantly influence anticancer activity against the A549 cell line. *In silico* ADMET and toxicity predictions were also carried out to evaluate drug-likeness and safety profiles. To support QSAR findings, molecular docking study was also performed to analyze ligand–target interactions. Overall, this study highlights the potential of indole-based compounds as promising lung cancer therapeutics and demonstrates the effectiveness of QSAR approach using VLife MDS in rational anticancer drug design.

Keywords: QSAR, A549, Anticancer, Indole Derivative

FROM PLANT TO PRODUCT: GREEN PROCESSING APPROACHES SHAPING THE FUTURE OF HERBAL FORMULATION

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Abstract

The expanding global reliance on herbal medicines has intensified the need for standardized, safe, and environmentally sustainable formulation strategies. Conventional extraction and processing methods frequently depend on toxic organic solvents, prolonged heating, and energy-intensive operations, which can degrade thermolabile phytoconstituents, compromise batch consistency, and generate ecological burden. Formulation-oriented analysis of major green extraction approaches including supercritical fluid extraction, microwave-assisted extraction, ultrasound-assisted extraction, enzyme-assisted extraction, and natural deep eutectic solvents within a "plant-to-product" developmental framework. Evidence indicates that green technologies enhance bioactive yield, reduce solvent toxicity, shorten processing time, and improve reproducibility while minimizing environmental impact. Furthermore, these approaches positively influence downstream formulation parameters such as stability, bioavailability, and quality assurance compliance. Despite significant progress, challenges persist in industrial translation, economic feasibility, harmonized regulatory acceptance, and comprehensive toxicological profiling of novel green solvents. A notable research gap lies in integrating green processing with Quality-by-Design (QbD), Process Analytical Technology (PAT), and digital optimization tools to enable predictive modeling and real-time quality monitoring. Future perspectives highlight the potential of AI-driven process modeling, continuous manufacturing platforms, and lifecycle assessment-based validation to strengthen sustainable herbal drug development that balance pharmacognostic integrity, regulatory compliance, and environmental stewardship, thereby supporting high-impact scientific and industrial applications.

Keywords: Green Processing, Herbal Formulations, Pharmacognosy, Sustainable Extraction, Quality Assurance, Phytochemical Integrity, Herbal Drug Development.

SYNERGIZING SDG13 AND SDG15 INTO A STRATEGIC FRAMEWORK FOR SANDFLY SURVEILLANCE AND GLOBAL HEALTH SECURITY

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Abstract

Climate change and the degradation of terrestrial ecosystem are significantly altering the ecological niche of disease-carrying vectors including Phlebotomous sandflies, which are the primary vectors of Leishmaniasis. As the world faces unprecedented climate shift (Sustainable Development Goal - 13) and loss of biodiversity (SDG-15) the geographical boundaries of these vectors are expanding into previously non endemic regions. The interplay between climate instability and habitat fragmentation creates a perfect storm for the resurgence of vector-borne diseases, leaving vulnerable population at high risk. The main objective of this study is to explore the synergistic effect of rising ambient temperature and land use changes on sandfly biodiversity proposing a structured framework that combines climatic resilience with biodiversity conservation to address this public health menace. To tackle this, the methodology adopts an integrated, multidisciplinary approach focusing on the utilization of Remote Sensing (RS) and Geographic Information System (GIS). These tools will be used to map high-risk zones created by deforestation and urbanization to evaluate how microclimatic changes influence sandfly population. Through this mapping, it is expected that the evaluations will demonstrate how rising temperature and biodiversity loss not only expand sandfly habitats but are also likely to critically alter their metabolic rates and pathogen transfer efficiency. Furthermore, the anticipated findings aim to highlight that traditional vector management often ignores the long-term impacts of global warming and land use changes. The conclusion will emphasize that protecting terrestrial ecosystems (SDG 15) is a vital public health necessity, as restoring natural biodiversity acts as a natural check on vector population. Looking ahead, integrating SDG 13 and SDG 15 goals makes this framework highly profitable and sustainable for future global health security. By incorporating entomological surveillance into environmental conservation efforts, we can develop climate-smart public health policies that will significantly reduce future healthcare burdens, making global health security both robust and economically viable.

Keywords: Climate Change, Sustainable Development Goal (SDG), Remote Sensing, Geographic Information System, Multidisciplinary Approach.

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PYRAZOLONE: ANTI-INFLAMMATORY ACTIVITY WITH KEY EMPHASIS ON SAR

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Abstract

The body's natural reaction to damage, illness, or toxic stimuli is inflammation. Although non-steroidal anti-inflammatory medications (NSAIDs) and corticosteroids biologics are effective anti-inflammatory therapies, they have some drawbacks, such as side effects and limited effectiveness in specific patient populations. To overcome the drawbacks of existing therapies and enhance patient outcomes, next-generation anti-inflammatory medication development is essential. This book chapter encompasses over 100 studies that showcase the anti-inflammatory properties of pyrazolone and its derivatives. This includes commercial drugs, synthetic methods, phytoconstituent, and structure-activity relationship (SAR) studies of various pyrazolone derivatives with EWGs and EDGs. The biological potential of pyrazolone derivatives as anti-inflammatory drugs was investigated. This study examined the link between their structure and activity, clarifying the important structural components required for biological activity. The book chapter will provide substantial support to researchers engaged in the development of targeted anti-inflammatory medications through the utilization of pyrazolones in the creation of novel scaffolds.

Keywords: Structure-Activity Relationship, Anti-Inflammatory Activity, Nsaids, Pyrazolones, Phytoconstituent.

DESIGN, SYNTHESIS AND MOLECULAR DOCKING OF NOVEL PYRAZOLE-2-ONE DERIVATIVES AS POTENTIAL ANTI –INFLAMMATORY AGENTS

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Abstract

Pyrazole-2-one derivatives represent an important class of heterocyclic compounds that have attracted considerable attention in medicinal chemistry due to their diverse pharmacological properties, particularly anti-inflammatory activity. Inflammation is a complex biological response involved in the pathogenesis of numerous acute and chronic diseases, and the development of safer and more effective anti-inflammatory agents remains a major therapeutic goal. Pyrazole-2-one scaffolds are structurally versatile and allow for extensive substitution, enabling fine-tuning of their biological activity and selectivity. Several pyrazole-2-one derivatives have demonstrated significant inhibition of key inflammatory mediators, including cyclooxygenase (COX) enzymes, prostaglandins, and pro-inflammatory cytokines such as tumour necrosis factor-α and interleukins. Mechanistic studies suggest that these compounds exert their anti-inflammatory effects through modulation of enzyme activity, suppression of oxidative stress, and interference with inflammatory signalling pathways. Compared to traditional non-steroidal anti-inflammatory drugs, certain pyrazole-2-one analogues exhibit improved efficacy with reduced gastrointestinal and systemic side effects. Recent advances in synthetic strategies have facilitated the rapid generation of novel pyrazole-2-one derivatives with enhanced pharmacological profiles. Structure–activity relationship studies further highlight the importance of substituent nature and position in optimizing anti-inflammatory potency. Overall, pyrazole-2-one-based compounds offer a promising platform for the development of next-generation anti-inflammatory agents. Continued research focusing on molecular mechanisms, pharmacokinetics, and safety evaluation is expected to support their progression toward clinical applications.

Keywords: Anti-Inflammatory Activity, Extensive Substitution, Novel Pyrazole-2-One Derivatives, Cyclooxygenase.

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INSIGHT TRANSDERMAL DRUG DELIVERY SYSTEM: ADVANCE, CHALLENGES AND FUTURE PERSPECTIVE: A REVIEW

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Abstract

Transdermal drug delivery system (TDDS) is non-invasive, controlled release across the skin barrier, eliminating hepatic first-pass metabolism, to enhances the bioavailability, it can altered pharmacotherapy. This review highlights recent developments, current challenges, and future perspective for Transdermal drug delivery systems. Major advances of Transdermal drug delivery systems utilized nano-technology in the form of liposomes, niosomes, nanostructured lipid carriers, or nano emulsion can improve its drug solubility and stratum corneum partitioning; electrically assisted transport; and microneedle array to create transient microchannel to improve hydrophilic drug permeation. For peptides such as insulin, iontophoresis can enhance permeability up to 10 times more, and dissolved microneedles facilitate painful vaccine delivery with their dosage's accurate range about 80-90%. Precision medicines illustrated transdermal patches utilized stimulation-responsive polymer (such as temperature, pH, and glucose-sensitive etc), as in tightly integrated insulin systems. In advance development can create difficulties continue to arise: the lipophilic barrier of the stratum corneum inhibit the penetration of hydrophilic and high-molecular-weight (>500 Da) pharmaceuticals; skin irritation for enhancement compounds includes DMSO or terpenes; inter-individual variability creates wrinkles, malnutrition, and disease circumstances; or scalability problems for the production of microneedles or nano systems. Commercialization is made up of more difficulties by regulatory obstacles like longevity of safety data and bioequivalence evidence. The future prospect required combination technologies, including 4D-printed patches and on-demand release and microneedles paired with nano-carriers for synergistic effects. Transformative applications are promised by integrating biosensors for real-time therapy monitoring, AI-driven formula optimization, and biologics delivery (include monoclonal antibodies via radiofrequency techniques). Environmental and patient-focused needs customised TDDS via 3D printing, sustainable, and biocompatible materials. In last, TDDS development will expand therapeutic windows for chronic diseases involve obesity, hypertension, and alleviating pain, while encouraging a paradigm shift toward efficient, patient-compliant therapies.

Keywords: Transdermal Patches, Microneedles, Nano-Carriers, Permeation Enhancers, Stimuli-Responsive Systems.

IN SILICO DRUG DISCOVERY FROM MEDICINAL PLANTS: AN UPDATED CHEMO-AND BIOINFORMATICS REVIEW FOR SUSTAINABLE PHARMACEUTICAL INNOVATION

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Abstract

Medicinal plants represent a rich source of bioactive compounds with proven therapeutic efficacy in traditional medical systems worldwide. However, their pleiotropic, multi-target pharmacological profiles, often driven by synergistic interactions in complex extracts, remain poorly characterized beyond empirical knowledge. This chapter provides a comprehensive overview of cheminformatics and bioinformatics methods for in silico drug discovery from medicinal plants, enabling systematic expansion of traditional therapeutic indications via computational analysis of phytochemical diversity. Drawing on the review by Lagunin *et al.,* it evaluates modern databases (e.g., COCONUT 2.0, NPASS 3.0) and predictive tools for biological activity (e.g., SwissTargetPrediction), target fishing, molecular docking, and network pharmacology. A reproducible workflow is outlined, accompanied by a case study of 50 Ayurvedic plants from Traditional Indian Medicine. This study replicates known therapeutic effects and reveals novel pleiotropic activities, particularly in neuroprotection and anticancer areas. Major challenges, such as data quality issues, algorithmic biases, the need for experimental validation, and Nagoya Protocol compliance, are discussed with best-practice guidelines. Future prospects emphasize generative AI, multi-omics integration, and personalized herbal formulations to accelerate evidence-based progress. Overall, the chapter empowers researchers to integrate ancient ethnobotanical insights with modern science, fostering sustainable, safer therapies for global health challenges.

Keywords: Medicinal Plants, In Silico Drug Discovery, Cheminformatics, Bioinformatics, Network Pharmacology.

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OVER-THE-COUNTER DRUGS- A PHARMACOVIGILANCE-BASED APPROACH

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Abstract

Over-the-counter (OTC) medicines are drugs that can be bought without a prescription from a registered medical practitioner. They play an important role in healthcare and are generally safe and effective when used as directed. OTC medicines are commonly used to treat minor health problems such as headaches, colds, fever, cough, indigestion, flu, and skin conditions. The shift of some medicines from prescription-only to OTC status has helped save time and reduce pressure on healthcare systems worldwide However, OTC medicines must have a wide safety margin, and their benefits should clearly outweigh their risks. Although many people believe OTC drugs are completely safe because they are available without a prescription, they can still cause side effects, be misused or abused, and interact with other prescription medicines. Not following label instructions can lead to serious harm. For example, an overdose of acetaminophen can cause liver damage, analgesics may increase the risk of gastrointestinal bleeding even at normal doses, and cough medicines like dextromethorphan and diphenhydramine may be abused for their euphoric effects. Therefore, a strong pharmacovigilance system is necessary to ensure the safe use of OTC medicines.

Keywords: Over-the-Counter (OTC), Drug Safety, Adverse Drug Reactions (ADRs), Pharmacovigilance, Patient Awareness, Healthcare, Burden Reduction.

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DESIGN AND APPLICATION OF SELF-HEALING HYDROGELS IN CONTROLLED DRUG RELEASE

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Abstract

Conventional controlled drug delivery systems often face challenges such as burst release, structural instability, and poor adaptability within dynamic physiological environments. To address these issues, this study introduces a multifunctional self-healing hydrogel platform designed through synergistic dynamic covalent and supramolecular crosslinking mechanisms. This innovative design allows for programmable and sustained drug release. The hydrogel network is constructed using reversible Schiff base linkages, redox-sensitive disulfide bonds, and hydrogen bonding interactions, which enable the material to recover structurally after mechanical disruption. This dual-dynamic crosslinking strategy provides rapid self-repair, shear-thinning injectability, and in situ gelation under physiological conditions. The tunable crosslinking density allows for precise modulation of mesh size and swelling behaviour, thereby controlling the kinetics of drug diffusion. To further enhance therapeutic performance, nano-engineered drug carriers are incorporated within the hydrogel matrix, creating a hybrid nanocomposite system. This integration reduces the risk of initial burst release and facilitates stimuli-responsive drug release triggered by pathological micro-environmental factors such as acidic pH and elevated redox potential. The interconnected network architecture enhances mechanical robustness while ensuring high biocompatibility and controlled degradation profiles. Unlike traditional hydrogel systems that rely on a single crosslinking mechanism, this work introduces a dual-dynamic, redox-sensitive self-healing network integrated with nano-carrier-assisted diffusion control. This enables mechanical resilience, adaptive self-repair, and microenvironment-specific drug release all within a single injectable platform. The proposed system establishes a direct correlation between structure, properties, and drug release, providing a rational framework for designing precision-responsive drug delivery matrices. Overall, this approach demonstrates the potential of intelligent self-healing hydrogels to transform controlled drug delivery strategies for applications in cancer therapy, wound healing, and localized regenerative treatments.

Keywords: Self-Healing Hydrogels, Controlled Drug Release, Dual-Dynamic Crosslinking, Stimuli-Responsive Systems, Injectable Nanocomposite, Redox-Sensitive Hydrogels, Precision Therapeutics

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ROLE OF RAS AND ANTIOXIDANT GENE POLYMORPHISMS AS PREDICTIVE BIOMARKERS OF CARDIOVASCULAR COMPLICATIONS IN TYPE 2 *DIABETES MELLITUS*

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Abstract

Type 2 Diabetes Mellitus (T2DM) is a chronic metabolic disorder closely associated with an increased risk of cardiovascular disease (CVD), the primary cause of death among diabetic individuals. While traditional risk factors, including hyperglycemia, dyslipidemia, and hypertension, play major roles in the development of cardiovascular complications, they fail to fully explain the significant variability in CVD outcomes among patients with T2DM. Emerging evidence indicates that genetic susceptibility, particularly polymorphisms in genes related to the Renin–Angiotensin System (RAS) and antioxidant defence pathways, may substantially influence the risk of CVD. Variants in RAS genes, such as ACE and ACE2, can modify enzyme function and disrupt vascular homeostasis, thereby promoting diabetic vascular injury. Similarly, polymorphisms in antioxidant genes such as CAT and GPx1 may weaken the body's defense against oxidative stress, leading to endothelial dysfunction. Collectively, these genetic variations hold potential as biomarkers for early CVD risk prediction and personalized therapeutic strategies in T2DM patients This study assessed the relationship between biochemical and clinical parameters and genetic polymorphisms of ACE2 (rs4830542), ACE I/D (rs1799752), CAT (rs7943316), and GPx1 (rs3811699). The analysis included 280 individuals—100 with T2DM, 80 with T2DM+CVD and 100 healthy age-matched controls. Genotyping was conducted using conventional Polymerase Chain Reaction (PCR), while clinical and biochemical data were collected during outpatient visits. Statistical analysis using Prism 8 revealed significant differences among groups in age, body mass index, hypertension prevalence, waist–hip ratio, blood pressure, diabetes duration, fasting and postprandial glucose levels, urea, creatinine, triglycerides, HDL, VLDL, and LDL cholesterol. No significant variation was observed in uric acid levels. Significant associations of ACE2, ACE, CAT, and GPx1 variants were found in T2DM patients. In those with both T2DM+CVD, ACE2, ACE, and CAT variants showed significant associations, whereas GPx1 did not. Polymorphisms in ACE2, ACE, and CAT genes may serve as promising biomarkers for assessing susceptibility to T2DM and related cardiovascular complications.

Keywords: Renin–Angiotensin System, Antioxidant Pathway, Cardiovascular Disorder (CVD), Polymorphism, Promising Biomarker, Type 2 Diabetes Mellitus (T2DM).

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KINETIC AND MECHANISTIC APPROACH FOR THE STUDY OF SOME PHARMACEUTICAL DRUGS AND THEIR OXIDATION PRODUCTS

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Abstract

The oxidation of pharmaceutical drugs plays an important role in determining their stability, efficiency and safety during storage and biological processes. The present study focuses on the kinetic and mechanistic investigation of the oxidation of selected pharmaceutical drugs and the identification of their oxidation products. The reactions were carried out using sodium periodate as oxidizing agents under controlled experimental conditions. The progress of the reactions was monitored by vont-hoff method and Ostwald dilution law. The kinetic data were analyzed to determine the order of reaction, rate constants, and activation parameters, which provide valuable information about the reaction pathway. Based on experimental observations and kinetic results, a probable reaction mechanism for the oxidation process has been proposed. The formation of intermediate species and the final oxidation products were also discussed to understand the transformation of the pharmaceutical compounds during oxidative degradation. The study provides insight into the reaction mechanism and stability behaviour of pharmaceutical drugs under oxidative conditions, which is useful for predicting degradation pathways, improving drug formulation, and ensuring quality control in pharmaceutical industries. The findings contribute to a better understanding of the chemical reactivity and environmental fate of pharmaceutical compounds.

Keywords: Pharmaceutical Drugs, Oxidation Process, Rate Constants, Ostwald Law, Vont-Hoff Method.

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STUDY ON TIO_2 NANOPARTICLES ANCHORED G-C_3N_4 SHEET STRUCTURE FOR PHOTODEGRADATION OF ORGANIC DYE UNDER NATURAL SUNLIGHT

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Abstract

Organic pollutants (OPs) in water bodies are one of the root causes for water crisis in worldwide. These organic pollutants are waste product from various industries, including clothing and paper industries. Semiconductors as photo-catalysts play vital role in photodegradation of organic dye under natural sunlight or/and simulated light. Titanium oxide (TiO_2) and graphitic carbon nitride, are valuable semiconductors, which are being explored by scientific community for their potential application as a photocatalyst. But, Graphitic carbon nitride and TiO_2 are not found sole efficient photocatalyst due to their poor structure properties, inappropriate optical band gap and a smaller number of reactive sites for photo degradation of dye. In this paper, we synthesised pure TiO_2 nanoparticles, pure Graphitic carbon nitride sheets and their composite structures in ratio of 80:20 and 60:40. Their properties were studied using XRD, FESEM, TEM, HRTEM, SAED, UV-Visible, and PL spectroscopic technique. XRD analysis confirms the existence of the rutile and anatase phase in TiO_2 nanoparticles, layered structures in Graphitic carbon nitride sheets and co-existence of TiO_2 and carbon nitride in composite samples. Electron micrographs further confirm the spherical shape of TiO_2 nanoparticles anchored in between two-dimensional graphic carbon nitride layered sheets. The optical band gap is found minimum in case of T60C40 sample. This composite sample exhibit a smaller number of defects at surface/infaces of composite nanomaterials. The superior photodegradation behaviour is achieved for the T60C40 sample for photodegradation of MB dye in 90 minutes under natural solar irradiation. It is ascribed to optimized crystalline structure, tuned bandgap, proper band edge alignment, porous network and z-scheme hetero-structure formation at the interface of TiO_2 and Graphitic carbon nitride. This paper enhances the understanding about the photodegradation of dye and development of well-defined step process for preparation of efficient z scheme hetero-structured nano-photocatalyst.

Keywords: Zno, Photodegradation, Graphitic Carbon Nitride, Heterostructure, Photocatalyst.

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YOUTH ENGAGEMENT IN REGIONAL CLIMATE ADAPTATION AND MITIGATION STRATEGIES: A ROADMAP TO SUSTAINABLE SOCIAL DEVELOPMENT

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Abstract

Climate change has become one of the most serious challenges of the present century, affecting societies in complex social, economic, and environmental ways. Beyond environmental damage, climate change disrupts livelihoods, increases inequality, and slows the progress of sustainable social development as envisioned under the Agenda 2030 framework i.e., SDG framework. Although several mitigation and adaptation measures have been designed at international and national levels, their outcomes often remain limited. This is largely due to weak community involvement, inadequate focus on region-specific conditions, and the marginal participation of young people in climate action processes. Against this backdrop, the active involvement of youth has gained growing significance. Young people form a substantial proportion of the global population and are likely to face the long-term consequences of climate change more intensely than previous generations. Their capacity for innovation, willingness to engage at the grassroots level, and close connection with local communities enable them to play a meaningful role in addressing climate challenges. Adopting a decentralized and regional approach, this paper explores how youth can contribute to climate adaptation and mitigation efforts as volunteers, community facilitators, and future leaders. The paper emphasizes that youth-driven initiatives at the regional level such as environmental awareness programmes, locally appropriate adaptation measures, disaster risk reduction activities, and sustainable management of natural resources can enhance community resilience and promote inclusive social development. By strengthening youth participation in regional climate governance, the study proposes a practical roadmap that links climate action with social justice, community empowerment, and sustainable development objectives. It concludes that empowering youth within regional climate strategies is not only crucial for addressing climate risks but also instrumental in advancing sustainable and inclusive social development.

Keywords: Youth Engagement, Regional Climate Adaptation, Sustainable Social Development, Sustainable Development Goal (SDG).

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DEVELOPMENT AND CHARACTERIZATION OF GASTRO RETENTIVE FLOATING TABLETS INCORPORATING PHYTOEXTRACT WITH ANTI ULCEROGENIC POTENTIAL

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Abstract

This project target to design and evaluation of gastro-retentive drug delivery system containing Phytoextract as a gastro protective agent was the goal of the present study. The gastro-retentive drug delivery systems were developed to increase the residence time of the drug in the stomach and thereby enhance the local effect on the gastric mucosa. The gastro-retentive floating tablets were prepared containing phytoextract and characterized for pre- and post-compression parameters. Pre-compression evaluation of the formulations was carried out for bulk density, tapped density, angle of repose and compressibility index. The post compression evaluation of the tablets included hardness, friability, weight variation, drug content uniformity, floating lag time, floating time and in vitro drug release studies. The developed tablets were characterized for their buoyancy and drug release behaviour. The prepared formulations were evaluated for their floating lag time, floating time and in vitro drug release. The optimized formulation showed satisfactory floating lag time, floating time and in vitro drug release. The gastro-retentive floating tablets containing phytoextract may be used for the management of gastric ulcers. Which have fewer side effect. The results suggest that the developed gastro-retentive floating tablets containing phytoextract could serve as a promising drug delivery system for the management of gastric ulcers by enhancing gastric retention and providing sustained therapeutic action.

Keyword: Gastro-Retentive Drug Delivery System, Floating Tablet, Phytoextract, Anti-Ulcer Genic, Controlled Release.

PREVALENCE, MOLECULAR CHARACTERIZATION, AND AWARENESS OF HEMOGLOBINOPATHIES AMONG ANTENATAL WOMEN ATTENDING A TERTIARY CARE HOSPITAL IN NOIDA

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Abstract

Hemoglobinopathies are one of the most prevalent monogenic disorders in the world and are a major public health problem in India. Antenatal screening enables early carrier detection and prevention of adverse outcomes. However, data on the prevalence and molecular characterization of hemoglobinopathies in rapidly urbanizing regions of North India remain limited. This study evaluated hemoglobinopathy prevalence, molecular profile, and pre-counselling among antenatal women in Noida. A cross-sectional study was conducted among 1000 first-trimester antenatal women at a tertiary care hospital in Noida, Uttar Pradesh. Hematological screening was done by CBC analysis followed by HPLC analysis for hemoglobin variants. Samples with abnormal HPLC patterns underwent molecular analysis including DNA isolation, HBB gene PCR amplification, and Sanger sequencing. Among 1000 antenatal women, 17 (1.7%) were found to have structural hemoglobin variants. Hemoglobin E (HbE) was the most common variant (13/1000; 1.3%), followed by Hemoglobin S (HbS) (3/1000; 0.3%), and Hemoglobin D (HbD) (1/1000; 0.1%). Most (98.3%) had normal hemoglobin patterns. Preliminary data showed poor awareness about the patterns of inheritance and the need for partner screening. The study shows the measurable prevalence of hemoglobinopathies (1.7%) among antenatal women in Noida, with HbE being the predominant variant, highlighting the need for integrated antenatal screening and awareness programs to improve maternal–child health outcomes.

Keywords: Hemoglobinopathies, Antenatal Screening, HPLC, Molecular Characterization, HBB Gene Mutation.

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CLOSED-LOOP SIMULATION AND OPTIMIZATION OF COMPLEX BFSI SYSTEM VIA LARGE LANGUAGE MODELS AS DYNAMIC PROCESS ORCHESTRATORS

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Abstract

Banking, Financial Services, and Insurance (BFSI) systems represent complex decision environments where operational efficiency, financial risk, and regulatory compliance must be addressed simultaneously. Existing decision-support and optimization approaches in BFSI are often static or narrowly focused, which limits their ability to adapt to changing market conditions, emerging fraud patterns, and regulatory updates. This study presents a closed-loop simulation and optimization framework in which Large Language Models (LLMs) are employed as dynamic process orchestrators rather than standalone predictive tools. The framework continuously observes system behavior, evaluates alternative strategies through simulation, and refines decisions using feedback from execution outcomes. Transactional data, customer behavior indicators, market signals, and compliance constraints are collectively utilized to support coordinated decision-making across key BFSI functions, including credit risk assessment, fraud detection, portfolio optimization, liquidity management, and insurance operations. The findings suggest that the proposed framework can improve adaptability and decision stability when compared with conventional static approaches, highlighting its potential role in the development of resilient and regulation-aware BFSI systems.

Keywords: Large Language Models, Closed-Loop Optimization, BFSI Systems, Financial Risk Management, Simulation-Based Decision Making.

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FRACTIONAL DERIVATIVES OF HIGHER INDEXED COMPLEX VALUED FUNCTIONS AND THEIR BIOLOGICAL APPLICATIONS

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Abstract

This study presents a unified framework for conformable fractional derivatives in complex and bicomplex settings and explores their potential applications in life sciences. Specifically, we investigate the conformable fractional derivative of complex valued functions of a real variable, the conformable fractional derivative of complex valued functions of a complex variable, and the conformable fractional derivative of bicomplex-valued functions of a complex variable. These formulations preserve essential properties of classical calculus while incorporating fractional-order effects, thereby providing a mathematically consistent and computationally efficient approach for modeling systems with memory and nonlocal behavior. The proposed framework is applied to the development of complex-valued con formable fractional models for biological signals, where amplitude–phase interactions and long-range temporal correlations are significant. Furthermore, fractional dynamics in biochemical and cellular processes are addressed through complex-valued con formable models capable of capturing coupled reaction–diffusion and transport phenomena. To describe interacting and multicomponent biological systems, bicomplex valued conformable fractional models are introduced, offering a natural representation of coupled physiological processes. Applications to fractional modeling of blood flow and tissue mechanics demonstrate the effectiveness of the approach in characterizing viscoelastic behavior and microcirculatory dynamics. In addition, memory-driven models in population biology and epidemiology are formulated to account for hereditary effects and multiscale interactions. Overall, the integration of conformable fractional calculus with complex and bi complex analysis provides a versatile mathematical framework for modeling complex biological systems, bridging advanced fractional theory with practical applications in life sciences.

Keywords: Conformable Fractional Derivative, Bicomplex-Valued Functions, Classical Calculus, Multicomponent Biological Systems.

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ECOSYSTEM RESILIENCE AND ENVIRONMENTAL SUSTAINABILITY THROUGH BIODIVERSITY

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Abstract

Biodiversity plays a fundamental role in enhancing ecosystem resilience and promoting environmental sustainability. Ecosystems with high biological diversity are better able to withstand and recover from disturbances such as climate change, natural disasters, invasive species, and human-induced pressures. This resilience arises from functional redundancy, genetic diversity, and complex species interactions that sustain key ecological processes. Biodiversity also supports essential ecosystem services, including nutrient cycling, soil fertility, pollination, water purification, and climate regulation, all of which are critical for long-term environmental sustainability and human well-being. This presentation highlights the role of biodiversity conservation and sustainable ecosystem management as effective strategies for enhancing resilience and securing long-term environmental sustainability. Emphasis is placed on integrating biodiversity-based approaches into environmental policy and conservation planning to address current and future ecological challenges.

Keywords: Ecosystem Resilience, Biodiversity, Environmental Sustainability, Ecosystem Services, Climate Change, Conservation, Sustainable Development.

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APPLICATION OF MICROORGANISM FOR EFFECTIVE REMOVAL OF HEAVY METALS FOR SANITATION OF ENVIRONMENT AND WASTE MANAGEMENT

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Abstract

Due to natural, anthropogenic activities and xenobiotics different unwanted substances enter into abiotic components of the ecosystem and lead to pollution. These pollutants contain toxic complex compounds, which are noxious to the environment and health. The intensive use of chemical substances such as hydrocarbons, pesticides, chlorinated hydrocarbons, xenobiotics and heavy metals in expeditious industrialization processes are the main causes of anthropogenic contamination. Heavy metals such as copper (Cu), iron (Fe), selenium (Se), nickel (Ni), and zinc (Zn); and non-biological essential metals such as lead (Pb), mercury (Hg), arsenic (As), cadmium (Cd) and tin (Sn) are high densities elements with metallic properties, toxic at low concentrations, non-degradable and the major pollutants of water and soil that bring about heavy metal toxicity. Heavy metals are important in trace amounts to living organisms for various biochemical and physiological functions but it's excess make serious toxicants and can bioaccumulate in ecosystems, environmental disorders and causing chronic diseases. Bioremediation is a novel technology designed to remediation of heavy metals. Bioremediation is an eco-friendly, sustainable process, more effective and inexpensive natural process in which microorganisms (such as fungi, bacteria, algae etc.) alter contaminated sites. Native microorganism strains are less potent and slow degraders of heavy metals; therefore, microorganisms have been modified by different methodologies of molecular biology in vitro to improve their activity. This article provides an overview on various studies on Microorganism and it's applications for the heavy metal bioremediation.

Keywords: Microorganism, Heavy Metals, Bioremediation.

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REGULATORY ROLE OF 6-BENZYLAMINOPURINE (6-BAP) IN *SPIRULINA* FOR CLIMATE CHANGE MITIGATION AND ENVIRONMENTAL SUSTAINABILITY

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Abstract

Climate change and environmental degradation have become major global concerns, highlighting the need for sustainable and biologically driven solutions. Cyanobacteria have emerged as promising microbial resources due to their high photosynthetic efficiency, rapid growth, and ability to produce valuable bioactive compounds. Among them, *Spirulina* has gained considerable attention for its nutritional, ecological, and biotechnological potential. The application of plant growth regulators such as 6-benzylaminopurine (6-BAP), a synthetic cytokinin, has been reported to influence cellular metabolism, growth, and physiological responses in various photosynthetic organisms. The present study focuses on the regulatory role of 6-BAP in enhancing the growth and physiological performance of *Spirulina* under controlled environmental conditions. The application of 6-BAP may stimulate cell division, pigment synthesis, and metabolic activity, leading to improved biomass productivity. Enhanced photosynthetic activity and increased production of bioactive compounds such as proteins, chlorophyll, and phycocyanin contribute to the potential use of *Spirulina* in sustainable biotechnology and environmental applications. Furthermore, improved biomass production of cyanobacteria supports carbon dioxide sequestration, thereby contributing to climate change mitigation. Cyanobacterial systems also play an important role in environmental sustainability through applications such as wastewater treatment, bioremediation, and biofertilizer production. Therefore, the integration of growth regulators like 6-BAP with cyanobacterial biotechnology could enhance biomass yield and metabolic efficiency, providing an eco-friendly approach for sustainable bioresource development and environmental management.

Keywords: Cyanobacteria; Spirulina; Climate Change Mitigation; Environmental Sustainability; Microbial Biotechnology.

EXPLORING DATA VISUALIZATION CAPABILITIES OF MATPLOTLIB AND SEABORN IN PYTHON

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Abstract

Data visualization is essential for comprehending intricate datasets, as it converts raw data into significant graphical formats. Within the realm of data science and analytics, Python has become one of the most prevalent programming languages, largely due to its robust visualization libraries. Notably, Matplotlib and Seaborn are frequently utilized for generating informative and aesthetically pleasing plots. This study investigates the visualization capabilities of Matplotlib and Seaborn in Python, offering a comparative analysis of their features, adaptability, and efficacy in data representation. This research indicates that the choice of the appropriate visualization tool is contingent upon the specific needs of the analysis, including customization requirements or the need for statistical representation. In summary, this study highlights the critical role of visualization tools in contemporary data analysis and demonstrates how Matplotlib and Seaborn work in tandem to convert data into actionable insights.

Keywords: Visualization Flexibility, Statistical Visualization Support, Ease of Use, Integration with Data Structures, Complementary Usage.

A NOVEL BACTERIAL-ALGAL CONSORTIUM FOR EFFICIENT DEGRADATION, DECOLORIZATION, AND DETOXIFICATION OF TEXTILE EFFLUENTS

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Abstract

This study reports the first application of a novel bioremediation strategy using a bacterial-microalgal consortium (BAC), designated BAC-BA^{3}NVNT^{1}, for the treatment of highly hazardous and recalcitrant textile effluent (TE). The consortium consists of a laccase-producing *Bacillus amyloliquefaciens* KTS03 and *Scenedesmus* sp. NVNT1. Under optimized conditions, BAC-BA^{3}NVNT^{1} significantly reduced effluent pH from 8.68$\pm$ 0.03 to 7.24 $\pm$ 0.03 and achieved high removal efficiencies for color (94.28%), BOD (94.60%), COD (92.01%), TDS (85.01%), phosphate (79.27%), sulfate (78.66%), nitrate (92.22%), and phenol (91.87%). The treatment was conducted in a self-fabricated vertical photobioreactor (vPBR; 2 L working volume) operated in batch mode under cool white-blue LED illumination (4000-5000 lux), at 30$\pm$ 1 °C, with a 40% inoculum volume and a 12 h light/dark cycle over 12 days. FT-IR and GC-MS analyses revealed extensive mineralization and biotransformation of organic pollutants present in untreated TE. Phytotoxicity assessment using *Phaseolus aureus* L. demonstrated a substantial reduction in toxicity following treatment, with seed germination rates of 84-92% compared to 25% in untreated TE (25%, v/v), indicating the potential reuse of treated effluent as a liquid fertilizer. Overall, the BAC-BA3NVNT1-based bioremediation approach demonstrates strong potential for efficient textile effluent detoxification, environmental protection, and public health safety.

Keywords: Textile Effluent Treatment, Bioremediation, Photobioreactor, Decolorization and Detoxification, Bacterial-Algal Consortium, Environmental Sustainability

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INVESTIGATING THE ANTIOXIDANT PROPERTIES OF MANGO (MANGIFERA INDICA) LEAF EXTRACT IN THE CONTEXT OF NEURODEGENERATIVE DISORDERS

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Abstract

The exploration of antioxidant properties in natural products has gained significant attention in recent years due to their potential therapeutic applications in pharmaceuticals. Antioxidants play a crucial role in protecting the body against oxidative stress, which is implicated in various chronic diseases such as cancer, cardiovascular diseases, and neurodegenerative disorders. Neurodegenerative disorders (NDDs) such as Alzheimer's (AD) and Parkinson's (PD) are characterized by progressive neuronal loss linked to chronic oxidative stress, neuroinflammation, and mitochondrial dysfunction. *Mangifera indica* (mango) leaves are a rich source of polyphenols, particularly the xanthone-C-glycoside mangiferin, which has demonstrated potent antioxidant, anti-inflammatory, and neuroprotective properties. This study explores the antioxidant capacity of mango leaf extract (MLE) and its potential to mitigate NDDs through multi-target molecular pathways. The study evaluated the phytochemistry of ethanolic and aqueous extracts of mango leaves, focusing on their antioxidant capacity (DPPH, ABTS, FRAP assays) and their ability to inhibit enzymes related to neurodegeneration (AChE, BChE). The neuroprotective potential of mangiferin, a primary constituent of MLE, was investigated in both in vitro (neuronal cell line) and in vivo (rodent/zebrafish) models of NDDs, focusing on ROS reduction and activation of cytoprotective pathways. Thus, results demonstrated that mango leaves possess significant antioxidant activity, often superior to standard antioxidants (e.g., Vitamin C/Rutin) due to high total phenolic content (76.39 ± 0.14 mg GAE/g) and the scavenging of reactive oxygen species (ROS). Mangiferin in MLE was shown to Reduce Neuroinflammation, Mitigate Oxidative Damage, Protect Neurons. Mango leaf extracts exhibit strong antioxidant and multifaceted neuroprotective properties, primarily driven by the polyphenol mangiferin. While in vitro and animal studies indicate high potential for managing neurodegenerative diseases.

Keywords: Antioxidant, Neurodegenerative Disorders, Mango Leaf Extract, Polyphenols.

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PSYCHEDELIC-ASSISTED THERAPY: BRIDGING NEUROPHARMACOLOGY AND CLINICAL PSYCHIATRY

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Abstract

Psychedelic-assisted therapy is now being reconsidered as a potential intervention for psychiatric disorders resistant to conventional treatments, which include major depressive disorder, post-traumatic stress disorder (PTSD), anxiety associated with life-threatening illnesses, and substance use disorders. Traditional serotonergic psychedelics, such as psilocybin and lysergic acid diethylamide (LSD), along with empathogens like MDMA, are being rigorously evaluated in regulated clinical settings. In contrast to conventional monoaminergic antidepressants that require prolonged administration, the Psychedelic drugs possess rapid and enduring therapeutic effects following only one or a few supervised psychotherapy sessions. Classic psychedelics primarily function as partial agonists at cortical 5-HT2A receptors within the neuropharmacological framework via Gq/11-coupled signalling pathways and enhancing phospholipase C activity. Recent advancements include neuroimaging studies demonstrating network-level reorganisation, the identification of biased 5-HT2A signalling pathways, and the development of next-generation non-hallucinogenic psychoplastogens designed to maintain therapeutic plasticity while minimising perceptual disturbances. Phase II and III clinical trials of MDMA-assisted therapy for PTSD have demonstrated significant symptom reduction and safety when conducted under medical supervision. Psychedelic-assisted therapy represents a transformative process of receptor-level pharmacology, systems neuroscience, and structured psychotherapeutic frameworks. An ongoing investigation into dosing strategies, long-term safety, and biomarker-driven personalisation will determine its future importance in precision psychiatry.

Keywords: Psychedelic Therapy, Psychiatric Disorder, Antidepressants.

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HALLUCINATIONS IN LARGE LANDUAGE MODELS: A COMPREHENSIVE SURVEY OF CAUSES, DETECTION, AND MITIGATIONS TECHNIQUES

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Abstract

The use of large language models (LLMs) in digital applications is growing, but their dependability is limited by a serious issue known as hallucination, in which models generate fluent but factually incorrect or unsupported information. Research on LLM hallucinations to early 2026 is examined in this survey from a theoretical, technical, and human-centered perspective. We first explain why hallucinations cannot be completely eliminated because LLMs are probabilistic systems that are trained on finite data while operating in an open and dynamic environment. The paper provides a clear classification of hallucinations. It includes internal model errors, failures due to lacking external knowledge, and new types like logical, multimodal, and agent-based hallucinations. We examine key causes throughout the model lifecycle. These include limits in training data, incentive issues during fine-tuning, and unstable behaviors during inference. The survey compares current methods for detecting hallucinations. It looks at both reference-based evaluations and newer reference-free techniques that assess model uncertainty and internal signals. We also review major strategies to reduce hallucinations. These strategies include retrieval-augmented generation, citation-based response frameworks, and hallucination-aware fine-tuning. Finally, we discuss how automation bias impacts human users. We argue that future AI systems should focus on managing and reducing hallucination risks instead of trying to eliminate them entirely. This survey gives practical advice for creating more reliable and trustworthy generative AI systems.

Keywords: Large Language Models, Hallucination, hallucination Causes, Hallucination Detection, Hallucination Mitigation, Hallucination Benchmarks, Hallucination Evaluation Metrics.

FORMULATION AND EVALUATION OF NARINGIN MICROSPORES AS A NOVEL DRUG DELIVERY SYSTEM

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Abstract

Naringin is a natural flavonoid with potent anti-inflammatory, antioxidant, and antimicrobial properties, widely explored for dermatological applications. However, its poor solubility and limited skin retention reduce its therapeutic effectiveness. The present study proposes the development of Naringin-loaded microsponges as a novel topical drug delivery system to enhance stability and provide controlled drug release. Microsponges are porous polymeric microspheres that entrap active ingredients and release them in a sustained manner, minimizing irritation and improving patient compliance. The formulation is prepared using the quasi-emulsion solvent diffusion method and optimized using Box–Behnken Design by evaluating particle size, encapsulation efficiency, and *In-vitro* drug release. This system is suitable for treating skin disorders such as psoriasis, acne, atopic dermatitis, and hyperpigmentation. Thus, Naringin microsponges represent a promising and effective approach for safe and targeted dermatological therapy.

Keywords: Naringin, Microsponges, Topical Drug Delivery, Controlled Release, Skin Disorder.

MAGNESIUM-DOPED ZNO: TAILORING PHOTOLUMINESCENCE FOR NEXT-GENERATION OPTOELECTRONICS

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Abstract

The luminescent characteristics of zinc oxide (ZnO) are currently the subject of intense research, driven by its potential applications in UV and visible light photonic devices. Featuring a wide direct bandgap of 3.37 eV, ZnO is a highly adaptable semiconductor uniquely suited for advanced optoelectronics. The undoped and 2at.% doped films are polycrystalline with hexagonal wurtzite structure and crystallite size between 65 and 145 nm. The lattice constant as well as anion-cation bond length remains unaltered except for 2 at.% doping and films are predominantly oriented along (101) plane. Surface structure consists of microclusters of dodecahedron-type and nearly spherical grains reducing in size with doping. Monotonous blue shift in absorption peak from 379 to 373 nm with successive increase in doping indicates increment in band gap of the material. Dominant green photoluminescence is obtained from screen printed ZnO films which gets doubled for 2 at% Mg doping and is ~2.4 times stronger than the accompanying UV emission. This is particularly important as no green emission was present in the starting oxide powders. In view of these properties such films can be a pathway for optical sources, sensors or photoconductors and solar cells.

Keywords: Zinc Oxide, Microclusters, UV Emission, Photoconductors.

EFFECT OF EUROPIUM DOPING ON THE PHOTOLUMINESCENCE AND PHOTOCONDUCTIVITY OF NANOCRYSTALLINE ZnO THIN FILMS

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Abstract

ZnO is a II-VI semiconductor with direct band gap of 3.37 eV and large exciton binding energy (60meV) at room temperature. The doping of rare earth ions in ZnO attract much attention due to their application in optoelectronics such as display panels, laser material, solid state lasers, fiber amplifiers and data storage. Nanocrystalline undoped and 3at.% Eu doped ZnO thin films have been grown by sol-gel spin coating. The films are polycrystalline with crystallite size less than 24nm. Both the films are highly transparent in the visible and near infrared region of the spectrum and transparency increases with doping. The band gap increased from 3.22 to 3.33 eV for Eu doped sample. Strong NBE emission occurs at 396nm from undoped film which shifts to 402nm for Eu doped sample. Doping of Eu decreases the rise and decay times as compared to undoped ZnO films, resulting in faster photoresponse. The doped sample is suitable for switching since the rise and decay pattern is reproducible and photocurrent sharply falls to less than 18% of the peak value as the illumination is put off. Best photo-switching is obtained in 2.2at. % Eu doped ZnO thin film

Keywords: Zinc Oxide, Nanocrystalline, NBE Emission, Optoleectronics

QUANTIFYING COLUMN JACKETING EFFECTIVENESS FOR SEISMIC RETROFIT OF RC BUILDINGS IN ZONE V: ETABS ANALYSIS

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Abstract

Recent earthquakes have exposed vulnerabilities in existing reinforced concrete (RC) buildings designed per IS 456:2000, lacking ductile detailing mandated by IS 13920:2016. Columns, as primary lateral load-resisting elements, exhibit brittle failure under seismic loading. This study quantifies seismic performance enhancement through reinforced concrete column jacketing for a G+5 RC moment-resisting frame in Seismic Zone V. A benchmark building model was developed in ETABS, analyzed using linear static (Equivalent Static Method) and response spectrum methods per IS 1893(Part 1):2016. Pre-retrofit analysis revealed excessive storey drifts (0.0042 > 0.004 limit), inadequate column confinement, and drift concentrations at upper storeys. Retrofitting involved concrete jacketing (150 mm each side), 40% additional longitudinal reinforcement (Fe500), and closely spaced 8 mm ties @100 mm c/c per IS 13920 Clause 6.2.5. Post-jacketing results showed 62% reduction in maximum storey displacement (182 mm to 69 mm), 58% decrease in inter-storey drift (0.0021), 42% increase in base shear capacity (2850 kN to 4052 kN), and enhanced stiffness (fundamental period reduced from 0.85s to 0.62s). Column interaction diagrams shifted favorably, with demand-capacity ratios improving from 1.12 to 0.78 under design earthquake loading. IS 13920-compliant column jacketing transforms seismically deficient IS 456:2000 structures into ductile systems meeting Zone V performance objectives. ETABS proves reliable for retrofitting evaluation. Findings establish practical design guidelines for strengthening existing RC buildings. Column Jacketing, Seismic Retrofitting IS 13920 Ductility, ETABS Analysis, Storey Drift Reduction, Zone V Performance.

Keywords: Earthquake, Seismic Retrofit, Jacketing, RC Building, Ductility

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DIGITAL PAYMENT FRAUD SYSTEM USING AI

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Abstract

Digital payment has become a common way of making transactions in today's world, not only within a country but also across international borders. As the use of online banking, mobile applications, and digital wallets continues to increase, cases of payment fraud are also rising. Existing fraud detection systems mostly depend on fixed rules, which makes them less effective when fraudsters use new and smarter techniques. An AI-based digital payment fraud detection system that helps in identifying suspicious transactions at an early stage. The system studies past transaction records to understand normal user behavior and then compares it with current activities. Transactions that show unusual patterns, such as sudden high spending, unexpected locations, or frequent attempts, are flagged for further verification. With regular use, the system adapts by learning from new transaction data. The main goal of this system is to improve transaction safety, reduce financial losses, and support real-time fraud detection. It can be used in banks, digital wallets, and international payment platforms. By applying artificial intelligence, the system helps build user trust and strengthens security in modern digital payment systems. Real-time detection is also a critical challenge. Digital payment systems process a large number of transactions every second, and analyzing each transaction without causing delay requires high processing speed and accuracy. Additionally, handling large volumes of transaction data while maintaining user privacy and data security is a major concern for financial institutions. The system continuously learns from new transaction data, allowing it to adapt to emerging fraud patterns. Suspicious transactions are immediately flagged for further verification, which helps in preventing financial loss at an early stage. Multi-level verification methods, such as OTP authentication or additional security checks, can be applied when risky transactions are detected.

Keywords: Digital Payment, Payment Fraud, Fraud Detection System, Artificial Intelligence (AI), Online Transactions, Financial Security.

REVOLUTIONIZING DRUG DISCOVERY: THE ROLE OF AI AND DEEP LEARNING IN MODERN MEDICINE

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Abstract

The growing importance of artificial intelligence (AI) in drug discovery is due to its ability to significantly reduce the time and cost associated with the traditional drug development process. Pharmaceutical companies are increasingly adopting AI tools for this purpose, leading to the discovery of new drug molecules, many of which have already entered clinical trials. An overview of the types of data used in AI-driven drug discovery and the sources from which this data is derived. It also describes key algorithms and machine learning (ML) techniques that are being applied in the field of various AI models, particularly deep neural networks (NNs). It compares them to traditional artificial neural networks (ANNs). It further elaborates on how AI advancements, particularly in deep learning, are impacting several critical stages of the drug discovery process. These stages include identifying drug targets, predicting their structures, and estimating interactions between drugs and their targets. Other important tasks enabled by AI include designing new drugs, predicting drug toxicity, and assessing pharmacokinetics (absorption, distribution, metabolism, excretion, and toxicity, often abbreviated as ADMET). AI also helps in evaluating potential drug-drug interactions.

Keywords: Artificial Intelligence (AI), Drug Discovery, Artificial Neural Networks (ANN), ADMET, De Novo Drug Design.

FLUOXETINE -ASSOCIATED NON-ALCOHOLIC FATTY LIVER DISEASE: MECHANISM AND MANAGEMENT – A REVIEW

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Abstract

Depression is a widespread neuropsychiatric condition that affects about 300 million individuals globally. According to the World Health Organization (WHO), it is one of the top reasons behind disability worldwide and has a significant social and economic impact on modern society. In clinical practice, depression is treated with a variety of antidepressant drugs, including tricyclic antidepressants (TCAs), monoamine oxidase inhibitors (MAOIs), and selective serotonin reuptake inhibitors. According to figures published by the NHS Business Services Authority (BSA), the number of persons prescribed antidepressants increased from 7.87 million in 2020/2021 to 8.32 million in 2021/2022. Out of those the number of SSRI prescription is risen by 35.2% from 33.3 million items in 2015/2016 to 45.0 million in 2021/2022. After long-term treatment with a selective serotonin receptor inhibitor (fluoxetine), non-alcoholic fatty liver disease (NAFLD) was seen. Through mechanistic behaviour such as Oxidative stress, mitochondrial dysfunction and inflammation. This review focused on evaluating several natural compounds for medicinal potential. The findings potentially reduce liver damage and enhancing liver function via a variety of pathways including oxidative stress, mitochondrial dysfunction, inflammation and prevent insulin resistance. Further research in this area could lead to more effective preventive and treatment strategies for fluoxetine-induced NAFLD.

Keywords: Drug Induced Liver Injury, Non-Alcoholic Fatty Liver Disease, Fluoxetine, Inflammation and Oxidative Stress.

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AI BASED EARLY WARNING SYSTEM FOR CARDIOVASCULAR RISKS DUE TO URBAN PARTICULATE MATTER (PM2.5)

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Abstract

A major contributing factor to the global increase in cardiovascular diseases (CVD) has been urban air pollution, namely fine particulate matter (PM2.5). Exposure to PM2.5 has been strongly linked in numerous medical studies to harmful cardiovascular outcomes, including myocardial infarction, heart failure, stroke, and hypertension. However, current air quality monitoring systems do not convert environmental data into useful health intelligence for preventive care; instead, they only give pollutant statistics. An artificial intelligence-based early warning system for estimating cardiovascular risks linked to exposure to PM2.5 in cities is presented in this work. The suggested approach uses machine learning techniques to create predictive risk models by combining historical and present air quality data with cardiovascular health indicators. Complex correlations between pollution exposure patterns and cardiovascular outcomes are found using sophisticated algorithms. Time-series forecasting techniques estimate the levels of short-term PM2.5 concentrations, thereby offering preemptive risk assessment. At the community level, the system generates three different kinds of risk alerts: low, moderate, and high risk. People, healthcare providers, and city officials can use a real-time visualization dashboard to pinpoint pollution-related cardiovascular risk areas and take prompt preventative measures. The suggested method immediately links environmental monitoring with public health analytics, in contrast to traditional air quality index platforms, enabling a transition from reactive therapy to preventative healthcare. By converting air pollution data into sophisticated decision-support tools, the initiative advances smart city health infrastructure. The suggested strategy is in line with the UN Sustainable Development Goals for climate action, sustainable cities, and exceptional health. It also promotes sustainable urban expansion.

Keywords: Particulate Matter (PM2.5), Cardiovascular Disease, Artificial Intelligence, Early Warning System, Air Pollution.

ADSORPTION OF HEAVY METALS FROM SYNTHETIC WASTEWATER BY GRAFT COPOLYMER OF (AA-CO-AAM) ON GUMGHATTI XANTHATES

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Abstract

In this research, four types of hydrogel grades have been synthesised and named as GgXAAm@1(1:1), GgXAAm@2(1:2), GgXAAm@3(1:3) and GgXAAm@4(3:1) respectively using xanthate of Gumghatti, acrylic acid and acrylamide. First of all, optimization of all these grades was done using different techniques like Fourier transform infrared spectroscopy, Thermogravimetric analysis, point of zero charge, field emission scanning electron microscope and energy dispersive X-ray spectroscopy, X-ray diffraction and X-ray photoelectron spectroscopy analysis., swelling capacity and % water retention respectively, and later GgXAAm@3 was found to be the best among all these. The swelling and % water retention of GgXAAm@3 is 325g/g and 67% respectively, thermal stability is highest among the all grades. The surface of xanthate hydrogel is exhibiting negative behaviour in the range of pH 1-10 which is also proven by the study of effect of pH. The optimum value of various parameters of metal ions removal like dose, concentration, pH, temperature, and time for the hydrogel is determined for cationic metal ion removal. Spontaneity of reaction for removal of metal ions and nature of force involved; (endothermic) which is driven with the help of Van 't Hoff equation. Adsorption follows Langmuir isotherm monolayer adsorption on homogeneous surface with correlation coefficient (R^2) are 0.990 (Cu^{2+}),0.997 for (Co^{2+}) having q_{max} [601(Cu^{2+}),581(Co^{2+})]. Kinetic study shows that the rate and mechanism of adsorption processes follow pseudo second order kinetics with adsorption rate ($k = 7.46\times10^{-4}$ for Cu^{2+} and 6.18×10^{-4} for Co^{2+}). The metal ions adhere on the hydrogel surface which is proved by XPS technique. GgXAAm@3 hydrogel can be used multiple times without losing its effectiveness or structural integrity. The selectivity test and effect of coexisting ions in the adsorption process were studied, and was most preferred for adsorption of Cu^{2+} and Co^{2+} ions and even under the effect of coexisting ions.

Keywords: GgXAAm Hydrogel, Clean water and Sanitation, Hygiene, Safe Drinking Water, Water Quality

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PHLEOBOTOMINE SANDFLIES VS MOSQUITOES: ADDRESSING THE NEGLECTED DISEASE

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Abstract

Sandflies are significant vector of several negl*ected tropical diseases such as* leishmaniasis, bartonellosis and sand-fly fever (kala azar) remain largely neglected in global vector control strategies compared to mosquitoes. Mosquitoes have received extensive attention due to their association with malaria, dengue and other diseases. Sand-flies continue to be underrepresented in research funding, surveillance programs and public health interventions. Leishmaniasis is a neglected vector-borne disease of the poor. This disparity persists despite the significant morbidity, mortality and socioeconomic burden caused by sand fly borne diseases, particularly in tropical and subtropical regions. The neglected stems from factors such as limited awareness, under-reporting and complex ecology of sand-flies, which complicates control measures. Sandflies has developed new guidelines\manuel for sandflies control surveillance and insecticide resistance monitoring to close historical gaps compared to mosquito's programs. Addressing this imbalance requires a paradigm shift in vector research policy, with greater emphasis on sand-flies as critical disease vectors. Recognizing their impact and integrating sand-flies control into broader vector management framework is essential to reduce the global burden of neglected tropical diseases and achieve equitable public health outcomes. Recognizing sand flies as critical vectors is essential for achieving equitable progress in vector-borne disease management. It is the second most important protozoan disease medically (in human life) after malaria, 350 million people are at risk in high-risk areas and 14 million people are immediately affected by diseases. A reorientation of global health priorities toward integrated vector control, increased investment in sand flies research, and improvement of their disease burden is urgently needed to reduce the impact of these overlooked pathogens. Long established WHO Protocol exists for mosquito control and resistance monitoring, reflecting their larger global disease burden and historical focus.

Keywords: Sandfly, Mosquito, Control Strategies, Neglected Disease, Awareness.

EVALUATION OF ML CLASSIFIERS IN INTRUSION DETECTION SYSTEM FOR API BASED SYSTEMS

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Abstract

Intrusion Detection Systems have been proven to be the backbone of security applications and have been adapted by all major players around the world. By the time, with the technology changes, researchers are including application of Machine Learning (ML) and Artificial Intelligence (AI) as a tool in making IDS more and more strong and useful for the industry. Use of ML in IDS requires to deal with many different aspects of security and data processing some of which are data collection, reduction, selection of classifier(s), outcome expected etc. Host based IDS and Network based IDS also impacts the direction of research. In this research, orientation to compare the use of various ML classifiers and compare their performance and accuracy using various metrics. Although, existing researches in this area provide a decent outcome, but specific classifiers used in this paper are for specific data outcomes. This research will be used as a base for applying IDS in API based systems where high throughput is a base requirement. Research shall compare the classifiers for ML Random Forest, XGBoost, and KNN etc. Their performance shall be compared using Detection Rate (DR), Matthews Correlation Coefficient (MCC), and Confusion Matrix etc.

Keywords: ML, AI, DR, KNN, XG Boost.

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INTERLINKED RIVERINE ECOLOGICAL INTEGRITY, SUSTAINABLE AGRICULTURE, AND BLUE ECONOMY OUTCOMES: EVIDENCE FROM THE YAMUNA RIVER, INDIA

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Abstract

Pesticide's usage has significantally grown due to increasing agriculture in the floodplains of the Yamuna River. This tendency raises concerns about the long-term sustainability of the food system, reduce of fish diversity, and contamination of freshwater ecosystems. The outcomes highlight the need of river basin governance in adopting sustainable agricultural practices, such as increased agriculture and industrial runoff organization and reduced chemical usage. Reports show that high use of agrochemicals, commonly organophosphorus, organochlorine pesticides has contaminated local agricultural products, groundwater, and river water. Such pollution promotes long-term organic chemical stress in fresh water ecosystem. Ecological evaluations along a 1250 km area of the Yamuna River recognize more than 150 fish species. However, the polluted zones showed lower Dissolved Oxygen (DO) levels increase Total Dissolved Solid (TDS) and Electric conductivity (EC) and changes in community assembly of fresh water ecosystem, representing biodiversity loss. The reduction of vulnerable species, change in species conformation, reduce of ecological integrity are all related to declines in water quality and affect the food chain of ecosystem. Inland fisheries, which support freshwater reliant blue economic activities and play essential role in regional food systems, are at risk owing to these changes. Unsustainable agricultural expansion has harmful consequences that extend throughout the food-water-biodiversity relationship. The blue economy context stresses the need for sustainable organization of aquatic resources to ensure food security, economic resilience, and biodiversity conservation. It is highlighting the relevance of river basin governance in adopting sustainable agricultural methods, such as enhanced agriculture and industrial runoff management and reduced chemical usage. A joint socio-ecological management policy is important to restore fish species, reduce down pesticide contamination, and boost the sustainability of food systems that depend on the Yamuna River environment.

Keywords: Pesticides, Biodiversity, Pollution, Agriculture Runoff.

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IMPLICATIONS OF TYPE II SYNTHETIC PYRETHROID LAMBDA CYHALOTHRIN ON BLOOD, BIO-CHEMICAL ENZYME AND HISTOLOGY IN FRESHWATER EDIBLE FISH *CHANNA PUNCTATUS* (BLOCH, 1793)

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Abstract

The agricultural sector represents more than 40% of India's Gross National Product and as such plays a crucial role in the country's development but due to attack of pest affect the production of crop productivity. Generally, for the protection of pest used pesticide, in present scenario Synthetic pyrethroids are used for the protection of crop. After long use of pesticide they absorb in soil and through run-off water enter in to aquatic media and adversely affect the aquatic animal. Lambda Cyhalothrin is type II synthetic pyrethroid which affect the aquatic fauna environment especially fish because they are highly sensitive. The present study was revealed to understand the adverse effects of Lambda Cyhalothrin in the fish *Channa punctatus*. Sub-lethal concentration of Lambda Cyhalothrin i.e., $1/10^{th}$ of 96h of LC_{50} was used for three exposures i.e., 15, 30 and 45 days along with control. To investigate the alteration of haematological parameter and elevation of bio-chemical changes after each exposure period collect Blood for haematological and bio-chemical parameter and for histolopathological examination take out Liver tissues from the different exposure period as well as control. After each exposure periods estimate the physico-chemical parameter of water. A significant ($p < 0.05$) elevation in the level of ALP, bilirubin, urea, BUN, creatinine and serum electrolytes (calcium, phosphorus, sodium and chloride) whereas a significant decrement in serum total protein, albumin, globulin and A:G ratio were observed after the completion of each experimental period as compared to control. Also, significantly ($p < 0.05$) changes in haematological parameter i.e., Hb%, RBC and MCHC, MCV and Neutrophils. Significantly changes of histopathological alterations in terms of vacuolization, necrosis, hypertrophy and stromal haemorrahge were observed in the exposed compared to controlled condition. These findings are quite suggestive of the disturbed whole metabolic activities of fish and adversely affect the healthy fish production.

Keywords: *Channa punctatus*, Lambda Cyhalothrin, Liver, Blood, Enzyme.

SYNTHESIS AND STRUCTURAL CHARACTERIZATION OF ZnO–HYDROXYAPATITE NANOCOMPOSITES FOR BIOMEDICAL APPLICATIONS

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Abstract

In the present research, the synthesis, characterization and antibacterial properties of ZnO hydroxyapatite (HAP) nanocomposites are investigated. The HAP was prepared through a simple and cost-effective wet chemical precipitation route. The prepared hydroxyapatite was sintered through a muffle furnace at 800°C for 6 hours with a heating rate of 5°C/min to enhance its crystallinity and stability. Thereafter, the ZnO nanomaterial was then incorporated into the HaP matrix in varying proportions (5, 10, and 15 wt%) using a solid-state reaction technique. The structural properties of the synthesized samples were examined using X-ray diffraction (XRD), which confirmed the formation of crystalline hexagonal hydroxyapatite along with the presence of wurtzite ZnO peaks in the composite samples, indicating successful composite formation without secondary phases. Surface morphology and particle distribution were examined using scanning electron microscopy (SEM), which confirmed a relatively even dispersion of ZnO particles within the HAp matrix. The dispersion of ZnO into HAp improves the mechanical strength and antibacterial properties of HAp, which are essential for biomedical implant applications. The obtained results suggest that the prepared ZnO–HAp nanocomposites possess suitable structural and morphological features, making them promising candidates for bone tissue engineering and other biomedical applications.

Keywords: Hydroxyapatite (HAP), ZnO, Nanocomposite, Tissue Engineering, Biomedical Implant.

3D PRINTING IN PERSONALIZED MEDICINE

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Abstract

3-dimensional Printing, also known as additive manufacturing is an emerging technology that is transforming personalized medicine in the field of pharmacy. It creates objects layer by layer from a digital model and enables the fabrication of customized dosage forms with precise dose release profile, improve patient compliance, patient specific dosing and reduces drug wastage. Various printing techniques such as inkjet printing, fused deposition modeling are currently being explored for manufacturing tablets, implants etc. A major breakthrough in this area was the approval of Spritam, the first FDA approved 3D printed drug for epilepsy, highlighting the clinical potential of this technology. Challenges such as regulatory approval, high costs and quality control remain, continuous technological advancements are expected to enhance its adoption. Overall 3D printing represents a promising advancement towards precise, patient centered and sustainable pharmaceutical care. Keywords- 3D Printing, Personalised medicine, Epilepsy, Inkjet printing, Fused deposition modeling.

Keywords: 3-D Printing, Spritam, Epilepsy

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DESIGN, DOCKING AND BIOLOGICAL ACTIVITY OF COUMARIN AMINO ACID DERIVATIVES

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Abstract

Coumarin is found naturally in various plants, such as Tonka beans, and is widely used in synthetic drug design. Coumarin contain benzopyrone scaffold in its structure, has emerged as a promising pharmacophore in neurodegenerative disorders (NDs) such as Alzheimer's Disease (AD). In this chapter, we discuss about the coumarin amino acid derivatives that are incorporated in the neurodegenerative mechanism, which is based on the docking on the different proteins. Natural Coumarins (e.g., umbelliferon, esculetin, scopoletin) exert antioxidant, anti-inflammatory and moderate enzyme inhibitory effects (Acetylcholinesterase activity, β-amyloid aggregation), these enzymes show broad-spectrum activity through modulation of oxidative stress and neuroinflammation in cellular and rodent models. However, their clinical potential is limited by the poor bioavailability and low potency. In this context, synthetic coumarin derivatives such as Coumarin-amino acid derivatives are studied because these heterocyclic hybrids demonstrate their higher potency, enhanced blood-brain barrier permeability, and synergistic inhibition. Docking studies of some coumarin scaffolds confirm significant cognitive rescue and restored synaptic function with favourable safety profiles. Despite the established safety of natural coumarins, synthetic versions enhance treatment efficacy. Hybrid strategies integrating natural scaffolds with rational chemical modifications represent a promising direction for next-generation ND therapeutics. The biological effects of synthetic derivatives of coumarin amino acids discussed that are used as novel drugs to treat Alzheimer's Disease. The therapeutic action of coumarins, also includes various scaffolds of coumarin analogues is given in a summarised way. Further ADMET studies are being processed to advance toward clinical evaluation.

Keywords: Coumarin Amino Acid Derivatives, Alzheimer's Disease, Blood-Brain-Barrier, Bioavailability.

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OPTIMIZING THE SYNTHESIS OF CHITOSAN XANTHATE-BASED HYDROGELS FOR EFFECTIVE HEAVY METAL ION REMOVAL FROM WASTEWATER

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Abstract

This study explores the optimization for Cu^{2+} and Ni^{2+} ions removal from wastewater by newly designed chitosan xanthate-based hydrogel (NAmACX hydrogel) as an adsorbent. The prepared NAmACX hydrogel was characterized using several analytical techniques, including Ultra-vis, Fourier transform infrared spectroscopy, Thermal gravimetric analysis, point of zero charge ΔpH_{PZC}, and Scanning electron microscope. The swelling and water retention ratio of the best grade of NAmACX hydrogel were found to be 298.4 g/g in 675 min and 88.5 % in 24 h in distilled water, respectively. The maximum removal efficiency of the NAmACX hydrogel was 92.51 % for Cu^{2+} and 90.67 % for Ni^{2+} ions under optimum conditions. According to isotherm studies, the Langmuir isotherm model fitted the experimental data best, with a supreme adsorption capacity of 621.1 mg/g for Cu^{2+} and 413.2 mg/g for Ni^{2+} ions. In addition, the pseudo-second-order kinetic model was followed with rate constants of 2.1×10^{-4} g/(mg.min) for Cu^{2+} and 1.7×10^{-4} g/(mg.min) for Ni^{2+} ions. Furthermore, the NAmACX hydrogel exhibited excellent desorption efficiencies of 92.51 % for Cu^{2+} and 90.67 % for Ni^{2+} ions. The findings highlight the potential of adsorption technology as a sustainable solution for treating heavy metal-contaminated wastewater.

Keywords: Hydrogel; swelling; wastewater treatment; heavy metal removal; adsorption

HYBRID AI SEVERITY INDEX (HASI): A MULTI-MODAL FRAMEWORK FOR POLLUTION RISK TRIAGE IN INDIAN CITIES

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Abstract

The retrospective effect of urbanization and industrialization has shown an adverse effect on environmental pollution, especially in highly populated cities like New Delhi, Kanpur, and Agra etc. The conventional method of monitoring indices and systems relies on predefined threshold-based parameters, which limit their predictive capabilities in the real-time scenario; that's why we(India) are among the top-most polluted cities in the world. This paper proposes a multi-model Artificial Intelligence framework that have capability to predict the risk. We have proposed the name Hybrid AI Severity Index (HASI) that integrates satellite images, real-time data using publicly available websites, and unstructured data from the public. This framework mainly uses Long short term memory(LSTM) for pollution forecasting in a time series manner, Vision Transformers (ViT) for satellite-based data, and Natural Language Processing(NLP) for handling textual data. On the basis of these inputs, HASI will be formulated into a unified score. which further classifies regions into critical, moderate, and safe. This AI-based approach helps in better decision-making and provides India with a whole new way to act and tackle the environmental pollution issue, and gives us freedom from western decided benchmarks like AQI. The experimental phase shows promising results and can act as an alternative to AQI. The Proposed Framework contributes to the Sustainable Development Goals (SDG 13 and 15) because it is perfectly aligned with intelligent environmental governance.

Keywords: Hybrid AI Severity Index, Air Pollution, LSTM, Vision Transformer, NLP, Sustainable Development Goals.

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RADIATION SHIELDING EFFECTIVENESS OF HARMACEUTICAL POLYMERS: A STUDY

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Abstract

The parameters of energy such as partial interaction cross section and total attenuation coefficients ($\mu_{tot.}$) of Pharmaceutical Polymers such as Poly Vinyl Pyrrolidone (PVP) (C6H9NO) n, Poly vinyl Alcohol (PVA) (C_2H4O)n are calculated by using the 'WinXcom' computer software over the energy range 1 KeV to 100 GeV. In this study regularities of interaction of gamma radiation with Poly Vinyl Pyrrolidone (PVP), Poly vinyl Alcohol (PVA) such as the exponential attenuation law, the decrease of the mass attenuation coefficient with increasing energy of gamma quanta, the increase of the mass attenuation coefficient with increasing atomic number of the absorber and the proportionality of the mass attenuation coefficient corresponding to Compton scattering to the atomic number of the absorber are discussed. Geometric progression (GP) method was used to calculate gamma-ray exposure buildup factors (EBF) of taken samples for the energy range 0.015–15 MeV, and penetration depths upto 40mfp.The result suggests that the interaction processes are 'Z' dependent. The graphs and equations describing the above dependency currently enable in determining the density of Poly Vinyl Pyrrolidone (PVP), Poly vinyl Alcohol (PVA). The values of EBF were found to be smaller in lower and higher photon energy regions whereas very large in intermediate energy region where Compton scattering dominates. Here PVP has higher values of $\mu_{(total)}$ in energy range as compared to PVA, so PVP shows good shielding effectiveness for gamma rays.

Keywords: Partial Interaction Cross Section, Total Attenuation Coefficients, Energy Exposure Build Up Factor and Geometric Progression (GP).

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CIRCULATING PROINFLAMMATORY CYTOKINES AND OXIDATIVE STRESS BIOMARKERS IN PRIMARY INTRACEREBRAL HEMORRHAGE: CLINICAL CORRELATIONS AND PATHOPHYSIOLOGICAL IMPLICATIONS

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Abstract

There is a paucity of information regarding the progression of proinflammatory cytokines in intracerebral hemorrhage (ICH) and their association with oxidative stress (OS) markers, clinical severity, radiological findings, and functional outcomes. We report temporal kinetics of mRNA expressions of proinflammatory cytokines [tumor necrosis factor α (TNFα) and interleukin (IL) 1β] on day 1, day 7, and day 15 of ICH and correlate the changes with OS markers (MDA, catalase and GPx), clinical severity, CT findings, and three-month outcomes. Ninety-seven patients with ICH were included. Their demographic, stroke risk factors, National Institute of Health Stroke Scale score (NIHSS), Glasgow Coma Scale (GCS) score, and CT findings were noted. TNF-α and IL-1β mRNA fold-change were measured by using real time PCR, and MDA, catalase, and GPx were measured by using a spectrophotometer. These biomarkers were also done in 57 healthy-controls. Outcome at 3 months was noted using the modified Rankin Scale (mRS) and categorized as death, poor (mRS 3-5) and good (mRS 0-2) outcomes. The ICH patients had elevated TNF-α [1.493 (0.961-2.255) fold change; 0.935 (0.316-1.511) fold change; p<0.001], IL-1β [1.257 (0.771-2.077) fold change; 0.813 (0.457-1.404) fold change; p<0.001], and MDA [7.332 (4.010-9.091) nmol/L; 1.629(0.941-3.095) nmol/L; p<0.001] compared to healthy controls, which remained elevated till 15 days. However, the catalase [0.566 (0.398-0.862) kU; 1.138 (0.973-1.364) kU; p<0.001] and GPx [3.858 (3.315-4.310) nmole/GSH; 5.623 (5.033-5.865) nmole/GSH; p<0.001] levels were reduced. The baseline TNF-α positively correlated with day 1 (r=0.716), day 7 (r=0.463), and day 15 (r=0.487) IL-1β. Day 1 IL-1β correlated with day 7 MDA (r=0.266) and day 15 catalase (r=-0.235) levels. 19.6% of patients died at three months. Death was associated with GPx and catalase but not with TNFα and IL1β. The temporal kinetics of proinflammatory cytokines in ICH have a linear relationship with oxidative stress biomarkers, whereas antioxidants have reverse. Strategies to suppressing the proinflammatory cytokines and oxidants along with supplementing antioxidants may be helpful in ICH, which need future studies.

Keywords: Intracerebral Hemorrhage, Oxidative Stress, mRNA Profiling, Outcomes.

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HOW FAMILY OCCUPATION AND EDUCATION INFLUENCE STARTUP FOUNDERS IN UTTAR PRADESH: A PRIMARY SURVEY ANALYSIS

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Abstract

This study aimed to investigate how family occupation and educational qualifications influence individuals who become startup founders in Uttar Pradesh, India. While the state's entrepreneurial environment is expanding, research on the socio-educational backgrounds of its founders remains limited. This study fills that gap by offering data-driven insights into the foundational factors that shape entrepreneurial aspirations in the region. A quantitative research approach was used, involving a structured questionnaire administered to 20 active startup founders across various sectors in Uttar Pradesh. The sample ensured representation from diverse districts and entrepreneurial clusters. Data were analyzed using descriptive statistics and independent samples t-tests to examine the relationship between family occupation, education level, and startup behavior. The results showed that most startup founders held undergraduate or higher degrees, primarily in engineering and management fields. A significant number of them came from service-based or business-oriented families, suggesting that both education and family occupational background play important roles in motivating entrepreneurial pursuits. Founders from non-business families also showed strong participation but followed different educational pathways. The study's findings can guide policymakers, incubators, and educational institutions in designing tailored support programs. By recognizing the impact of both education and family background, ecosystem stakeholders can implement more inclusive mentorship, funding access, and training initiatives to encourage entrepreneurship across broader social strata. This research provides one of the first empirical investigations into the socio-educational backgrounds of startup founders in Uttar Pradesh. It contributes original insights into how human capital and inherited social capital intersect to influence startup creation in a less-explored regional context.

Keywords: Startup Founders, Family Occupation, Educational Qualification, Entrepreneurial Motivation, Socio-economic Background, Uttar Pradesh Startups, Human Capital.

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SYNERGISTIC EFFECT OF ANTIFUNGAL THERAPY FOR OVERCOMING MALE GENITAL & GROIN FUNGAL INFECTION RESISTANT FUNGAL STAINS

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Abstract

Current research focuses on developing advanced topical drug delivery systems to effectively manage resistant fungal infections affecting the male genital groin region. These infections, commonly referred to as Tinea cruris, are often associated with excessive sweating, poor hygiene, friction, and warm humid conditions that promote fungal growth. Such infections may cause severe itching, redness, irritation, and inflammation, significantly affecting patient comfort and quality of life. Recurrent infections and the emergence of resistant fungal strains make treatment with conventional antifungal formulations challenging. Traditional topical dosage forms such as creams, lotions, and ointments often exhibit limited drug penetration and short retention time at the site of infection, and may cause adverse reactions, particularly in immunocompromised individuals. Therefore, there is a need for improved formulations that enhance drug delivery, provide prolonged retention, and increase therapeutic effectiveness against resistant fungal strains. The present study aims to develop a nano-hydrogel formulation incorporating the antifungal drug Itraconazole and the anti-inflammatory agent Mometasone furoate to achieve a synergistic therapeutic effect in the treatment of resistant male genital groin fungal infections. The nano-hydrogel system is designed to enhance localized drug delivery, prolong the residence time of the formulation on the affected skin surface, and improve penetration into infected tissues. The nanoscale size of the drug particles facilitates better permeation through the skin barrier, thereby improving antifungal activity while simultaneously reducing inflammation and irritation. In this study, the nano-hydrogel formulation was prepared by converting itraconazole and mometasone furoate into nanoparticles using the solvent diffusion method. The prepared nanoparticles were then incorporated into a Carbopol-based hydrogel matrix to obtain a stable topical gel formulation. The optimized formulation showed a pH of 7.04 ± 0.1, a practical yield of 98% ± 0.5, and a viscosity of 408 cp ± 0.5. Drug content was uniform, and spreadability was found to be optimal. The particle size of nanoparticles, analyzed using Scanning Electron Microscopy and Fourier Transform Infrared Spectroscopy, ranged between 60–200 nm, while crystallinity was confirmed using Powder X-Ray Diffraction. Antifungal activity was evaluated using a Franz diffusion cell method. The zone of inhibition against Tinea capitis and Tinea barbae was found to be 23.30 ± 0.57 mm and 30.10 ± 0.57 mm, respectively. Drug release was measured by UV–Visible Spectrophotometry at 222 nm. The results indicate that the itraconazole–mometasone nano-hydrogel formulation is more effective at lower dosages and produces fewer side effects compared with conventional antifungal treatments.

Keywords: Antifungal, Male Genital, Groin Fungal, Itraconazole, Mometasone, Nano-hydrogel.

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THE IMPACT OF TUMOUR NECROSIS FACTOR ALPHA (TNF-A) GENETIC VARIANTS ON STRUCTURAL AND FUNCTIONAL STABILITY OF PROTEIN

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Abstract

Tumour Necrosis Factor Alpha (TNF-α) is a Multifunctional cytokine primarily produced by immune cells such as macrophages and T cells that plays a role in several physiological and pathological processes, including inflammation, immunology, and cancer. Tumour Necrosis Factor Alpha (TNF-α) is an essential mediator of cancer progression, as it stimulates the growth of tumour cells, angiogenesis (the construction of blood vessels), and metastasis (the spread of cancer cells to distant areas). Moreover, it can supress the body's immune response to cancer, which makes tumours resistant to the immune system's ability to recognise and eliminate them. In all, 1840 SN Ps TNF-α were retrieved from the NCBI SNP database; 380 of them were found in the intronic region, 169 were missense, and 110 were synonymous. After that, 15 harmful SNPs were found using SIFT analysis for missense. Analysis through I-mutant tool was performed with all the 15 deleterious SNPs where the results were obtained in the form of DDG values, and it predicts the stability of variants. After using PolyPhen2 and I-Mutant, 11 SNPs were filtered out as deleterious having Protein ID: ENSP00000398698 and ENSP00000413450 at chromosome number 6. After analysing the data from several tools, six SNPs were chosen for additional examination in MutPred and MutPro (rs370893734, rs369780852, rs374531985, rs369510319, rs11574936 and rs142240704). MutPred indicated that four of these SNPs had an impact on the protein's structural and functional stability. All six of the SNPs indicated a decrease in stability when the change in protein stability due to these SNPs was predicted using MutPro. The six SNPs were then entered into HOPE to display the modifications to the protein's three-dimensional structure and replicate the effects of replacing amino acid residues on native proteins. These four SNPs—can be considered leading contenders for the destabilisation of the protein structure and may be involved in a number of inflammatory illnesses. Additionally, ten proteins—TRAF2, TNFRSF1B, CHUK, NFKB1, TAB2, TNFRSF1A, RIPK1, CASP8, TRADD, and MAP3K7—exhibited interactions with TNF-α. In this study, the deleterious SNPs of TNF-α have been predicted, these SNPs might show contributions in the case of several diseases and lead to TNF-α associated diseases.

Keywords: TNF-α, dbSNP, SIFT, Polyphen2, Mutpred.

COMMON FUZZY FIXED-POINT THEOREMS IN BICOMPLEX-VALUED METRIC SPACES WITH PROSPECTIVE BIOLOGICAL APPLICATIONS

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Abstract

The primary objective of this paper is to establish several common fuzzy fixed-point results for fuzzy mappings within a complete bicomplex-valued metric space. By imposing specific rational-type contractive conditions introduced here, we prove existence results showing that two fuzzy mappings in such a space can share a common fuzzy fixed point. The theorems extend and generalize several well-known results in the existing literature, and an illustrative example is included to demonstrate applicability of the hypotheses. While the present work focuses on theoretical development and proofs, we outline concise prospective directions that indicate how these results might be employed in applied settings such as computational biology and biomedical signal processing. These application ideas are proposed as future research avenues in this article.
AMS Subject Classification (2020): 03B52, 46G20, 46S40, 47H10, 58B12.

Keywords: Fuzzy Mappings, Fixed Point, Hausdorff Distance, Bicomplex Valued Metric Spaces, Fuzzy Fixed Point.

MICRONEEDLE PATCHES: A MINIMALLY INVASIVE PLATFORM FOR PAINLESS AND EFFICIENT VACCINE DELIVERY

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Abstract

Conventional vaccination methods that use hypodermic needles often come with various drawbacks, including pain, fear of needles, the risk of needle-stick injuries, and the need for trained healthcare professionals. These issues can hinder vaccination coverage and patient compliance, particularly in mass immunization campaigns. Microneedle (MN) patch technology has emerged as a minimally invasive and patient-friendly alternative for delivering vaccines efficiently and painlessly. Microneedle patches are composed of arrays of tiny projections that can penetrate the outermost layer of the skin (the stratum corneum) without reaching deeper pain receptors or blood vessels. This allows for transdermal vaccine administration with minimal discomfort. This study focuses on the engineering design, fabrication strategies, and immunological benefits of dissolvable and biodegradable polymer-based microneedle systems for controlled antigen delivery. By targeting antigen-presenting cells in the epidermal and dermal layers, microneedle-mediated delivery improves the efficiency of the immune response while requiring lower doses of antigen compared to conventional intramuscular injections. Advanced fabrication techniques, such as micro-molding and 3D microfabrication, allow for precise control over needle geometry, mechanical strength, and dissolution rates. Additionally, incorporating stabilizing excipients into the polymer matrix enhances antigen stability, which eliminates the need for cold-chain storage and promotes the feasibility of global distribution. Controlled dissolution behaviour further ensures sustained antigen release, fostering prolonged immune activation and improved immunogenicity.

Keywords: Microneedle Patches, Painless Vaccine Delivery, Transdermal Immunization, Dissolvable Microneedles, Controlled Antigen Release.

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EXPLORING MICROBIAL STRATEGIES FOR COST-EFFECTIVE BIO-CELLULOSE PRODUCTION FROM VEGAN SOURCES

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Abstract

Bacterial Cellulose (BC) is a high-quality, biodegradable biopolymer, with notable characteristics of high purity, high crystallinity, high mechanical strength, high water holding capacity and biocompatibility, making it suitable for many different types of biomedical and industrial uses. However, the large-scale commercialisation of Bacterial Cellulose is hampered by high production costs, dependence on expensive culture media, and reliance on patented or genetically engineered strains of bacteria such as *Komagataeibacter xylinus.* This research investigates a sustainable, cost-effective, vegan method of Bacterial Cellulose production using *Gluconacetobacter diazotrophicus*, a non-patented microorganism that has not been widely researched, and that is to be cultured on modified, agro-industrial waste-derived culture media. The use of plant-derived substrates aims to promote waste valorisation and support circular bioeconomy principles. Bacterial cellulose was produced using different culture media, including standard Hestrin–Schramm (HS) medium, LB supplemented with glucose, and a modified bamboo waste-based medium. Cellulose production was carried out under static and agitated fermentation conditions, resulting in the successful formation of cellulose pellicles and sheets across all tested media. The obtained bacterial cellulose was subsequently purified using alkaline treatment to remove bacterial cells and medium impurities. Culture conditions such as incubation time, aeration, and environmental parameters were maintained to facilitate efficient cellulose synthesis. This work aims to demonstrate the feasibility of producing and purifying bacterial cellulose using *G. Diazotrophicus* in both conventional and low-cost sustainable media systems. This work establishes a foundation for future physicochemical characterisation and application-oriented studies of environmentally friendly bacterial cellulose for potential use in biomedical materials, packaging, textiles, and bio-based products.

Keywords: Bacterial Cellulose, Bio-Cellulose, Gluconacetobacter Diazotrophicus.

THE INTERCONNECTED THREAT OF TYPHOID: A ONE HEALTH PERSPECTIVE

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Abstract

Typhoid fever, caused by Salmonella Typhi, is a major global health concern, especially in low- and middle-income nations. The One Health concept acknowledges the connection of human, animal, and environmental health, emphasizing the necessity for joint efforts to eradicate typhoid. Water pollution, sanitation and hygiene (WASH) practices, animal reservoirs, and environmental contaminants are all involved in transmission. The spread of antimicrobial resistance (AMR) affects treatment and preventative efforts. By strengthening WASH initiatives, refining immunization protocols, and increasing observation, a One Health approach can help lower these risks. Integration between the human, animal, and environmental sectors is necessary for managing typhoid. The Typhoid Vaccine Acceleration Consortium (TyVAC) and GAVI are collaborating to introduce typhoid conjugate vaccines in endemic regions. Key solutions include improving sanitary infrastructure, promoting hygienic practices, and administering vaccination programs. Current research focuses on developing new vaccines and comprehending AMR dynamics. This article also show that Typhoid is also play an important role to achieve SDG 3 goal.

Keywords: Typhoid, One Health, Green Biotechnology, Vaccines.

STRUCTURE-BASED COMPUTATIONAL CHARACTERIZATION OF PHYTOCOMPOUND MODULATORS OF NLRP3 INFLAMMASOME IN ORAL CANCER USING DOCKING AND MD SIMULATIONS

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Abstract

The NLRP3 inflammasome is a central regulator of innate immunity and chronic inflammation, both of which contribute to inflammation-driven oral cancer progression. Understanding NLRP3-ligand interactions is therefore essential for identifying new therapeutic strategies. In this study, a structure-based computational workflow combining molecular docking, molecular dynamics (MD) simulations, and binding free energy analysis was employed to assess the inhibitory potential of phytocompounds against NLRP3. The refined 3D structure of the NLRP3 protein (PDB ID: 7ALV) was utilized for docking-based screening of 93 phytocompounds with reported bioactivity. Physicochemical properties and drug-likeness were assessed via Swiss ADME. The top-scoring ligands were further evaluated through 100 ns MD simulations using GROMACS, assessing complex stability via RMSD, radius of gyration (R_g), hydrogen bond profiles, and MM/PBSA binding free energies. Tinocordiside, Jatrorrhizine and Withaferin A formed structurally stable complexes with the NLRP3 protein, demonstrating strong binding affinities (docking scores ≤ -9 kcal/mol), and encouraging binding free energies ranging from -25.90 to -12.17 kcal/mol. Overall, this integrated *in silico* approach successfully identified potential phytochemical inhibitors of NLRP3, providing valuable molecular insights to support the development of novel anticancer agents against inflammation-associated oral carcinogenesis.

Keywords: NLRP3, Oral Cancer, Phytocompounds, Molecular Docking, MD Simulation.

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IoT-ENABLED QUALITY AGRICULTURE FOR RESOURCE EFFICIENCY AND CIRCULAR FOOD SYSTEMS

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Abstract

This paper searches for IoT-enabled quality agriculture to behave resource use and reduce environmental impacts. Agriculture faces mounting challenges in leveling productivity with sustainability, as increasing resource demands strain water, energy, and soil systems. Agriculture is undergoing a digital transformation, with the Internet of Things (IoT) future as a key driver of sustainable practices. The integration of Internet of Things (IoT) technologies into farming grooming offers a transformative footpath toward quality agriculture and circular food systems. By deploying soil moisture sensors, nutritious monitors, and climate stations, IoT systems provide real-time data that allows farmers to apply water, fertilizers, and pesticides only when necessary. This research explores the role of IoT-enabled solutions in advancing sustainable agriculture by optimizing resource efficiency, reducing environmental impacts, and fostering closed-loop practices. IoT sensors, drones, and smart devices can provide real-time monitoring of soil moisture, nutrient levels, and crop health, enabling farmers to make data-driven decisions that minimize water and fertilizer use while enhancing yields. Furthermore, IoT systems can support renewable energy integration in agriculture, such as solar-powered irrigation and wind-powered cold storage, thereby reducing reliance on fossil fuels. Beyond resource optimization, IoT application can ease circular economy models in agriculture by tracking and managing waste streams, converting crop balance into bioenergy or compost, and ensuring efficient reuse of resources. The study also examines barriers to adoption, including cost, connectivity limitations, and farmer readiness, while highlighting opportunities for scalable deployment in both smallholder and industrial farming contexts. By combining IoT-driven exactness agriculture with circular economy principles, this research aims to demonstrate how digital technologies can create resilient, low-carbon, and resource-efficient food systems. The expected outcomes include reduced input consumption, improved crop fruitfulness, and practical frameworks for IoT-enabled sustainable farming that can be replicated globally. Ultimately, this study positions IoT as a critical enabler of agricultural transformation, aligning food production with environmental control and long-term sustainability goals.

Keywords: Internet of Things (IoT), Precision Agriculture, Sustainable Farming, Circular Economy, Smart Sensors.

AI-BASED OBJECT DETECTION IN IMAGES AND VIDEOS [DETECTING OBJECTS (CARS, PEOPLE, ANIMALS) USING MODELS LIKE YOLO OR SSD.]

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Abstract

Object detection is a very important part of computer vision that lets independent systems find and recognize real-world things or objects like automobiles, people, and animals in digital photos and videos. This research discusses the major evolution of detection strategies, highlighting the move from old handmade feature engineering to modern deep learning architectures based on Convolutional Neural Networks (CNNs). A major focus is made on comparing popular models: the two-stage Faster R-CNN and single-stage detectors like You Only Look Once (YOLO) and Single Shot Multibox Detector (SSD). Our investigation of the sources reveals a definite trade-off between speed and accuracy; although Faster R-CNN gives higher precision for complicated or small objects, YOLO excels in real-time applications, often obtaining the highest frames-per-second (FPS). SSD serves as an ideal middle ground, blending moderate hardware resource consumption with consistent performance. Beyond technical metrics like Mean Average Precision (mAP) and VRAM usage, we explore practical implementations in autonomous driving, surveillance, and medical imaging. Finally, the article covers recurring issues such as occlusion, lighting fluctuations, and small object detection, concluding that model selection must be carefully tuned to the specific accuracy or latency requirement of the target environment.

Keywords: Object Detection, Deep Learning, Convolutional Neural Networks (CNN), Real-Time Detection, Computer Vision.

DATA-DRIVEN SMART HEALTHCARE SYSTEMS FOR SUSTAINABLE PUBLIC HEALTH MANAGEMENT

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Abstract

Smart Healthcare System that uses data and digital technologies are changing the way public health services are planned and delivered. Technologies similar as connected medical bias, artificial intelligence, pall computing, and data analytics help healthcare providers collect and study health information more efficiently. This paper reviews the main technologies, system designs, and practical uses of data-driven smart healthcare systems that support better and further sustainable public health operations. Operations similar as remote case monitoring, telemedicine, smart sanitarium operation, and complaint vaticination systems help croakers and health authorities make faster and more accurate opinions. These systems also reduce pressure on hospitals, ameliorate healthcare access in pastoral and civic areas, and support early discovery of conditions. The paper also discusses common challenges, including guarding patient data, high setup costs, and difficulties in participating data between healthcare associations. In addition, the check explains how smart healthcare results promote preventative care and better use of medical coffers, making healthcare services more affordable and effective. Eventually, unborn developments similar as substantiated healthcare, secure data sharing, and smart megacity health integration are bandied, showing how technology can help make stronger and further sustainable public health systems for future generations.

Keywords: Smart Healthcare, Data Analytics, Public Health Management, Telemedicine, Sustainable Healthcare.

PAN-CANCER EXPRESSION AND PROGNOSTIC SIGNIFICANCE OF PD-L1 (CD274) IN LUAD, BRCA, AND KIRC USING TCGA DATA: AN IN-SILICO STUDY

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Abstract

Programmed death-ligand 1 (PD-L1, also known as CD274) functions as a critical immune checkpoint molecule which allows tumor cells to escape detection by the immune system. It is of utmost importance to study PD-L1 expression patterns and their prognostic value in various cancer types to create customized immunotherapy treatments. We conducted a detailed study which examined PD-L1 expression patterns together with their prognostic value and their relationship to tumor advancement and immune cell presence across three main cancers. Methods: We conducted an integrated bioinformatics analysis which used publicly accessible TCGA transcriptomic datasets together with web-based bioinformatics tools such as GEPIA2, UALCAN and TIMER2.0. We also conducted differential expression analysis to compare tumor and normal tissue samples while Kaplan-Meier survival analysis was used to determine prognostic effects and the research team studied expression patterns across different tumor stages and how they related to immune cell infiltration. The study found that PD-L1 expression showed different patterns between various cancers since LUAD and KIRC tumors showed high expression levels but BRCA tumors displayed moderate and fluctuating expression rates.The research found links between cancer survival rates and specific prognostic factors that differed between three examined cancers. Analysis of different stages showed that PD-L1 expression changes occurred in relation to tumor advancement. The research found that PD-L1 expression levels showed strong positive relationships with the presence of CD8+ T cells and macrophages and dendritic cells. The study found that PD-L1 expression depends on the type of cancer which establishes its potential as a prognostic biomarker and treatment target in LUAD, BRCA and KIRC while proving the need for personalized immunotherapy approaches.

Keywords: PD-L1, TCGA, Pan-Cancer Analysis, Immune Checkpoint, Prognostic Biomarker.

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MGNREGA AS A TOOL FOR PROMOTING DECENT RURAL EMPLOYMENT: A CASE STUDY OF HARDOI DISTRICT

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Abstract

This study assesses MGNREGA as a policy tool for enhancing quality rural employment in Hardoi District, Uttar Pradesh, contextualizing its results within the Sustainable Development Goal 16 framework of accountable, inclusive, and participatory government. The rural economy of Hardoi, characterized by reliance on agriculture, seasonal unemployment, and ongoing out-migration, serves as a significant case for analyzing the potential of public job guarantee systems to achieve governance outcomes that are both egalitarian and institutionally sound. The study employs a descriptive and analytical research design, utilizing secondary data from the MGNREGA Public Data Portal and annual reports from the Ministry of Rural Development. It examines important performance measures -such as job card issuance, person-days generated, wage payment timings, women's involvement, SC/ST inclusion, and budget utilization -over a five-year span. A block-level comparative examination of Sandi, Sandila, and Bilgram elucidates intra-district variability in institutional delivery. The Study indicate that although Hardoi has realized significant advancements in employment generation and the engagement of marginalized groups, substantial governance deficiencies remain. Delays in wage payments, deficiencies in the 100-day guarantee, obstacles within the Aadhaar-Based Payment System, and inadequate implementation of social audits collectively undermine the scheme's efficacy as a legitimate instrument for decent work. These deficiencies signify overarching shortcomings in transparent, accountable, and responsive local institutions-the fundamental tenets that SDG 16 aims to fortify. The study advocates enhancing grievance redressal systems, augmenting panchayat-level accountability, and aligning MGNREGA execution with state livelihood initiatives. It asserts that attaining sustained rural employment necessitates not just financial investment but also revolutionary governance reform at the district and block levels.

Keywords: MGNREGA, Decent Work, Rural Governance, SDG 16, Employment Guarantee.

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A BEHAVIORAL BIOMETRIC FRAMEWORK FOR ROBUST DEEPFAKE VIDEO DETECTION

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Abstract

The rapid growth of deep learning technologies has enabled the creation of highly realistic deepfake videos, which pose serious risks to digital identity, online trust, and cybersecurity. Traditional deepfake detection methods mainly focus on visual artifacts such as image distortions, lighting inconsistencies, and facial warping. However, modern deepfake generation techniques have significantly improved, reducing visible imperfections and making visual-only detection methods less effective. Therefore, there is a need for more reliable detection strategies. This research proposes a deepfake detection framework based on behavioral biometrics. Instead of relying only on pixel-level analysis, the proposed system examines natural human behavioral patterns that are difficult to replicate accurately. These include eye blinking frequency, head movement consistency, facial landmark stability, and lip–speech synchronization. Such behavioral cues are involuntary and time-dependent, making them more robust indicators of authenticity. The extracted behavioral features are processed and analyzed using machine learning models, including temporal models capable of capturing sequential patterns in video data. Experimental evaluation on standard benchmark datasets demonstrates that the behavioral biometric-based approach improves detection accuracy and robustness compared to conventional visual-based methods. The results indicate that incorporating behavioral analysis enhances generalization and provides a more explainable framework for deepfake detection. Overall, this study highlights the importance of human-centric features in combating evolving deepfake threats and presents a reliable direction for future research in secure video authentication systems.

Keywords: Deepfake Detection, Behavioral Biometrics, Machine Learning, Cybersecurity, Video Authentication.

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COGNITIVE DISSONANCE AND PRO-ENVIRONMENTAL BEHAVIOUR

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Abstract

The escalating global environmental crisis has rendered the gap between environmental awareness and pro-environmental behaviour one of the most pressing concerns in contemporary psychological and sociological research. Despite widespread recognition of ecological threats such as climate change, plastic pollution, and biodiversity loss, individuals persistently engage in behaviours that contradict their stated environmental values. This article examines the role of cognitive dissonance — the psychological discomfort arising from holding conflicting cognitions — as a central explanatory mechanism for this value-action gap. Drawing on Festinger's foundational cognitive dissonance theory (1957), this article explores how individuals employ rationalization, denial, trivialization, compensatory behaviour, and downward social comparison to resolve psychological tension without modifying environmentally harmful conduct. The analysis further investigates how identity construction, social norms, cultural context, and generational differences shape the intensity and resolution of environmental dissonance. Special attention is given to the hypocrisy induction paradigm developed by Aronson and colleagues (1991), which demonstrates that strategically induced dissonance can serve as a powerful catalyst for genuine pro-environmental behaviour change. The article also highlights the limitations of purely psychological interventions, emphasizing that structural barriers — including economic inequality, inadequate infrastructure, and limited access to sustainable alternatives — significantly constrain individuals' capacity to act on their environmental values. It is argued that effective environmental behaviour change requires the integration of dissonance-based psychological strategies with systemic policy reforms that reduce the material costs of sustainable living. The findings carry significant implications for environmental education, public communication campaigns, and policy design. This article concludes that cognitive dissonance, when properly understood and ethically harnessed, represents a valuable psychological lever for promoting pro-environmental behaviour at both individual and collective levels.

Keywords: Cognitive Dissonance, Pro-Environmental Behaviour, Value-Action Gap, Hypocrisy Induction, Environmental Psychology, Sustainability, Behaviour Change.

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IMPACT OF GLP1R NSSNP ON SEMAGLUTIDE BINDING: A MOLECULAR DOCKING STUDY TOWARD PERSONALIZED THERAPY

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Abstract

The glucagon-like peptide-1 receptor (GLP1R) is a class B G-protein-coupled receptor that plays a central role in glucose homeostasis, insulin secretion, and appetite regulation. Genetic variations in the GLP1R gene, particularly non-synonymous single nucleotide polymorphisms (nsSNPs), can alter receptor structure, ligand binding, and downstream signaling, thereby influencing therapeutic responses. Semaglutide, a long-acting GLP-1 receptor agonist, is widely used for the management of type 2 diabetes mellitus and obesity due to its potent glycemic control and weight-reducing effects. However, inter-individual variability in treatment efficacy suggests a potential role of GLP1R genetic variants.In this study, molecular docking analysis was performed to evaluate the binding affinity of Semaglutide with wild-type (WT) GLP1R and multiple nsSNP variants (T353M, T149M, R227H, P358L, Q394R, L360P, G361R, I357T, and C46Y). Docking scores indicated differential binding across variants, with the WT receptor showing a docking score of −259.28. Enhanced binding affinity was observed for variants such as C46Y (−282.32) and Q394R (−276.45), whereas reduced affinity was noted for R227H (−251.72) and I357T (−257.83). Confidence scores remained high across all complexes, suggesting reliable docking predictions. These findings demonstrate that nsSNP-induced structural alterations in GLP1R can significantly influence Semaglutide–receptor interactions. The study highlights the importance of incorporating genetic profiling of GLP1R variants to better predict therapeutic response, supporting the advancement of personalized treatment strategies for diabetes and obesity.

Keywords: GLP1 Receptor (GLP1R), Semaglutide, Non-synonymous SNPs (nsSNPs), Molecular Docking, Personalized Medicine.

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IDENTIFICATION OF RELAPSE-SPECIFIC GENE EXPRESSION IN ACUTE LYMPHOBLASTIC LEUKEMIA

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Abstract

Acute lymphoblastic leukemia (ALL) is a cancer of the lymphoid line of blood cells characterized by the development of large numbers of immature lymphocytes. Treatment involves chemotherapy and radiotherapy; however relapse is a leading cause of treatment failure but the molecular mechanisms underlying relapse remain incompletely understood. In the present study differential gene expression (DEG) analysis was carried out using transcriptomic profiles of ALL relapse samples versus matched diagnosis samples (GSE28460). Statistically significant DEGs (443) were identified (P value < 0.05 and log2FC >0.5) using GEO2R. Functional annotation and pathway enrichment analyses were conducted to characterize biological processes associated with relapse. Upregulated genes were enriched in pathways related to oncogenic signaling, stress response, immune modulation, and metabolic adaptation, while downregulated genes were associated with tumor suppressive functions, redox homeostasis, and lipid metabolism. Pathway enrichment highlighted dysregulation of oxidative stress response, inflammatory signaling, cell cycle control, and metabolic remodeling. The study thus identifies a set of relapse-associated DEGs in ALL that may contribute to leukemic persistence and treatment resistance in ALL and may be studied further to as probable therapeutic targets.

Keywords: Acute Lymphoblastic Leukemia, Gene Ontology, Relapse, DEGs.

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INTERNET OF THINGS (IOT) IN SMART DOOR LOCK

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Abstract

The proposed system, Smart Door Lock, is an advanced security system intended for the betterment of residential and commercial security by integrating the latest digital technologies. In this research paper, the proposed system of designing, developing, and implementing the concept of a smart door locking system, replacing the traditional mechanical locking system with an intelligent and automated system, is discussed. In the proposed system, the microcontroller and wireless communication technologies like Wi- Fi and Bluetooth are used. The system has various authentication methods, which include password-based entry, RFID card verification, fingerprint-based biometric identification, and one-time password access. All these features enhance the security of the system by reducing the chances of lost keys and unauthorized duplication of the same. Real-time notifications and access logs are made available to the user, which helps in monitoring the access attempts. In the event of any suspicious activity, the system has the ability to send an alarm to the user's mobile device. The evaluation of system performance is based on response time, reliability, power consumption, and strength of security. The experimental results show that the proposed smart door lock system ensures efficient operation, faster authentication, and higher security compared to traditional locking systems. The incorporation of Internet of Things technology ensures compatibility with smart home environments. In general, the Smart Door Lock system offers a cost-effective, user-friendly, and highly secured solution for modern smart door locking, contributing to the development of smart home security technologies and digital automation systems.

Keywords: RFID Card, Power Consumption, Smart Door Lock, Bluetooth.

COUPLED EFFECTS OF HIGH-DENSITY POLYURETHANE FOAM INFILL, SLENDERNESS RATIO, AND MATERIAL TYPE ON BUCKLING-RESISTANT PERFORMANCE OF STEEL AND ALUMINIUM CIRCULAR TUBES: EXPERIMENTAL AND NUMERICAL INSIGHTS

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Abstract

Foam-filled metallic tubes offer superior energy absorption and stability for lightweight structures, yet the interplay of high-density polyurethane (PU) foam infill, slenderness ratio (λ=20−100λ=20−100), and tube material (steel vs. aluminium) on axial compression remains underexplored. This study quantifies these coupled effects through comprehensive testing and modeling. Empty and PU foam-filled (density: 150 kg/m³) circular tubes (D/t = 50) underwent monotonic axial compression across slenderness ratios. Metrics included load-displacement curves, peak capacity, stiffness, and failure modes. Validated nonlinear finite element models (accounting for plasticity, imperfections, and foam-tube interaction) enabled parametric analyses. Foam infill boosted ultimate load by 25-60%, initial stiffness by 40-80%, and post-buckling stability versus hollow tubes. Enhancements peaked in short columns (λ<40λ<40) via confinement delaying local buckling; higher slenderness shifted dominance to global Euler buckling. Steel tubes achieved 1.5-2x higher absolute capacities, while aluminium excelled in specific strength (up to 20% superior). Models predicted experiments within 5-8% error. High-density PU foam markedly elevates axial performance, with slenderness dictating local-to-global buckling transitions. This validated framework guides optimal design of foam-filled tubular columns for aerospace, automotive, and seismic applications.

Keywords: Polyurethane Foam-Filled Tubes, Slenderness Ratio, Axial Compression, Steel/Aluminium Columns, Local/Global Buckling, Finite Element Analysis.

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IN SILICO ASSESSMENT OF SELECTED NATURAL FLAVONOIDS AS POTENTIAL CARDIOPROTECTIVE AGENTS TARGETING CALPAIN AND LIPOPROTEINS

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Abstract

Cardiovascular diseases (CVD) are a group of disorders of the heart and blood vessels; these are the leading cause of death globally. There is enormous proof that these dietary flavonoids can protect against disease because they are antioxidants, anti-inflammatories, and lipid-modulators. The goal of this study was to use in-silico molecular docking and ADMET analysis to see how well certain natural flavonoids—gossypetin, apigenin, luteolin, and pinocembrin—could protect the heart. In this study, molecular docking was conducted with AutoDock Vina to examine the binding affinity of these compounds to critical cardiovascular disease-related targets, specifically calpain and lipoprotein-associated proteins. The results showed that gossypetin had the strongest binding affinity for calpain, making several hydrogen bonds and hydrophobic interactions in the active site. These interactions point to a stable complex that may be able to stop calpain-mediated pathological processes. Pinocembrin, apigenin and luteolin all had moderate but significant effects on lipoprotein targets. This suggests that they may play a role in regulating lipid metabolism and protecting against atherosclerosis. SwissADME ADMET predictions showed that apigenin and pinocembrin have good pharmacokinetic profiles, with high gastrointestinal absorption and compliance with Lipinski's rule of five. On the other hand, gossypetin, which binds strongly, had lower predicted absorption because it is very polar. Overall, the results point to a complementary cardioprotective strategy in which gossypetin may work mainly by reducing inflammation and inhibiting calpain, while apigenin and luteolin help control lipids and protect the endothelium. This computer-based insight that focuses on people supports the idea that natural flavonoids could be good candidates for preventing and treating heart disease. It is suggested that more in vitro and in vivo studies be done to confirm these results and see if they can be used in the clinic.

Keywords: Flavonoids, CVDs, Molecular Docking, Calpain Inhibition, and ADMET.

EVALUATION OF DIAGNOSTIC VALUE OF SERUM PROCALCITONIN, LACTATE AND HIGH-SENSITIVITY C–REACTIVE PROTEIN FOR PREDICTION OF BACTEREMIA IN ADULT PATIENT IN EMERGENCY PATIENT

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Abstract

Early diagnosis of bacteremia in emergency department patients is essential for prompt initiation of antimicrobial therapy and improved outcomes. While blood culture remains the gold standard, it is time-consuming and prone to false-positive results. Hence, serum biomarkers such as Procalcitonin (PCT), Lactate, and High-Sensitivity C-Reactive Protein (hs-CRP) are being explored for their potential in early identification of bacteremia. To evaluate and compare the diagnostic efficacy of serum PCT, Lactate, and hs-CRP in predicting bacteremia among adult patients with suspected infections presenting to the emergency department. This prospective observational study included adult patients (>18 years) with suspected infections for whom blood cultures and serum biomarkers (PCT, Lactate, and hs-CRP) were simultaneously measured at presentation. Bacteremia was confirmed through positive blood culture results, excluding contaminants. Diagnostic performance was analyzed using ROC curves, sensitivity, specificity, and predictive values. Patients with culture-positive bacteremia showed significantly higher levels of PCT, Lactate, and hs-CRP compared to culture-negative cases. Among these, PCT demonstrated the highest diagnostic accuracy with an AUC of 0.71, sensitivity of 83.9%, and specificity of 43.8% at a cut-off value of 0.396. Lactate and hs-CRP also correlated with bacteremia (AUCs 0.59 and 0.60, respectively), though with lower diagnostic power. Combined biomarker analysis further improved diagnostic accuracy. Serum PCT serves as the most reliable single biomarker for early detection of bacteremia in emergency settings. Lactate and hs-CRP provide additional supportive value, enhancing timely diagnosis and appropriate antibiotic administration.

Keywords: Bacteremia, Procalcitonin, Lactate, Hs-CRP, Biomarkers, Emergency Medicine.

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CHEMICAL COMPOSITION AND IN VITRO CYTOTOXIC AND ANTILEISHMANIAL ACTIVITIES OF ESSENTIAL OIL FROM THE AERIAL PARTS OF *ERIGERON KARVINSKIANUS*

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Abstract

The genus *Erigeron* (family Asteraceae) is widely recognized for its ethnopharmacological importance; however, the biological potential of *Erigeron karvinskianus* remains largely unexplored. This study presents the chemical profiling and the first comprehensive evaluation of the antileishmanial and anticancer activities of essential oil extracted from the aerial parts of *E. karvinskianus* collected in Uttarakhand, India. The essential oil, obtained by hydro-distillation (yield: 0.11% v/w), was analyzed using GC–MS, revealing 15 constituents that accounted for 80.17% of the total composition. The major compounds identified were trans-ocimene (23.29%), β-copaen-4-α-ol (19.32%), and 4-methoxy-1-naphthalenol (11.57%), along with notable amounts of β-elemene and Z-caryophyllene. Antileishmanial activity was assessed against *Leishmania donovani* (Dd8 strain). The essential oil exhibited significant dose-dependent inhibition of promastigotes, with 55.87±2.70%, 79.26±2.35%, and 87.07±2.94% inhibition at 10, 50, and 100 µg/mL, respectively ($p < 0.001$). Intracellular amastigote inhibition ranged from 17.54±2.05% to 67.27±8.27%, comparable to the reference drug Miltefosine. Importantly, minimal cytotoxicity was observed in J774.A1 macrophages, indicating selectivity toward the parasite. The anticancer potential was evaluated on MCF-7 cells using the MTT assay. The essential oil demonstrated notable cytotoxicity, with an IC_{50} value of 2.712±0.07 µL/mL after 24 h treatment, showing a trend comparable to the IC_{50} value of 99.07±0.05 nM for the standard drug Paclitaxel. Overall, these results underscore the potential of *E. karvinskianus* essential oil as a valuable natural source for the development of novel therapeutic agents. Further comprehensive mechanistic investigations and in vivo studies are necessary to substantiate its pharmacological efficacy and confirm its clinical relevance.

Keywords: Essential Oil, Cytotoxic, Antileishmanial Activities, Pharmacological Efficacy.

FORMULATION OPTIMIZATION OF TOLNAFTATE TRANSDERMAL PATCH FOR FUNGAL TREATMENT

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Abstract

Tolnaftate possesses antifungal activity and have biological half life of two hours, and it has many gastro-intestinal side effects when administered orally. In present work to the formulation of a matrix-type transdermal patch containing tolnaftate were prepared by solvent casting method and factorial design for optimization using polymers Eudragit RL-100, Hydroxy methyl propyl cellulose (HPMC) and Ethyl cellulose (EC). Propylene glycol was used as penetration enhancer as well as plasticizer and methanol and dichloromethane were used as solvent in same concentration. All the prepared patches were evaluated for their weight variation, moisture content, folding endurance, thickness, drug content and *In-vitro* permeation study. Further prepared patches characterized for scanning electron microscopy. From the result it was concluded that combination of three polymers shows good physical properties and shows higher drug release as compared to formulation containing two polymers.

Keywords: Tolnaftate, Eudragit RS-100, HPMC, Ethyl Cellulose, Tween80

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NETWORK TOXICOLOGY OF TRIAZOLE-BASED POLLUTANT

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Abstract

Triazole-based chemicals represent a significant class of emerging environmental contaminants widely generated from pharmaceutical, agricultural, and industrial activities. Due to their persistence, bioaccumulation potential, and toxicological relevance, triazole-based pollutants pose significant risks to ecological systems and human health. Conventional toxicological assessments predominantly focus on single-target mechanisms and therefore may not adequately capture the complex, multi-pathway interactions underlying triazole-induced toxicity. To address this limitation, the present study employs a network toxicology approach to elucidate the systemic molecular interactions associated with triazole exposure. An integrated compound–target–pathway network was constructed using curated chemical–protein interaction data. Topological analyses, including degree centrality, betweenness centrality, and clustering coefficient, were applied to identify key hub proteins, bridging nodes, and critical regulatory pathways. The results demonstrate that the oxidative stress response, xenobiotic metabolism, inflammatory signalling, regulation of apoptosis, and DNA damage repair proteins represent central mechanisms of triazole-associated toxicity. Notably, several widely used triazole-based pollutants, including Letrozole, Itraconazole, Voriconazole, Fluconazole, and Ketoconazole, consistently emerged as highly connected and influential nodes within the network. The release of these chemicals to the environment has been associated with endocrine disruption, oxidative stress, impaired growth and reproduction, immune dysfunction, and organ toxicity in non-target aquatic organisms and poultry. Furthermore, environmental persistence may contribute to microbial resistance and the emergence of azole-resistant strains. This systematic investigation highlights that triazole compounds are therapeutically beneficial yet environmentally hazardous, and demonstrate the utility of network toxicology as an integrative framework for mechanistic understanding, predictive risk assessment, and regulatory decision-making regarding triazole contamination.

Keywords: Itraconazole, Voriconazole, Triazole, Xenobiotic Metabolism, Fluconazole.

TOXICOLOGICAL EVALUATION OF SYNTHETIC FOOD PRESERVATIVES THROUGH CYTOGENETIC ANALYSIS IN *ALLIUM CEPA L.*

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Abstract

In recent years, the consumption of packaged foods has increased significantly, leading to widespread use of synthetic food preservatives. Although these additives help prevent spoilage and extend shelf life, several studies report their potential cytotoxic and genotoxic effects after prolonged exposure. This research work highlights commonly used synthetic preservatives, including BHA, BHT, SA, SN, PG, SMB, and SB, and summarizes their cellular impacts based on published research. Many studies have used *Allium cepa* L. as a bioassay model to evaluate toxicity. Findings consistently show a concentration-dependent decrease in mitotic index and the occurrence of chromosomal abnormalities such as chromosome stickiness, bridges, and laggards. Treated cells also exhibit impaired DNA synthesis and reduced protein content, indicating disruption of the cell cycle. While preservatives play an important role in maintaining food quality, evidence suggests potential health risks at higher concentrations and long-term exposure. Further research is needed to better understand their mechanisms of action and long-term biological effects.

Keywords: Food Preservatives, Cytotoxic, Genotoxic, Chromosomal Aberration, Antimicrobial, Mitotic Index.

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NANOEMULGEL-BASED DELIVERY OF PLANT-DERIVED ANTILEISHMANIAL COMPOUNDS FOR ENHANCED DERMAL THERAPY

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Abstract

Cutaneous leishmaniasis (CL) is a neglected tropical disease caused by *Leishmania* parasites, leading to chronic ulcerative skin lesions, scarring, and social stigma. Despite the availability of conventional treatments such as pentavalent antimonials, amphotericin B, and miltefosine, their clinical use is limited by systemic toxicity, painful administration, high cost, prolonged therapy, and increasing drug resistance. In recent years, plant-derived bioactive compounds including alkaloids, flavonoids, terpenoids, quinones, and phenolic constituents have gained attention due to their significant antileishmanial activity, safety profile, and immunomodulatory properties. These phytoconstituents exert their effects through multiple mechanisms such as disruption of parasite membrane integrity, induction of oxidative stress, mitochondrial dysfunction, and modulation of host immune responses. However, their therapeutic potential is often hindered by poor aqueous solubility, low dermal penetration, chemical instability, and limited bioavailability. Nanoemulgel systems have emerged as a promising topical delivery platform to overcome these challenges. By integrating nanoemulsion technology with hydrogel matrices, nanoemulgels enhance the solubilization of lipophilic herbal compounds, improve skin permeation through nanosized droplets, and increase drug retention at the target site. The gel network provides suitable viscosity, improved spreadability, prolonged residence time, and better patient compliance. Moreover, nanoemulgels facilitate controlled drug release and targeted delivery to infected macrophages within the dermal layers, thereby reducing systemic exposure and minimizing adverse effects. The nanosized droplets improve solubilization and penetration of lipophilic phytoconstituents, while the gel base provides suitable viscosity, prolonged residence time, and patient compliance. This review highlights the therapeutic potential of plant-derived antileishmanial agents and comprehensively discusses formulation strategies, selection of excipients, preparation methods, physicochemical characterization, stability assessment, and in vitro and in vivo evaluation of herbal nanoemulgels. Current challenges, safety considerations, and regulatory aspects are also addressed. The convergence of ethnopharmacology and nanotechnology offers a promising strategy for developing effective, safe, and patient-friendly dermal therapies for cutaneous leishmaniasis.

Keywords: *Cutaneous leishmaniasis,* Herbal Extracts, Nanoemulgel.

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MULTIFRACTAL AND LONG-MEMORY DYNAMICS IN WEEKLY INFLUENZA INCIDENCE IN INDIA: EVIDENCE OF NONLINEAR PERSISTENCE WITHOUT DETERMINISTIC CHAOS

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Abstract

Understanding how Influenza spreads is essential for improving forecasting in epidemic disease dynamics and strengthening public health preparedness. The present study examines weekly Influenza incidence data from January 2009 to December 2025 in India using a comprehensive time series framework. Fractal dimension estimates for the present data confirm that the epidemic time series has a self-similar character. This scaling behaviour suggests that Influenza transmission displays structural consistency across different time scales, which aligns with the hierarchical nature of human contact networks and the multiple pathways through which the virus spreads. The additional presence of multifractality reveals that the dynamics are not uniformly scaled, meaning that small and large outbreaks are driven by fundamentally different intensities. From a biological standpoint, this likely reflects variation in strain virulence, antigenic drift, environmental factors, and the impact of public health interventions. The estimated Hurst exponent indicates that Influenza transmission follows a persistent long-memory process. In other words, Influenza activity is not simply a series of short-term random fluctuations; rather, past patterns continue to exert influence over time, reflecting the accumulated effects of host immunity, viral evolution, climatic conditions, and social contact behaviour. Despite clear evidence of nonlinearity in the data, both Lyapunov exponent analysis and the 0–1 chaos test indicate that the system does not exhibit deterministic chaos. This means that although Influenza dynamics are complex and nonlinear, they are not governed by low-dimensional chaotic attractors. Instead, the system appears to operate through structured randomness and nonlinear feedback, rather than through extreme sensitivity to initial conditions. Taken together, these findings characterize Influenza transmission as a persistent, multifractal nonlinear process that retains memory but remains free of chaotic instability. Biologically, this implies that longer-term forecasting may be partially feasible due to the persistence of past trends, while short-term variability stems from nonlinear interactions and heterogeneous driving factors. These insights carry meaningful implications for modelling of the spread of Influenza in India, forecasting methodology, and adaptive public health planning.

Keywords: Influenza Dynamics, Long-Memory Processes, Multifractality, Nonlinear Dynamics, Chaos.

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RISING THERMAL STRESS PREDICTING ECOSYSTEM COLLAPSE IN MADHYA PRADESH DRY FORESTS

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Abstract

Rising thermal stress associated with climate change is increasingly threatening the stability, resilience and functional integrity of tropical dry forest ecosystems. Tropical dry forests are particularly vulnerable because they already operate close to climatic thresholds of temperature and moisture availability. The present study evaluates the role of increasing thermal stress as a predictive indicator of ecosystem degradation and potential collapse in the dry forests of Madhya Pradesh, India. Long-term climatic trends were analysed in conjunction with land surface temperature (LST) and vegetation dynamics derived from satellite-based Normalized Difference Vegetation Index (NDVI) to assess ecosystem vulnerability across spatial and temporal scales. The results reveal a consistent rise in thermal stress across dry forest regions of Madhya Pradesh, reflected by increasing surface temperatures and prolonged exposure to extreme heat conditions. NDVI analysis shows a persistent declining trend corresponding with rising LST, indicating progressive vegetation stress, canopy degradation and reduced photosynthetic activity. Areas experiencing repeated high thermal stress exhibit incomplete seasonal recovery of vegetation, suggesting weakening ecosystem resilience. Furthermore, zones characterized by elevated thermal stress show higher forest fire incidence, reduced regeneration potential and increased disturbance frequency, highlighting their proximity to ecological thresholds. The findings demonstrate that rising thermal stress acts as a critical driver of ecosystem degradation in Madhya Pradesh dry forests and can serve as an effective early warning indicator of ecosystem collapse. The graphical abstract conceptualizes a pathway from climate change–induced temperature rise to increasing LST, vegetation stress, accelerated forest degradation and heightened collapse risk. Integrating thermal stress indicators into forest monitoring frameworks, strengthening fire management strategies and promoting climate-resilient forest practices are essential to enhance adaptive capacity, safeguard biodiversity and prevent irreversible ecosystem collapse under future warming scenarios.

Keywords: Thermal Stress, Tropical Dry Forests, Land Surface Temperature (LST), NDVI, Ecosystem Collapse, Forest Fire, Climate-Resilient Forest Management.

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INTEGRATING AI, MACHINE LEARNING AND MOLECULAR MODELLING TO ACCELERATE SUSTAINABLE DRUG DISCOVERY AND DEVELOPMENT

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Abstract

Artificial intelligence (AI), machine learning (ML), and molecular modelling are transforming modern drug development by allowing for more rapidly, data-driven, and resource-efficient research methodologies. Conventional drug development is still costly, time-consuming, and has a high failure rate. A sustainable substitute for conventional experimental processes is offered by the combination of computational intelligence and structure-based design. Target identification, virtual screening, hit-to-lead optimisation, and prediction of pharmacokinetic and toxicity profiles are all made possible by AI and ML approaches analysing large-scale biological and chemical information. Simultaneously, molecular modelling techniques like as molecular docking, molecular dynamics simulations, and quantitative structure activity relationship (QSAR) modelling provide atomic-level mechanistic insights into ligand–target interactions. When these techniques are used together, early-stage decision-making is improved, laboratory experimentation is decreased, and predicted accuracy is increased. Importantly, AI-assisted de novo drug design and generative models help to promote sustainable pharmaceutical innovation by reducing chemical waste, lowering energy usage, and shortening development durations. The combination of AI-driven analytics with computational chemistry platforms marks a major step toward effective and ecologically responsible drug discovery, despite contemporary challenges including data diversity, computational interpretability, and regulatory considerations. This review highlights recent methodological advancements, practical applications, current limitations, and future perspectives in integrating AI, ML, and molecular modelling to accelerate sustainable drug discovery and development.

Keywords: Artificial Intelligence, Machine Learning, Sustainable Drug Discovery, Computational Drug Design, QSAR Modelling

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LICHEN CAMOUFLAGED ARACHNIDA AND THEIR HABITAT PREFERENCES IN THE ROYAL BOTANICAL GARDENS, PERADENIYA, SRI LANKA

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Abstract

Camouflage is a widespread evolutionary adaptation feature that enables species to mimic their background setting, thereby evading predators or ambushing prey. Among these, lichens offer nutritional resources, shelter, nesting material, structural support and provide cryptic colorations, complex spatial patterns that facilitates effective camouflage, allowing species to inhabit specific microhabitats. Lichens, abundant in the Royal Botanical Gardens, Peradeniya, create microhabitats conducive to concealment. In recent research has emphasized the chemical properties of liches and their associated fungi, no comprehensive study has documented lichen-camouflaged species in Sri Lanka. This study identifies lichen camouflaged arachnida, assess their diversity and habitat preferences, examine their associations with host lichen and plant species, and compile a checklist of such species within the Royal Botanic Gardens. The study employed a random sampling approach across three habitat strata: tree-dominated area, open grass and lawn area, and riparian and moist zone. Sampling targeted lichen camouflaged arachnida across fifteen locations to ensure comprehensive coverage of the garden area. Quadrant and line transect methods were employed to collect data on mobile and less mobile species, respectively. Species identification relies primarily on morphological analysis. A comprehensive inventory documented five arachnid families dominated by Sclerosomatidae, Hersillidae, Salticidae, Lycosidae, and Ctenidae, with distinct patterns of abundance and habitat association. Diversity analyses indicated that tree-dominated habitats supported the most structurally balanced assemblages, recording four families and the highest effective diversity (Shannon-Wiener $H' = 1.084$), where Sclerosomatidae contributed 46.8% of individuals alongside well-represented Hersillidae and Salticidae. Riparian habitats exhibited the highest numerical abundance ($N = 204$) and nominal richness (five families), but were characterized by extreme dominance of Sclerosomatidae (97.1%), resulting in markedly reduced diversity ($H' = 0.169$) and evenness ($J' = 0.105$), while grassland habitats showed reduced occupancy, low abundance ($N = 18$), and only two families, reflecting strong habitat filtering. These findings contribute valuable baseline insights into the biodiversity conservation, dominance structure, and habitat specialization of cryptic arachnid assemblages within tropical urban botanical habitats.

Keywords: Camouflaged arachnida**,** Lichen, Royal Botanic Garden, Cryptic, Microhabitat

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ENVIRONMENTAL SUSTAINABILITY AS A TOOL FOR REDUCING SANDFLY PROLIFERATION IN LEISHMANIASIS-ENDEMIC REGION

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Abstract

Leishmaniasis continues to pose a significant major public health challenges concern in endemic region of India. Where ecological and socio-environmental conditions favour the proliferation of sandflies. The primary vectors of the disease. Conventional control strategies, primarily based on indoor residual spraying and chemotherapeutic management, provide short-term reduction. In this context, environmental sustainability emerges as a strategic and long- term tool for reducing sandfly abundance and interrupting disease transmission. this study explores the role of sustainable environmental management in controlling sandfly proliferation in relationship between microclimatic factors (temperature, humidity, soil, moisture), housing condition, organic accumulation, livestock, shelter proximity, vegetation density and land use patterns with sandfly density and seasonal dynamics. Field survey, entomological collections, and spatial analysis were conducted to asses vector abundance in relation to environmental determinants. This indicates that poor sanitation, high organic matter content, damp soil, cracked walls significantly enhance sandfly survival and breeding. Seasonal peaks were observed during warmed humid months corresponding to favourable microclimatic condition. Conversely, sustainable intervenes, such as improved housing structure (plastered walls, proper ventilation) waste management, controlled livestock shelter placement, community-driven environmental sanitation and habitats modification significantly reduced vectors density resting and breeding niches. The study highlights that integrating eco-friendly environmental practices with existing vector control programs con provides a cost-effective community–driven and sustainable solution for long-term disease reduction. Environmental sustainability not only minimizes sandfly proliferation but also strengthens community resilience, improves overall public health infrastructure, support integrated vector management (IVM), reduces insecticide dependency, promotes eco-friendly control and support national Kala-azar elimination goals.

Keywords: Liesmaniasis, Socio-Environmental Condition, Proliferation, Sandfly, Seasonal Dynamics.

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SUSTAINABLE CHEMICAL UPCYCLING OF TEXTILE PET WASTE INTO HIGH-GRADE RPET USING A RENEWABLE CATALYST SYSTEM

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Abstract

The rapid growth of PET textile consumption has resulted in a substantial increase in polyester waste, posing serious environmental and resource management concerns. Sustainable recycling technologies are urgently needed to recover value from textile waste while maintaining material quality comparable to virgin polymers. This study presents a patented and commercially implemented chemical upcycling process that converts post-consumer textile polyethylene terephthalate (PET) waste into high-grade recycled PET (rPET) using a renewable catalyst system. The process utilizes an eco-friendly heterogeneous catalyst (HT) and ethylene glycol (EG) under controlled reflux conditions for an optimized reaction period. Through catalytic depolymerization, textile PET is converted into monohydroxyethyl terephthalate (MHT), which is subsequently purified and repolymerized to produce high-purity rPET. Unlike conventional recycling approaches that often require additives and yield downgraded materials, the rPET produced through this method is additive-free, exhibits excellent purity, and is designed to ensure non-leaching behaviour suitable for food-contact applications. Comprehensive characterization of recycled PET was conducted using LC–MS, DSC, and TGA to assess structural integrity and thermal stability. The recovered MHT intermediate was confirmed through LC–MS, ^{13}C-NMR, ^{1}H-NMR, and TGA analyses. Importantly, both the catalyst and solvent can be reused multiple times, significantly enhancing the economic viability and environmental sustainability of the process by lowering operational costs and reducing secondary waste generation. Utilizing MHT as a feedstock for new textile production reduces reliance on virgin petrochemical resources, promoting circular economy principles. The technology has demonstrated industrial feasibility through startup-level commercialization and has received national recognition for innovation. Process parameters such as temperature, time, and catalytic conditions were systematically evaluated to optimize efficiency and scalability for large-scale applications.

Keywords: Textile Waste, Polyester, Recycling, Catalyst.

COMPUTATIONAL IDENTIFICATION OF *COMMIPHORA* PHYTOCOMPOUNDS TARGETING ALDOSE REDUCTASE AND TNF-A IN DIABETIC NEUROPATHY

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Abstract

Diabetic neuropathy is a common complication of diabetes, leading to nerve damage and severe pain. The phytocompounds synthesised from medicinal plants have shown potential therapeutic effects on diabetic neuropathy. In this study, we have investigated the effect of phytocompounds identified in *Commiphora* sp. on two key proteins involved in diabetic neuropathy Tumor Necrosis Factor-α (TNF-α) (PDB ID: 1TNF) and Aldose Reductase (PDB ID: 2FZB). A total of 23 (2-methoxy furanodiene, α -copaene, α -humulene, α-pinene, β- elemene, β-Pinene, β -selinene, camphene, camphorene, cembrane, cholestene, curzerene, cycloartane, dammarane, e-guggulsterone, germacrene, limonene, myrcene, oleanane, pregnane, pregnenolone, ursane, z-guggulsterone) phyto-chemical compounds from *Commiphora* were screened for binding affinity to TNF-α (PDB ID: 1TNF) and Aldose Reductase (PDB ID: 2FZB). Based on pharmacokinetic properties, molecular docking, and molecular dynamics simulations, two best scoring molecules were selected for further analysis. Docking analysis showed that Z-guggulsterone had the strongest binding affinity for Aldose Reductase (-12.21 kcal/mol), which was better than E-guggulsterone (-9.84 kcal/mol) and even the control inhibitor Ranirestat (-10.48 kcal/mol). A molecular dynamics simulation lasting 200 ns confirmed that the complexes were stable. The Aldose Reductaseligand systems had low RMSD fluctuations (<0.3 nm) and stable energy profiles. The MMPBSA analysis backed up these results, showing that Z-guggulsterone had the best binding free energy (−9.83 ± 12.80 kJ/mol). The Free Energy Landscape (FEL) and PCA analysis also showed clear low-energy basins, which means that the conformational states stayed stable during the whole simulation. The study aimed to explore the interaction, binding affinity, and stability of these compounds with the target proteins, providing insight into their therapeutic potential.

Keywords: Diabetic Neuropathy, Tumor Necrosis Factor-A (TNF-A), Aldose Reductase, E-Guggulsterone, Z-Guggulsterone, Commiphora, Molecular Docking, Molecular Dynamics Simulation.

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BACTERIOCINS FROM LACTIC ACID BACTERIA AS INNOVATIVE THERAPEUTICS FOR MULTIDRUG-RESISTANT INFECTIONS IN NEONATAL SEPSIS

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Abstract

Neonatal sepsis persists as a significant global health challenge and remains a leading cause of neonatal morbidity and mortality, particularly in low- and middle-income countries. The rapid emergence of multidrug-resistant (MDR) pathogens has critically compromised the therapeutic efficacy of conventional antibiotic therapies, thereby requiring the development of alternative antimicrobial strategies based on molecular innovation and biological compatibility. Bacteriocins, ribosomally synthesized antimicrobial peptides produced by lactic acid bacteria (LAB), have emerged as promising therapeutic alternatives within this framework. In contrast to broad-spectrum antibiotics, bacteriocins frequently exhibit narrow-spectrum antimicrobial activity, allowing targeted pathogen suppression while minimizing collateral disruption of commensal microbiota an essential consideration in neonates with immunological immaturity and evolving microbial colonization. Accumulating experimental evidence demonstrates substantial in vitro efficacy of LAB-derived bacteriocins against MDR pathogens implicated in neonatal sepsis. These peptides use antimicrobial effects through diverse and well-characterized mechanisms, including membrane permeabilization, pore formation, and inhibition of critical intracellular processes. Furthermore, bacteriocins derived from milk-associated LAB-particular investigation due to their evolutionary association with neonatal host defense and their potential translational relevance in neonatal clinical settings. The physicochemical stability of these peptides including thermal stability, enzymatic resistance, and pH tolerance further supports their pharmaceutical feasibility and formulation adaptability. Collectively, LAB-derived bacteriocins represent a biologically

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distinct and compatible adjunct or alternative to conventional antimicrobial therapies for MDR neonatal infections. Nevertheless, systematic in vivo validation, pharmacodynamic and pharmacokinetic profiling, toxicity assessment, and well-designed multicentric clinical trials remain essential to establish their clinical efficacy, safety, and regulatory applicability within neonatal intensive care practice.

Keywords: Lactic Acid Bacteria, Bacteriocins, Neonatal Sepsis, Multidrug Resistance, Antimicrobial Peptides.

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PREVALENCE AND MOLECULAR ANALYSIS OF β-THALASSEMIA AMONG ANTENATAL WOMEN ATTENDING A TERTIARY CARE HOSPITAL IN NOIDA

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Abstract

Background: β-thalassemia remains a major public health concern in India, with a high carrier frequency contributing to sustained disease burden and significant medical, psychological, and socioeconomic challenges. Early detection through antenatal screening plays a crucial role in preventing the birth of affected children. Objectives: The present study aimed to determine the prevalence of β-thalassemia carriers among antenatal women attending a tertiary care hospital in Noida and to characterise the underlying molecular mutations. Methodology: A total of 1000 antenatal blood samples were screened using complete blood counts and red cell indices, followed by haemoglobin analysis using high-performance liquid chromatography (HPLC). Samples showing elevated HbA_2 levels (≥3.5%) were considered suspected carriers and selected for molecular confirmation. Considering the high-risk nature of the antenatal population and the need to avoid missing positive cases, all suspected samples were carefully evaluated. Confirmed cases subsequently underwent molecular characterisation using Sanger sequencing. Results: Of 1000 screened samples, 27 women were confirmed as β-thalassemia carriers, yielding a prevalence of 2.7%. Molecular analysis revealed IVS-I-5 (G>C) as the most frequent mutation, followed by Codon 41/42 (-TTCT), Codon 8/9 (+G), and Codon 16 (-C). The observed mutation spectrum highlights regional genetic variability. The study demonstrates a considerable carrier prevalence among antenatal women, emphasising the importance of routine antenatal screening, particularly during the first trimester. Identification of prevalent mutations facilitates accurate carrier detection and enables appropriate genetic counselling. Early antenatal screening, particularly during the first trimester, enables informed reproductive decision-making and helps prevent affected births, thereby reducing the long-term burden of β-thalassemia.

Keywords: β-thalassemia, Antenatal Screening, HPLC, HbA_2, Sanger Sequencing

AN AUTONOMOUS IOT-ENABLED ROBOTIC SCARECROW FOR PRECISION FARMING

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Abstract

A recurring problem in agriculture worldwide is crop damage from animal and avian infiltration. Because animals eventually grow accustomed to recurring, predictable patterns, traditional scarecrow systems provide little protection. Intelligent, automated, and adaptable deterrence systems that can consistently protect fields are necessary for modern smart farming. Using multi-sensor intrusion detection, robotic mobility, machine-driven deterrence tactics, wireless IoT connection, and cloud-based monitoring, this paper offers a thorough and in-depth analysis of an IoT-based robotic scarecrow system intended to reduce crop loss. The system is an effective tool for precision agriculture because it integrates sensing, actuation, connectivity, artificial intelligence support, and renewable power. Thorough field research reveals a 92% decrease in intrusion events, demonstrating the efficacy and dependability of the suggested method. The theoretical underpinnings, hardware choice, algorithmic modelling, environmental factors, performance measures, deployment tactics, and socioeconomic effects are all extensively covered in this study.

Keywords: IoT, Precision Farming, Algorithm, Environmental Factors.

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NEURODEGENERATION IN AN AGEING INDIA: ECONOMIC BURDEN FORECASTS AND STRATEGIC POLICY DIRECTIONS TOWARDS 2047

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Abstract

India is undergoing a rapid demographic transition marked by population ageing, which is expected to significantly increase the burden of neurodegenerative diseases (NDs), including Dementia and Alzheimer's disease. This study estimates the current and projected epidemiological and economic burden of neurodegenerative disorders in India up to the year 2047. The research evaluates age-wise prevalence, incidence, disability-adjusted life years (DALYs), and associated economic costs across high-risk age groups (50+, 60+, and 70+ years). A mixed-method framework was adopted, integrating a detailed review and meta-analysis (PRISMA-guided), data collection, and forecasting models using national and global datasets for benchmarking and further projections. Economic burden estimation incorporates direct medical costs, caregiver expenses, productivity loss, and long-term care expenditures. DALY-based burden measures were further translated into economic loss using value-of-statistical-life (VSL) and human-capital approaches to project macroeconomic impact. The study addresses a significant research gap in India-specific cost-of-illness modeling for neurodegenerative disorders, providing scenario-based projections aligned with demographic transitions and evolving risk factors. Our findings underscore the substantial long-term economic burden and implications of ageing-driven neurodegenerative disease burden and highlight the urgency of policy reforms in healthcare financing, subsidy mechanisms, infrastructure development, workforce training, and research investment. By integrating epidemiological forecasting with economic modeling, this research provides an evidence-based framework to guide national health planning and resource allocation strategies in preparation for India's independence centenary in 2047.

Keywords: Neurodegenerative Diseases, Economic Burden, DALYs, Ageing Population, Cost-of-Illness, Forecasting Models, India.

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INTERNET OF THINGS (Iot) IN SMART HOME SYSTEM

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Abstract

A smart home system is an innovative technological solution that combines different home devices and appliances into a single, centralized, and automated system. It allows users to control and manage home functions such as lighting, temperature, security, and entertainment systems using smartphones, tablets, or voice assistants. The main aim of a smart home system is to provide users with increased comfort, convenience, energy savings, and security using innovative technologies such as the Internet of Things, wireless communication, sensors, and cloud computing. In a smart home setup, devices are networked and communicate with each other using communication protocols such as Wi- Fi, Bluetooth, or Zigbee. Sensors are used to detect changes in the environment, such as motion, temperature, and light intensity, to enable automated actions according to user settings. Devices can be programmed to turn on automatically when motion is detected, adjust temperature according to user settings, and send real-time notifications to homeowners. Smart home systems also play a role in energy savings, as they optimize the use of electrical appliances and prevent wastage of power. The system allows users to program operations, turn off appliances from a distance, and analyze power consumption patterns. Moreover, modern systems use artificial intelligence to learn from user behavior and make intelligent decisions. In conclusion, a smart home system is a major breakthrough in home automation technology, as it provides better lifestyle quality, improved security, and effective resource management.

Keywords: Smart Home, Home Automation, Internet of Things, IoT Devices, Wireless Communication, Sensors, Smart Thermostat, Smart Lighting, Security System, Surveillance Cameras, Energy Management.

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NAVIGATING THE COMPLEXITY OF CANCER DRUG RESISTANCE: A SYSTEMATIC OVERVIEW ON NETWORK PHARMACOLOGY STRATEGIES

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Abstract

Drug resistance remains the primary hindrance to achieving long-term remission in cancer patients, contributing to over 90% of the cancer related deaths. It is worth considering if the single-pathway drug-discovery methodologies provide the right viewpoint, given the persistent inability to bring numerous promising targeted medications from the lab to the clinic. Network biology has shown that malignancies have complex biological networks that are hardwired to resist changes, even when those changes are caused by medications with specific mechanisms of action. Hence, cancer therapeutic methods including the modulation of several targets, known as network pharmacology tactics, are required. By analyzing recent advancements in high-throughput sequencing and protein- protein interaction (PPI) networks explore the primary mechanisms of resistance, including pathway crosstalk, bypass signaling, and clonal evolution. Network pharmacology provides a superior framework for deciphering the multi-factorial nature of therapeutic failure by targeting how cancer cells utilize redundant pathways to maintain survival under drug pressure, topological analysis (e.g.- node degree betweenness centrality) to identify "vulnerable" hubs in resistance networks. Such approaches will play transformative role in identifying effective multi-drug combinations capable of overcoming adaptive resistance mechanism.

Keywords: Cancer, Drug Resistance, Network Pharmacology, Polypharmacology, Systems Biology.

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A REVIEW ON PRESERVATION OF DIGITAL DOCUMENTS USING BLOCKCHAIN

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Abstract

The preservation of digital evidence plays a vital role in the field. The primary emphasis is on the integrity, authenticity, admissibility and long- term preservation of digital evidence during legal proceedings. Conventional centralised record management systems often face risks such as data manipulation, unauthorised access and vulnerabilities due to single points of failure, which undermine the credibility and permanence of legal documents. In recent years, blockchain technology has emerged as a groundbreaking solution to tackle these issues due to its decentralised, tamper-proof, and transparent structure. This review paper investigates the current landscape of research regarding blockchain-based preservation of legal records, examining various frameworks, methodologies, and implementation models suggested in both academic and industrial sectors. It conducts a systematic review of the latest advancements in privacy-preserving research solutions and mechanisms within the blockchain domain. This text highlights how cryptographic hashing, distributed ledger mechanisms, and smart contracts can ensure secure storage, provenance verification, and auditable access control for digital legal archives. It also discusses the integration of blockchain with complementary technologies such as the Inter-Planetary File System (IPFS), digital signatures, and cloud infrastructures to enhance scalability and interoperability. Furthermore, the paper evaluates existing challenges—including privacy concerns, regulatory compliance, and system efficiency—and outlines potential directions for future research and practical adoption.

Keywords: Blockchain, Legal Documents, Digital Preservation, IPFS, Privacy, Security, E-Governance, Judicial Records, Chain of Custody, Distributed Storage.

ADVANCES IN POLYMER NANOCOMPOSITES: INSIGHTS INTO STRUCTURE, INTERFACE ENGINEERING, AND FUNCTIONAL BEHAVIOR

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Abstract

Polymer nanocomposites constitute an advanced class of materials in which nanoscale fillers are incorporated into polymer matrices to obtain enhanced and multifunctional properties at low filler concentrations. The introduction of nanofillers generates extensive interfacial regions that significantly modify polymer chain arrangement and mobility. This review focuses on recent developments in polymer nanocomposites with particular attention to nano structural features, interface engineering, and their influence on functional performance. The role of filler geometry, dispersion state, and interfacial compatibility in governing mechanical behaviour, thermal stability, barrier efficiency, flame retardancy, and electrical properties is critically discussed. Approaches such as surface functionalization and compatibilization are highlighted as effective strategies for controlling interfacial interactions and improving property balance. By establishing clear relationships between nanoscale structure and macroscopic behaviour, this work provides design insights for the development of high-performance polymer nanocomposites for emerging structural and functional applications.

Keywords: Polymer Nanocomposites, Nanofillers, Interface Engineering, Structure–Property Relationship Functional Materials.

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QUANTUM MECHANICS IN SEMICONDUCTOR PHYSICS FOR ADVANCED ELECTRONIC APPLICATIONS

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Abstract

Semiconductor materials form the backbone of modern electronic technology, enabling the development of transistors, diodes, integrated circuits, and optoelectronic devices. The behaviour of charge carriers in these materials cannot be fully explained using classical physics, especially at the microscopic and nanoscales. Quantum mechanics provides the fundamental framework for understanding the electronic properties and transport phenomena in semiconductors. This review paper discusses the application of key quantum mechanical principles in semiconductor physics. Band theory explains the formation of valence and conduction bands from atomic energy levels and describes how the band gap determines electrical conductivity. The concept of Fermi energy and charge carrier distribution further helps in understanding intrinsic and doped semiconductors. Quantum tunnelling is another important phenomenon where charge carriers penetrate potential barriers even without sufficient classical energy. This effect is widely utilised in tunnel diodes and nanoscale electronic devices, enabling high-speed operation and miniaturisation of components. Additionally, quantum confinement in low-dimensional semiconductor structures such as quantum wells significantly alters electronic and optical properties. These structures produce discrete energy levels and are extensively used in laser diodes, photodetectors, and high-performance transistors. The integration of quantum mechanical concepts with semiconductor technology has revolutionised modern electronics and nanodevice engineering. Understanding these principles is essential for the development of faster, smaller, and energy-efficient electronic systems.

Keywords: Quantum Mechanics, Semiconductor Physics, Band Theory, Quantum Tunnelling, Quantum Wells, Nanoelectronics.

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INNOVATIVE STRATEGIES FOR AVIAN BIODIVERSITY CONSERVATION UNDER CLIMATE CHANGE: ADVANCING SUSTAINABLE DEVELOPMENT GOALS

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Abstract

Climate change and anthropogenic pressures are impacting avian biodiversity worldwide. Birds, serving as sensitive bioindicators, reflect ecosystem changes and provide essential ecological services. Rising temperatures, habitat fragmentation, land-use change, and extreme weather events are affecting avian distribution, migration patterns, breeding phenology, and survival rates. This review synthesizes current research on innovative technological and interdisciplinary approaches for avian conservation under changing climatic conditions. It examines tools such as remote sensing, Geographic Information Systems (GIS), automated acoustic monitoring, machine learning-based species identification, and citizen-science platforms. These technologies improve biodiversity monitoring, facilitate real-time habitat assessment, and support evidence-based conservation planning. The review also discusses the alignment of avian conservation strategies with Sustainable Development Goals (SDG 1 and SDG 15), highlighting the socio-economic benefits of ecosystem services provided by birds. Integrating technological innovation with community-based conservation initiatives and policy frameworks is essential for building climate-resilient ecosystems. The study concludes that interdisciplinary and technology-driven approaches are critical for safeguarding avian biodiversity and promoting sustainable development in the context climate change.

Keywords: Avian Biodiversity, Climate Change, Conservation Technology, Ecosystem Services, Sustainability.

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HETEROCYCLIC COMPOUNDS AS HEMOZOIN INHIBITORS: A DECADE OF MECHANISTIC INSIGHTS AND STRUCTURE-ACTIVITY RELATIONSHIP EVALUATION (SAR) EVOLUTION

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Abstract

Malaria is still a global health problem, and because Plasmodium falciparum is resistant to the most common antimalarials, new drugs need to be found. Hemozoin formation is a validated and clinically proven drug target. It is the parasite's way of getting rid of toxic heme that is released when hemoglobin is broken down. Heterocyclic compounds have become the best scaffolds for inhibiting hemozoin over the past ten years (2015–2026). They provide a wide range of chemical space for optimizing the structure-activity relationship (SAR). This thorough review combines mechanistic insights and SAR evolution from 212 research articles. These articles cover quinoline-based agents, nitrogen-containing heterocycles (indoles, imidazoles, benzimidazoles, pyrazoles, quinazolines), oxygen- and sulfur-containing heterocycles (benzofurans, thiazoles, thiophenes), and hybrid architectures. Some important mechanistic paradigms are π-π stacking of heme complexes, iron coordination, stopping β-hematin nucleation and crystal growth, and vacuolar accumulation through basic side chains. SAR studies show that planar aromatic surfaces, heteroatoms in the right places, and aminoalkyl/Mannich base substituents are very important for potency and selectivity. Hybrid molecules that block hemozoin and have other targets (like kinases, transporters, and microtubules) work better and are less likely to become resistant. Even though a lot of progress has been made, there are still problems to solve, such as improving pharmacokinetic properties, lowering cardiotoxicity and cytotoxicity, and translating in vitro activity to in vivo efficacy. This review gives a complete guide for designing next-generation hemozoin inhibitors. It focuses on multitarget strategies, structure-based optimization, and bringing up ADMET concerns early in the discovery process.

Keywords: Plasmodium Falciparum, B-Hematin, Hemezoin, Malaria, Heterocyclic Scaffolding

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COUPLED EFFECTS OF HIGH-DENSITY POLYURETHANE FOAM INFILL, SLENDERNESS RATIO, AND MATERIAL TYPE ON BUCKLING-RESISTANT PERFORMANCE OF STEEL AND ALUMINIUM CIRCULAR TUBES: EXPERIMENTAL AND NUMERICAL INSIGHTS

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Abstract

Foam-filled metallic tubes offer superior energy absorption and stability for lightweight structures, yet the interplay of high-density polyurethane (PU) foam infill, slenderness ratio (λ=20−100λ=20−100), and tube material (steel vs. aluminium) on axial compression remains underexplored. This study quantifies these coupled effects through comprehensive testing and modeling. Empty and PU foam-filled (density: 150 kg/m³) circular tubes (D/t = 50) underwent monotonic axial compression across slenderness ratios. Metrics included load-displacement curves, peak capacity, stiffness, and failure modes. Validated nonlinear finite element models (accounting for plasticity, imperfections, and foam-tube interaction) enabled parametric analyses. Foam infill boosted ultimate load by 25-60%, initial stiffness by 40-80%, and post-buckling stability versus hollow tubes. Enhancements peaked in short columns (λ<40λ<40) via confinement delaying local buckling; higher slenderness shifted dominance to global Euler buckling. Steel tubes achieved 1.5-2x higher absolute capacities, while aluminium excelled in specific strength (up to 20% superior). Models predicted experiments within 5-8% error. High-density PU foam markedly elevates axial performance, with slenderness dictating local-to-global buckling transitions. This validated framework guides optimal design of foam-filled tubular columns for aerospace, automotive, and seismic applications.

Keywords: Polyurethane Foam-Filled Tubes; Slenderness Ratio; Axial Compression; Steel/Aluminium Columns; Local/Global Buckling; Finite Element Analysis.

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TARGETING SST1/SST4-MEDIATED NEPRILYSIN UPREGULATION FOR AMYLOID - β CLEARANCE IN ALZHEIMER'S DISEASE

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Abstract

Alzheimer's disease (AD) is the leading cause of dementia worldwide and is characterized by a gradual and irreversible decline in cognitive function. A central pathological hallmark of AD is the extracellular accumulation of amyloid-β (Aβ) peptides in the brain, which aggregate to form senile plaques that disrupt neuronal communication and trigger neurodegeneration. Under normal physiological conditions, Aβ levels are tightly regulated through a balance between production and enzymatic degradation. Neprilysin (NEP), a membrane-bound zinc metalloprotease, is one of the most important endogenous enzymes responsible for the clearance of Aβ peptides in the brain. NEP degrades soluble Aβ, thereby limiting its aggregation and deposition. However, both the expression and enzymatic activity of NEP decline with advancing age and during the progression of AD. This reduction contributes significantly to impaired amyloid clearance and promotes plaque accumulation, accelerating disease pathology. Recent studies have highlighted the regulatory influence of somatostatin signalling on NEP expression. Somatostatin, a neuropeptide widely distributed in the central nervous system, modulates NEP levels primarily through somatostatin receptor subtypes SST1 and SST4. Activation of these receptors in the hippocampus—a brain region critically involved in learning and memory—has been shown to upregulate NEP expression and enhance Aβ degradation. Conversely, reduced somatostatin signalling in ageing and AD may further diminish NEP activity. Together, these findings suggest that targeting the somatostatin–NEP regulatory pathway represents a promising therapeutic strategy to enhance amyloid clearance and potentially slow the progression of Alzheimer's disease.

Keywords: Alzheimer's Disease, Amyloid-B, Neprilysin, Somatostatin Receptors, SST1, SST4, Hippocampus, Neurodegeneration.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON PROFESSIONALS

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Abstract

Professional fields are built upon specialized skills, ethical standards, and structured methods that guide practice and decision-making. The growing integration of Artificial Intelligence (AI) into professional settings is transforming the way services are delivered and managed. While AI technologies increase efficiency, reduce workload, and save time, their expanding role also raises concerns about their influence on professionals' competencies. Dependence on automated systems may gradually weaken critical thinking, problem-solving ability, interpersonal engagement, and independent judgment. In addition, the widespread adoption of AI has implications for service quality, ethical practice, and employment patterns, as intelligent systems are increasingly capable of performing multiple tasks simultaneously at minimal cost. This paper examines how the use of AI affects professionals, their skill development, service recipients, and employment opportunities, highlighting both its advantages and its potential challenges.

Keywords: Professionals, Artificial Intelligence, Skill Development, Ethical Practice, Employment, Technological Impact.

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RELIABILITY AND RISK ASSESSMENT OF A 12-YEAR-OLD ROOFTOP SOLAR PHOTOVOLTAIC SYSTEM OPERATING UNDER COMPOSITE CLIMATE CONDITIONS

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Abstract

The present study investigates the results of a comprehensive visual inspection and risk assessment of a 5-kW rooftop photovoltaic (PV) system consisting of 20 crystalline silicon modules (250 Wp each), installed in 2014 at the University of Lucknow, Second Campus. The system has been exposed to a tropical composite climate characterized by high solar radiation, elevated humidity, and significant seasonal temperature variations, including severe winters, which may compromise its structural and electrical integrity over time. After 12 years of continuous field operation, prevalent degradation modes were identified and their impacts were quantified using a systematic Failure Modes and Effects Analysis (FMEA) framework. The inspection revealed several significant defects commonly observed in aged PV systems, including delamination, encapsulant discoloration, corrosion, hotspots, snail trails, and cell cracks. To evaluate and prioritize these defects, the Risk Priority Number (RPN) method was applied. The RPN was calculated as the product of three parameters—severity (S), occurrence (O), and detection (D)—each rated on a 1–10 scale. This quantitative approach enabled prioritization of failure modes based on their potential to cause power degradation or system failure. The analysis indicates that hotspot formation and cell cracks were observed in approximately 10% of the modules, whereas cell scratches and busbar corrosion were present in nearly 50% of the inspected modules, highlighting the increased vulnerability of interconnection components in long-term field exposure.

Keywords: Solar PV System, Degradation Rate, Risk Priority Number, Hotspot.

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ANALYSIS OF THE EFFECTIVENESS OF DIFFERENT DIGITAL STEGANOGRAPHY DETECTION TECHNIQUES IN DIGITAL FORENSIC INVESTIGATIONS

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Abstract

Cybercrime is one of the various forms of crimes that occur in our digital age. Digital steganography poses significant challenges to digital forensic investigations by enabling covert communication through data hidden in digital media. Exposing such hidden information requires comprehensive and effective steganography methods. Advanced steganalysis algorithms are necessary because cybercriminals and bad actors commonly use steganography to avoid detection when sending illicit material, even when it is encrypted. This study analyses the effectiveness of various digital steganalysis detection techniques, such as transform domain analysis, digital media and digital data, comparing their detection accuracy, artificial intelligence, machine learning classifiers techniques, deep learning, statistical analysis, transform domain methods, hybrid approaches, visual and structural techniques, signature-based detection, computational performance, and applicability in forensic scenarios. The effectiveness of each technique is evaluated within the framework of a forensic investigation, taking into account factors such as detection accuracy, flexibility, and obstructions. The study concludes that the most complete approach to detecting steganographic evidence in forensic situations is a hybrid strategy that combines multiple detection techniques. Results indicate that machine learning-based steganalysis, particularly when combined with feature-rich models, offers superior detection rates across diverse steganographic algorithms. Each technique's effectiveness is evaluated within the framework of a forensic investigation, taking into consideration elements like detection accuracy, flexibility, and obstacles. Enhancing evidence retention and expediting investigations by directly integrating sophisticated steganalysis tools into digital forensic platforms.

Keywords: Digital Forensics, Cybercrime, Forensic Investigation, Steganography, Steganalysis, Forensic Tools and Detection Techniques.

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ENVIRONMENTAL EXPOSURE, WOMEN'S HEALTH BURDEN, AND ECONOMIC PRODUCTIVITY: A COMMUNITY-BASED CROSS-SECTIONAL STUDY IN VARANASI DISTRICT, INDIA

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Abstract

Environmental exposures disproportionately affect women in resource-constrained settings and may contribute to increased morbidity and reduced economic productivity. District-level evidence quantifying this association remains limited in India. To examine the relationship between environmental exposure, women's health burden, and economic productivity in Varanasi district, India. A community-based cross-sectional study was conducted among 450 women aged 18–55 years using multistage stratified random sampling. Environmental exposure, health outcomes, and economic indicators were assessed using a validated structured questionnaire. Environmental Exposure Index (EEI), Health Burden Score (HBS), and Economic Productivity Impact Score (EPIS) were computed. Multivariate logistic regression and cost-of-illness modeling were performed to estimate adjusted associations and economic burden. High environmental exposure was observed in 62% of participants. Anemia symptoms (48%), menstrual irregularities (34%), and chronic fatigue (52%) were significantly higher among women in the upper EEI tertile ($p < 0.01$). Women with high HBS reported a mean of 9.3 ± 3.1 workdays lost over six months and 27% higher out-of-pocket healthcare expenditure. Adjusted analysis showed that high EEI independently predicted reduced productivity (AOR: 2.14; 95% CI: 1.38–3.29). The estimated annual productivity loss attributable to environmentally linked morbidity was approximately 11.6% of mean household income. Environmental exposure significantly contributes to women's health burden and measurable economic loss in Varanasi. Gender-responsive environmental health policies are critical for sustainable economic resilience.

Keywords: Environmental Exposure, Women's Health, Economic Burden, Productivity Loss, Cross-Sectional Study.

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FROM PLASTICS TO PARASITES: DIGITAL TWIN ECOSYSTEM AS PREDICTIVE TOOLS FOR DISEASE EMERGENCE IN FRESHWATER SNAIL HOSTS

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Abstract

Microplastic contamination is now widely acknowledged as a persistent and multifaceted stressor in freshwater ecosystems. Despite growing concern, its role in shaping host–parasite interactions and broader disease ecology remains incompletely understood. Freshwater gastropods act as obligate intermediate hosts for several trematode parasites of medical and veterinary importance, making them reliable bioindicators of environmentally driven disease risk. In this context, the present study introduces a Digital Twin Ecosystem (DTE) framework designed to mechanistically examine how microplastic exposure influences snail physiology, immune competence, and parasite transmission under varying climatic conditions. The DTE framework incorporates experimentally derived biomarkers including oxidative stress responses, hemocyte activity, reproductive investment, and survival parameters together with infection prevalence records and environmental variables such as temperature gradients, pH fluctuations, and measured microplastic loads. By linking ecological and epidemiological components within a unified simulation platform, the model captures complex feedback relationships between pollution-induced physiological stress and trematode amplification in snail populations. Initial scenario simulations indicate that chronic, sublethal exposure to microplastics may alter energy allocation patterns and immune regulation, thereby increasing host vulnerability to parasitic infection and elevating cercarial release under warming scenarios. These findings suggest that combined pollution and climate pressures could shift freshwater disease transmission thresholds beyond conventional expectations. By employing Digital twins as dynamic representations of biological systems, this approach moves beyond descriptive ecotoxicology toward predictive ecosystem-level disease assessment. The integration of ecological modeling, parasitology, and environmental informatics provides a scalable early-warning framework for identifying emerging aquatic disease hotspots and informing strategies aligned with Planetary One Health objectives.

Keywords: Digital Twin Ecosystems, Microplastic Stress, Freshwater Gastropods, Trematode Transmission, Eco-epidemiological Modeling.

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INTEGRATION OF SECURE QUANTUM KEY DISTRIBUTION (QKD) FRAMEWORK IN DRONE-AS-A-SERVICE (DAAS): A COMPREHENSIVE REVIEW AND FUTURE RESEARCH DIRECTIONS

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Abstract

This review paper provides a comprehensive analysis of the integration of Quantum Key Distribution (QKD) technology within Drone-as-a-Service (DaaS) systems to ensure quantum-secure communication. The use of drones as a service is growing fast in areas like disaster relief, farming, healthcare, delivery and surveillance. This growth has created a need for reliable communication systems. The current security methods used in drone networks are not strong enough to protect against threats from powerful computers. We need solutions that are safe from these threats. One promising solution is Quantum Key Distribution (QKD). QKD uses the basics of how the world works at a level to keep communications safe. This review looks at research from 2019 to 2025 on using QKD with drones as a service. It examines ways to make communication safe like using satellites combining different types of networks and testing out new technologies. The review also talks about the technical problems that need to be solved. These problems include: Making sure the beam is aligned properly, dealing with changes in the air, making hardware smaller, saving energy, optimizing the rate of creation, getting systems to work together. The review also explores new ideas like using blockchain to verify identities artificial intelligence to manage keys and designing smaller quantum systems. Drone-as-a-Service systems that use QKD are still being tested. They are becoming more practical. This is due to advancements in quantum hardware and integrated communication systems. The goal is to create Drone-as-a-Service systems that're secure, scalable and protected from future threats. To achieve this the review summarizes developments identifies gaps in research and outlines future directions. Quantum Key Distribution and Drone-as-a-Service are key to making this happen. QKD will play a role in securing Drone-as-a-Service systems. Drone-as-a-Service will benefit greatly from the use of QKD.

Keywords: Quantum Key Distribution, Drone-as-a-Service, Quantum Security, Free-Space Optical Communication, Hybrid Quantum–Classical Networks.

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