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INTERNATIONAL CONFERENCE ON ECOTOXICOLOGY & ENVIRONMENTAL SCIENCES (ICEES-2024)

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Venue
AUDITORIUM, AMITY UNIVERSITY JHARKHAND, RANCHI

Date: 21-22 October, 2024

Jointly Organized by

INSTITUTE OF ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (IE&ES),
Y/7, XI, Purbachala, Salt Lake, Kolkata – 700097, West Bengal, India
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INTERNATIONAL CONFERENCE ON ECOTOICOLOGY AND ENVIRONMENTAL SCIENCES

(ICEES-2024)

21st – 22nd October, 2024

at

Main Auditorium,
Amity University Jharkhand, Ranchi – New Campus

ABSTRACT VOLUME

Jointly organized by

INSTITUTE OF ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (IE&ES),
Y/7, XI, Purbachal, Salt Lake,
Kolkata – 700097, West Bengal, India

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AMITY UNIVERSITY JHARKHAND (AUJ),
Amity University Ranchi – New Campus, HEC Core Capita Area, Murma, Naya Sarai, Block Negri,
Ranchi, Jharkhand, India

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INSTITUTE OF ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (IE&ES),INDIA

www.ieesonline.in

ISBN: 978-81-928924-7-4

Published by:

INSTITUTE OF ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (IE&ES),
Y/7, XI, Purbachal, Salt Lake,
Kolkata – 700097, West Bengal, India

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AMITY UNIVERSITY JHARKHAND (AUJ),
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Printed by:

LASERGRAPHICS

97, Baithakkhana Road,Kolkata–700009,West Bengal, India

DISCLAIMER: Publishing institutes or any of its Editor's assumes no responsibility for authenticity or reliability of scientific data published in this book. The publications carried out in this book are accepted on good faith.

Acknowledgements

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MAIDAN SPORTS
Maidan Market, Kolkata, West Bengal, India

For Logistic

AMITY UNIVERSITY JHARKHAND, RANCHI
HEC Core Capita Area, Murma, Naya Sarai, Block Negri, Ranchi, Jharkhand, India

For Printing

LASER GRAPHICS
97, Baithakkhana Road, Kolkata–700009, West Bengal, India

For Publication

EM INTERNATIONAL
C-101, Prakriti, Balewadi, Baner, Pune – 411 045, Maharasthra, India

For Hospitality

HOTEL CROWN PLAZA
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INTERNATIONAL CONFERENCE ON ECOTOXICOLOGY AND ENVIRONMENTAL SCIENCES (ICEES – 2024)

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AMITY UNIVERSITY JHARKHAND (AUJ), Ranchi
New Campus, HEC Core Capita Area, Murma, Naya Sarai, Block Negri, Ranchi, Jharkhand, India

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Message from Chairperson, ICEES - 2024



Environmental Ecotoxicology is a multidisciplinary field of science concerned with the study of the harmful effects of various physical, chemical and biological agents on the environment as well as on living organisms at the population and ecosystem level. The sources of environmental contaminants are diverse and they are largely anthropogenic as waste product discharged in the form of solid, liquid and gas emitting from Industries, Agricultural products, Incinerators, sewage plants etc. Many of these contaminants devastate the ecosystem and adversely affect human health. The damaging effects may not only be temporary but may also have long-term effects. Institute of Ecotoxicology and Environmental Sciences regularly organize National and International Seminars, Workshops to disseminate awareness and knowledge among students, scholars, faculties, policy makers to improve the quality of environment and to maintain sustainable development. The present International Conference, 2024, jointly organized by Institute of Ecotoxicology and Environmental Sciences and Amity University, Jharkhand, Ranchi is one of such endeavor. It is the platform to highlight the different aspects of the environment to make it pollution free and approach for sustainable ecosystem as well as sustainable development. I sincerely express my gratitude to our National and International Scientific Advisors and heartfelt gratitude to the Organizers of Amity University, Jharkhand, Ranchi, for providing helps in scientific activities, scientific sessions as well as Technical support and hospitalities. I express my sincere thanks to those who provided financial support to IE &ES for conducting this International Conference at Amity University, Ranchi. Special thanks and gratitude to Vice Chancellor, Dean of Science, Registrar and other Faculty members of Amity University for their kind support to make this conference successful. Our efforts are to improve the quality of Post - Graduate teaching and Research in India. Our effort will be successful if the young scientists/researchers are benefited from the deliberations of resource persons.

With warm hearty welcome.

Dr. Sarmila Pal
Chairperson
ICEES-2024

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New Campus, HEC Core Capita Area, Murma, Naya Sarai, Block Negri, Ranchi, Jharkhand, India

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Message from Organizing Secretary, ICEES - 2024



It is my immense pleasure to cordially invite you all to the "International Conference on Ecotoxicology & Environmental Sciences (ICEES-2024) which will be held on 21st & 22nd October' 2024 at the Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi, India. The Conference is jointly organized by Institute Of Ecotoxicology and Environmental Sciences (IE&ES), Kolkata and Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi, India & aims to focus the attention of researchers and experts on various multidisciplinary fields of Biotechnology providing opportunities for exchange of ideas, scientific knowledge and experience among researchers, academicians, scientists and students from different field of biotechnology as well as from industry on the same platform for a brief yet intense period of discussion, collaboration, and addressing related problems in research and also to provide a platform to the researchers to showcase their talent and publish their work in reputed journals. Eminent Invited Speakers will join us from various parts of the globe and hope everyone will learn emerging trends in biotechnology and enrich themselves. I wish you all the best of luck for the "International Conference on Ecotoxicology & Environmental Sciences (ICEES-2024).

Dr. Amit Kumar Dutta
Organizing Secretary
ICEES-2024

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AMITY UNIVERSITY JHARKHAND (AUJ), Ranchi
New Campus, HEC Core Capita Area, Murma, Naya Sarai, Block Negri, Ranchi, Jharkhand, India

Message from Convenor, ICEES - 2024



Dear Participants,

Welcome to the International Conference on Ecotoxicology and Environmental Sciences. This conference aims to address pressing environmental challenges, explore the latest scientific advancements, and foster collaboration across disciplines. We encourage you to engage in discussions, exchange ideas, and forge partnerships that will contribute to our collective understanding and solutions.

This time it will be a unique experience for all concerned as it will be happening at the Main Auditorium of Amity University, Jharkhand, Ranchi. The capital of the state of Jharkhand is with awesome importance for its educational and natural resources surrounded with vital industrial zones of the country. Participants from various sectors and from different corners of the country along with the foreign delegates will definitely contribute to make this conference a great success.

I am pleased to announce that as per the resolution of the Governing Council of IE & ES, first time the society is going to announce one prestigious award for the outstanding promising talent in the field of Environmental Sciences or other branches of science & technology - IE&ES EMERGING SCIENTIST AWARD - “Prof. B. Bhattacharya Memorial Award.” I hope that the main motto to organize this conference will be achieved. The participants especially the students and researchers will be benefitted.

My heartfelt gratitude to Vice Chancellor, Amity University Jharkhand for enormous support and guidance. I do admire Dean of Science, the Registrar and other Faculty members of Amity University Jharkhand for their continuous support.

Thank you for being part of this important dialogue. Together, we can advance our knowledge and commitment to protecting our planet.

Warm regards,

Dr. Debabrata Mukherjee
Convener
ICEES-2024

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Message from Joint Convenor, ICEES - 2024



On behalf of the Organizing Committee, I would like to extend a warm welcome to all dignitaries, guests, keynote speakers, and all participants to the "International Conference On Ecotoxicology & Environmental Sciences (ICEES-2024)", which will be held from 21st& 22nd October' 2024at Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi. Recent advances in biotechnology have been astounding, and they have enormous potential for solving many of the problems and challenges we are currently facing or may encounter soon. I am hoping that the scientific/technical sessions of the ICEES-2024 will cover the complete spectrum of biotechnology and its potential for finding solutions to such issues. I am also convinced that this wonderful event will be full of inspiration, information, and interaction for aspiring professionals. Furthermore, this Conference will serve as a forum for exchanging and discussing new ideas, as well as for forming new contacts and collaborations for future scientific endeavors. I owe a debt of gratitude to our Honorable Vice Chancellor- Prof. (Dr.) Ashok K. Srivastava, Our Sr. Director & Dean (Academics)- Prof. (Dr.) Ajit Kr. Pandey, and our Registrar- Mr. Prabhakar Tripathi, for their continuous encouragement, guidance, and support in organizing this conference

Dr. Kunal Kumar
Joint Convenor
ICEES-2024

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New Campus, HEC Core Capita Area, Murma, Naya Sarai, Block Negri, Ranchi, Jharkhand, India

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Message from Conference Coordinator- Program Chair, ICEES - 2024



Amity Institute of Biotechnology, Amity University Jharkhand, Ranchi and Institute Of Ecotoxicology And Environmental Sciences (IE&ES), Kolkatajointly organizing an "International Conference On Ecotoxicology & Environmental Sciences (ICEES-2024)"on 21st& 22nd October' 2024. The main objective of the Conference is to provide a brief introduction to the current trends in the field of research and its uses in the applied fields of Biotechnology. The various themes of the International Conference are designed for faculty members, Research Scholars, Students, and Industry participants in enhancing their knowledge in current research trends and future needs. It will help to create an awareness among the participants about present research trends and bring required orientation among them. Thus, it would provide exposure through its utility significance and importance for further welfare of the society. The Abstract Book provides list of preface, messages, circular, technical program, list of organizing committee, about the conference, about the University & Institute, about Ranchi- Jharkhand and list of abstracts received from researcher, scholars across the globe. I express my gratitude to the members of Advisory Committee, Local Organizing Committee, Participants and all those who have worked hard to make this "International Conference on Ecotoxicology & Environmental Sciences (ICEES-2024)" a successful one.

Dr. Jayeeta Chattopadhyay
Conference Coordinator- Program Chair
ICEES-2024

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Message from Treasurer and Conference Co-ordinator, ICEES - 2024



It is my pleasure to welcome you all to the International Conference on Ecotoxicology and Environmental Sciences (ICEES-2024) to be held during 21st & 22nd October, 2024 at Amity University Jharkhand, Ranchi, India. We are delighted to host this event, bringing experts and enthusiasts from around the world to share insights, research findings, and innovative solutions addressing critical environmental challenges.

This year's conference promises to be an enriching experience, with a diverse program featuring keynote speeches, panel discussions, and networking opportunities. We encourage you to actively participate, interact, and engage with fellow attendees.

Over the next two days, you will have the opportunity to engage with leading researchers, participate in stimulating discussions, and explore new ideas that advance our understanding of ecotoxicology and its impact on ecosystems and human health.

Thank you for being a part of this event. We hope you find the conference both inspiring and informative. Together, we can further our understanding of ecotoxicology and its vital role in environmental science.

My sincere thanks to Vice Chancellor, Amity University Jharkhand for accepting the proposal of this conference and my heartfelt gratitude to Dean of Science, the Registrar and other Faculty members of Amity University Jharkhand for their continuous support.

Best regards,

Mrs. Shreyasee Mukherjee
Treasurer and Conference Coordinator
ICEES-2024

INTERNATIONAL CONFERENCE ON ECOTOICOLOGY AND ENVIRONMENTAL SCIENCES (ICEES-2024)

21st – 22nd October, 2024

at

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PROGRAMME SCHEDULE

Note: 15 minutes are allotted for each Plenary lectures and 10 minutes are allotted for each Contributed paper. Presenters are urged to abide by this time restriction strictly. Session Chairpersons are requested to announce the time limit at the beginning of each session.

Monday 21st October 2024

Kit Distribution and Registration: 9.0 AM onwards

Inaugural session: 10.0 AM to 11.0 AM

10.00 A.M: National Anthem of India followed by other participating countries
10.10 A.M: Felicitation to the guests
10.15 A.M: Opening Song
10.20 A.M: Welcome Address by the Organizing Secretary, ICEES-2024
10.25 A.M: Address by the Chairperson of ICEES-2024
10.30 A.M: Address by the Chief Patron of ICEES-2024
10.35 A.M: Address by the Special Guests
10.45 A.M: Address by the Convenor of ICEES-2024
10.50 A.M: Address by the Program Chair of ICEES-2024
10.55 A.M: Vote of Thanks by the Joint Convener of ICEES-2024

Keynote Speech: 11.00 AM to 11.15 AM

POST-MODIFIED METAL-ORGANIC FRAMEWORKS FOR SOLAR FUEL PRODUCTION

Tapas Kumar Maji
Molecular Materials Laboratory, Chemistry and Physics of Materials Unit, School of Advanced Materials (SAMat), Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur Post, Bangalore- 56064, India.

TEA BREAK: 11.15 AM – 11.30 AM

Scientific Session I: Toxicology of Metals and Metalloids: Impact on Environment and Human Health

Chair: Prof. Pasquale Avino Co-Chair: Dr. Koel Mukherjee

Plenary Lecture: 11.30 AM - 11.45 AM

ICEES-24/IP-002

TOXICOLOGY OF METALS AND METALLOIDS: IMPACT ON ENVIRONMENT AND HUMAN HEALTH

Okechukwu Jonathan Okonkwo

Department of Environmental, Water and Earth Sciences, Faculty of Science,
Tshwane University of Technology, Pretoria, South Africa

Contributed Papers: 11.45 AM to 1.15 PM

CP-01(AP), CP-03(RS), CP-10(AP), CP-17(AP), CP-29(RS), CP-36(PG), CP-56(RS), CP-60(AP), CP-66(RS),

START OF POSTER PRESENTATION AND WORKSHOP/DEMONSTRATION

Time for selection round will be announced at the venue.

Scientific Session II: Genetic or Molecular Susceptibility to Environmental Toxicants-Biological Impacts

Chair: Dr. Manoj Kumar Co-Chair: Dr. Salini Mehta

Plenary Lecture: 1.15 PM to 1.30 PM

ICEES-24/IP-013

TOXICOGENOMICS AND NETWORKING STUDIES OF BIOLOGICAL MACROMOLECULES IN FISH BODY (Danio rerio) IN PRESENCE OF TOXICANTS

Dr. Koel Mukherjee

Assistant Professor, Department of Bioengineering and Biotechnology,
Birla Institute of Technology Mesra, Jharkhand

Contributed Papers: 1.30 PM to 2.10 PM

CP-34(RS), CP-40(RS), CP-83(AP), CP-84(UG)

LUNCH: 2.15 PM - 2.45 PM

Scientific Session III: Microbial Interaction Operating in Nature: Biomarkers and Bio-indicators

Chair: Dr. Arup Kumar Mitra Co-Chair: Dr. Sanyukta

Plenary Lecture: 2.45 PM to 3.00 PM

ICEES-24/IP-011

MICROBIOME IN AQUATIC ECOSYSTEMS- EXPLORING FUNCTIONAL INTRICACIES TO ADDRESS SDGs

Prof. Punyasloke Bhadury

Professor, Indian Institute of Science Education And Research Kolkata

Contributed Papers: 3.00 PM to 4.10 PM

CP-19(UG), CP-25(UG), CP-28(UG), CP-30(PG), CP-41(UG), CP-42(UG), CP-55(RS)

Scientific Session IV: Climate Change: Impact and Mitigation

(1st PARALLEL SCIENTIFIC SESSION):

Chair: Prof. Sarmila Pal Co-Chair: Dr. Ladly Rani

Plenary Lecture: 2.45 PM to 3.00 PM

ICEES-24/IP-004

CLIMATE CHANGE IMPACT AND ADAPTATION STRATEGY IN SOUTHWEST COASTAL REGION OF BANGLADESH

Prof. Sarder Safiqul Islam

Agrotechnology Discipline, Khulna University, Khulna-9208, Bangladesh

Contributed Papers: 3.00 PM to 3.30 PM

CP-12(RS), CP-52(RS), CP-68(AP)

TEA BREAK: 4.15 PM - 4.25 PM

Scientific Session V: Green Chemistry

Chair: Prof. (Dr.) P. Agamutu Co-Chair: Prof. (Dr.) Jayeeta Chattopadhyay

Plenary Lecture I: 4.30 PM to 4.45 PM

ICEES-24/IP-003

FROM PM10 TO MICROPLASTICS: A DEEP JOURNEY FROM THE AEROSOL SOURCES TO THE EFFECTS ON THE HUMAN RESPIRATORY TRACT

Prof. Pasquale Avino

Department of Agricultural, Environmental and Food Sciences,

University of Molise, Italy

Plenary Lecture II: 4.45 PM to 5.00 PM

ICEES-24/IP-009

ANTIOXIDANT ENZYMES AND CELLULAR TOXICITY: EXPLORING CASTOR GROWTH DYNAMICS UNDER CADMIUM STRESS

Dr. Manoj Kumar,

Professor and Dean, Central University of Jharkhand, Ranchi, INDIA

Contributed Papers: 5.00 PM to 5.50 PM

CP-22(UG), CP-65(RS), CP- 70(RS), CP-78(AP)

CULTURAL PROGRAMME: 6.00 PM - 8.00 PM

DINNER AT 8.00 PM

Tuesday 22nd October, 2024

Scientific Session VI: Waste Management-from waste to worth: Innovating Sustainable Solutions

Chair: Prof. Punyasloke Bhadury Co-Chair: Dr. Debjani Dutta

Plenary Lecture: 10.00 AM to 10.15 AM

ICEES-24/IP-001

WASTE MANAGEMENT-FROM WASTE TO WORTH: INNOVATING SUSTAINABLE SOLUTIONS

Prof. Dr. P. Agamutu,
Jeffrey Sachs Center on Sustainable Development,
Sunway University, Malayasia

Contributed Papers: 10.15 AM to 10.45 AM

CP-57(RS), CP-58(RS), CP-61(UG)

TEA BREAK: 10.45 AM - 11.00 AM

Scientific Session VII: Environmental Pollution: Origin and Surveillance

Chair: Dr. Ghanashyam Das Co-Chair: Dr. Amit Kr. Dutta

Plenary Lecture I: 11.0 AM to 11.15 AM

ICEES-24/IP-008

ONE EARTH AND ONE FAMILY: ENVIRONMENTAL RESILIENCE AND SURVEILLANCE TOWARDS UNIVERSAL WELLBEING IN LINE WITH 'ONE HEALTH'

Dr. Snehasish Mishra
Bioenergy Lab, School of Biotechnology, Campus 11, KiiT Deemed University, Patia, Bhubaneswar – 751 024, Odisha, India

Contributed Papers: 11.15 AM to 11.55 AM

CP-07(RS), CP-024(UG), CP-035(PG), CP-039(RS)

Scientific Session VIII: Environmental Management and Control
(2nd PARALLEL SESSION)

Chair: Prof. (Dr.) Arvind Deshmukh Co-Chair: Dr. Kunal Kumar

Plenary Lecture: 11.0 AM to 11.15 AM

ICEES-24/IP-005

ENVIRONMENTAL MANAGEMENT AND CONTROL: A CASE STUDY ON THE SUNDARBANS – THE WORLD LARGEST MANGROVE FOREST

Dr. Abdullah Harun Chowdhury,
Professor, Environmental Science Discipline,
Khulna University, Khulna-9208, Bangladesh.

Contributed Papers: 11.15 AM to 12.15 PM

CP-SP, CP-27(UG), CP-31(PG), CP-73(AP), CP-74(RS), CP-75(AP)

Scientific Session IX: Safety Evaluation of Contaminants in Food - Health and Hygiene (3rd PARALLEL SESSION)

Chair: Dr. Snehasish Mishra Co-Chair: Dhananjay Kumar Pandey

Plenary Lecture: 12.15 PM to 12.30 PM

ICEES-24/IP-012

SAFETY EVALUATION OF CONTAMINANTS IN FOOD – HEALTH AND HYGIENE

Dr. Debjani Dutta,
Associate Professor, National Institute of Technology,
Durgapur, West Bengal, India

Contributed Papers: 12.30 PM to 1.20 PM

CP-05(AP), CP-38(UG), CP-54(RS), CP-71(AP), CP-76(RS)

Scientific Session X: GIS, Remote Sensing and Instrumentation

Chair: Dr. Biplab Sarkar Co-Chair: Dr. Debabrata Mukherjee

Plenary Lecture I: 12.00 PM to 12.15 PM

ICEES-24/IP-015

USE OF GIS AND RESISTIVITY SURVEY TECHNIQUES IN GROUNDWATER EXPLORATION – A REVIEW

Dr. Pinaki Roy
Assistant Professor, Department of Geology,
Durgapur Government College, Durgapur, West Bengal, India

Plenary Lecture II: 12.15 PM to 12.30 PM

ICEES-24/IP-010

IMPACT OF CLIMATE CHANGE AND NEOTECTONIC FORCES IN SHAPING LANDFORM HETEROGENEITY AND FLUVIAL GEOMORPHOLOGY IN DARJEELING-JALPAIGURI, EASTERN HIMALAYA

Dr. Sunipa Mandal,
Associate Professor, Department of Geological Sciences,
Jadavpur University, Kolkata, India

Contributed Papers: 1.00 PM to 1.30 PM

CP-11(RS), CP-47(UG), CP-48(UG)

LUNCH: 1.30 PM - 2.0 PM

Scientific Session XI: Nanotechnological approaches to Environmental Sciences

Chair: Prof. (Dr.) M. Anwar Mallick Co-Chair: Dr. Sunipa Mandal

Plenary Lecture: 2.0 PM to 2.15 PM

ICEES-24/IP-006

APPLYING NANOTECHNOLOGY FOR ENVIRONMENTAL BLISS: AN AGRICULTURAL PERSPECTIVE

Dr. Biplab Sarkar

Principal Scientist (Nanobiotechnology), ICAR-Indian Institute of Agricultural Biotechnology, Ranchi, Jharkhand, India

Contributed Papers: 2.15 PM to 2.25 PM

CP-09(RS), CP-67(RS)

Scientific Session XII: Harvesting Hope: Production of Biomass for a Greener Future (4th PARALLEL SESSION)

Chair: Dr. Arup Kumar Mitra Co-Chair: Dr. Nimmy Srivastava

Plenary Lecture: 2.00 PM to 2.15 PM

ICEES-24/IP-014

MICROBIAL SOLUBILIZATION OF METALS FROM ELECTRONIC WASTE (E-WASTE)

Prof. (Dr.) Arvind Deshmukh

President, Microbiologists Society,

C-2/12, Parijatak Apartment, Naikwadi Nagar, Osmanabad, Maharashtra, India

Contributed Paper: 2.15 PM to 3.35 PM

CP-15(AP), CP-21(UG), CP-23(UG), CP-26(UG), CP-32(PG), CP-33(RS), CP-64(RS), CP-82(RS)

Scientific Session XIII: Biodiversity and Conservation: Threats & Mitigation

Chair: Dr. Pinaki Roy Co-Chair: Dr. Sweta Sinha

Plenary Lecture: 2.25 PM to 2.40 PM

ICEES-24/IP-007

ARSENIC CONTAMINATION IN THE AGRICULTURAL FIELDS OF LOWER BENGAL AND ITS MITIGATION

Dr. Arup Kumar Mitra

Associate Professor & Founder Head, Post Graduate Department of Microbiology, St. Xavier's College (Autonomous), 30, Mother Teresa Sarani, Kolkata - 16

Contributed Papers: 2.40 PM to 3.10 PM

CP-13(RS), CP-20(UG), CP–37(PG)

Scientific Session XIV: Oral Presentation for Selection of 'IE&ES Scientist Awards'

Chair: Dr. N Ganesh Co-Chair: Dr. Arup Kumar Mitra

Contributed Papers: 3.15 PM to 4.15 PM

TEA BREAK: 4.15 PM to 4.30 PM

VALEDICTORY SESSION: 4.30 PM to 6.0 PM

Vote of Thanks by the Convener ICEES-2024: 6.0 PM

END OF CONFERENCE

DINNER FOR GUESTS AT 8.0 PM (22nd October, 2024)

- **Besides the two Parallel Scientific Sessions for Oral Presentation there will be two other Parallel Sessions for Poster presentation and Workshop/ Demonstration on 21st and 22nd October, 2024**

POST CONFERENCE TOUR

23rd and 24th October, 2024

Please note: Programme schedule may change due to unavoidable circumstances

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❖ **Please note the Abbreviations stand for:**

IP: Invited Papers

CP: Contributed Papers

SP – Special Presentation

DS – Distinguished Scientist

YS – Young Scientist

UG – Under Graduate (Student)

PG – Post Graduate (Student)

RS – Research Scholar

AP – Academician / Professional

P – Poster

W – Workshop/Demonstration

Keynote

POST-MODIFIED METAL-ORGANIC FRAMEWORKS FOR SOLAR FUEL PRODUCTION

Tapas Kumar Maji

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Abstract

The much-needed renewable alternatives to fossil fuel can be achieved efficiently and sustainably by converting solar energy to fuels via hydrogen generation from water or CO_2 reduction. Sunlight-driven H_2 production and CO_2 reduction are promising routes for the production of chemical feedstocks as fuel precursors to mitigate the CO_2 concentration in the atmosphere and also to alleviate the global energy crisis. [1-5] Nature's design of carrying out the photosynthetic redox cycle involving CO_2 and water inspired us to develop highly efficient integrated catalytic systems for artificial photosynthesis. The versatile and highly amenable structural tunability of metal-organic frameworks (MOFs) by post-synthetic modification (PSM) allows tailoring inherent semiconducting and optoelectronic properties, compared to traditional inorganic semiconductors. Besides, PSM is an excellent choice to introduce a functional photosensitizer into the MOF matrices to galvanize the electronic and optical properties for photocatalytic H_2O and CO_2 reduction. [1-3] Our presented results demonstrated an excellent approach to green H_2 production and carbon neutralization for tackling the energy crisis. [1-6]

My talk will focus on developing integrated photocatalytic systems through post-synthetic modification of MOFs for H_2O and CO_2 reduction.

Keywords: Metal Organic Frameworks (MOFs), Photocatalysis, CO_2 reduction, Solar fuel production

ICEES-24/IP-001

WASTE MANAGEMENT-FROM WASTE TO WORTH: INNOVATING SUSTAINABLE SOLUTIONS

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Abstract

The Waste to Worth Mission brings scientific processing of waste to the forefront to build a zero landfill and zero waste nation. It emphasizes converting wastes from environmental and economic liabilities to valuable resources, creating liveable jobs and community development opportunities. The management of agricultural and biomass waste is crucial amidst rising fossil fuel costs and climate change. Annually, global agriculture generates around one trillion tonnes of waste, contributing to a $17 trillion biomass economy spanning chemicals, biotechnology, and forestry. This paper explores utilizing agricultural biomass and others as alternative energy sources to reduce fossil fuel dependency and mitigate greenhouse gas emissions. Biomass currently accounts for approximately 10% of the global energy supply, predominantly in developing countries for cooking and heating. Projections indicate that biomass could mitigate global CO2e emissions by 5,500-6,000 megatons annually by 2030, with carbon sequestration potential nearing 90%. In the Asia-Pacific region, food waste constitutes 20% to 70% of municipal solid waste and it could be converted to Biogas or Compost. This report explores sustainable waste management solutions by transforming agricultural and biomass waste into valuable resources. The presentation assesses carbon sequestration potential, methane reduction, and economic benefits derived from agricultural waste utilization. Findings suggest that agricultural waste utilization could reduce greenhouse gas emissions by 1,100-3,000 Mt CO2e annually by 2030 through soil carbon sequestration. Additionally, methane emissions from rice fields could decrease by 26%, offering economic gains of $5.5 billion annually at a $20 per tonne carbon price. Transformations include turning sludge into organic-based fertilizers, clays and sawdust into cat litter, fuel pellets from petroleum coke dust, and recovering valuable metals from spent batteries. Gasification and pyrolysis offer promising avenues for converting plastic waste into valuable products, enhancing the economic and environmental performance of the system when integrated with other subsystems. Advanced methodologies for waste transformation through thermo-chemical and biochemical conversion processes are examined. Techniques such as combustion, gasification, pyrolysis, liquefaction, and fermentation convert waste into heat, electricity, and fuels, aligning with principles of sustainability and resource recovery. Waste-to-energy plants provide an ecological and cost-effective way of energy recovery by converting municipal solid waste into electricity and/or heat. Energy is generated by burning waste at high temperatures to create steam, which drives a wind turbine to create electricity. This comprehensive approach underscores the transformative potential of waste management, turning waste from a burden into a resource, exemplifying the integration of environmental stewardship with economic viability.

Keywords: *Waste Management, Waste, Worth, Innovating, Sustainable, Solutions*

ICEES-24/IP-002

TOXICOLOGY OF METALS AND METALLOIDS: IMPACT ON ENVIRONMENT AND HUMAN HEALTH

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Abstract

Metals and metalloids are generally characterized by relatively high densities. Discussions on their impact on the environment and human health can be challenging because they are diverse. Some of the most commonly studied metals include, chromium (Cr), copper (Cu), Nickel (Ni), lead (Pb), mercury (Hg) and zinc (Zn) and metalloids, antimony (Sb), arsenic (As), boron (B), silicon (Si) and germanium (Ge). These occur naturally and their natural sources include, weathering of metal-bearing rocks and volcanic eruptions, forest fires, whereas anthropogenic sources include mining and various industrial and agricultural activities. Among the metals, Cu, Co, Fe, Mg and Zn and others have functional roles that are essential for various diverse biochemical activities in the human body. However, when in high concentrations, they can be harmful to the body; whereas others such as As, Cd, Hg, and Pb even at very low concentrations are well-known environmental pollutants due to their toxicity, persistence in the environment, and bio-accumulative nature. Their multiple industrial, domestic, agricultural, medical and technological applications have led to their wide distribution in the environment. As persistent pollutants, they tend to accumulate in the environment and consequently contaminate the food chains, where they pose health threat to their consumers. Their toxicity involves many mechanistic aspects, some of which are still not well understood. However, each metal has unique features that drives its specific toxicological mechanisms of action and their toxicity depends on several factors such as dose, route of exposure, and chemical species, age, gender, genetics, and nutritional status of exposed individuals. This review highlights the environmental occurrence, uses, routes of human exposure, and molecular mechanisms of toxicity, genotoxicity and carcinogenicity of arsenic, cadmium, lead, and mercury, selected because of their public health concern.

Keywords: Metals, metalloids, production and use, human exposure, toxicity, genotoxicity, carcinogenicity

ICEES-24/IP-003

FROM PM_{10} TO MICROPLASTICS: A DEEP JOURNEY FROM THE AEROSOL SOURCES TO THE EFFECTS ON THE HUMAN RESPIRATORY TRACT

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Abstract

This lecture shows a complete chemical-physical characterization of the particulate matter in the range 10 nm to 10 μm. This issue is important for understanding the effects of new technological processes on the evaluation of the air quality; simultaneously, it is not trivial considering the relative analytical and toxicological implications. It will be discussed how the main fraction of the aerosol average size distributions during different events in a big city both in winter and summer periods, is characterized by significant levels of $PM_{2.5}$, especially in summertime, when the atmospheric stability conditions are numerically more than those in other period causing a pollutant accumulation: almost 75 % of total PM_{10} fraction is $PM_{2.5}$. A particular attention has been devoted to investigate the contribution of Ultrafine Particles (UFPs) on aerosol number concentration and their dynamic of formation: the trends both of UFPs vs. NO_x and of UFPs vs. total PAH show the primary origin of these pollutants and the narrow relationship between combustion processes and their presence in urban atmosphere. Particle formation in the nucleation mode was favoured in periods with high radical oxidative activity. Finally, it is possible to state that microplastics are ubiquitous emerging contaminants: they are of different shapes (e.g., fiber and fragment) and sizes (0.1 μm to 5000 μm) and have been identified, both indoors and outdoors.

Lastly, it will be reported the health effects in terms of the aerosol regional doses deposited in the human respiratory system in a traffic environment. Cumulative and instant doses are calculated for submicrometric and ultrafine particles deposited in the lobes of the lung described by a stochastic model (60th percentile). On the other hand, drawing conclusions about the effects of inhaled microplastics on human health is difficult due to the heterogeneity of the results reported by different studies and the lack of standardization of analytical methods. Moreover, the sources of these pollutants and the factors involved in their distribution are still unclear.

This study was carried out under the grant BRIC.INAIL ID 14/2022 “Approccio integrato per la determinazione e la caratterizzazione di microplastiche aerodisperse in ambienti di lavoro”. Project title: “Caraterizzazione delle Emissioni in Luoghi di LavOro di microPlasticHe Aerodisperse e Nanoplastiche – CELLOPHAN”.

Keywords: Aerosol; Ultrafine particle; Microplastics; Urban air; Indoor; Atmosphere; Human health.

ICEES-24/IP-004

CLIMATE CHANGE IMPACT AND ADAPTATION STRATEGY IN SOUTHWEST COASTAL REGION OF BANGLADESH

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Abstract

Climate change poses significant threats to the southwest coastal region of Bangladesh, impacting its demographic, environmental, and socio-economic landscape. This article assesses impacts of climate change, highlighting the region's susceptibility to cyclones, flooding, salinity intrusion, and river erosion. Coastal areas which is home to over 25% of the population of the nation, are particularly vulnerable to rising sea levels, frequent cyclones, and tidal surges which causes in significant displacement and migration. Salinity intrusion adversely affects agriculture, reducing crop yields and impacting public health. Pregnant women and the elderly being especially vulnerable to health-related effects of climate change. The study also explores various adaptation strategies to mitigate the adverse effects of climate change. Building disaster-resilient infrastructure, such as geosynthetic-reinforced soil (GRS) embankments and full-height rigid (FHR) facing constructions, is critical for protecting coastal communities. Technological interventions, including GIS and remote sensing, are essential for early detection and management of infrastructure defects. Indigenous knowledge is essential in climate adaptation, offering flexible and locally relevant solutions. Energy efficiency and emission reduction are crucial for sustainable development. The implementation of environmental management systems (EMS) in factories and the promotion of compressed natural gas (CNG) for vehicles can act as key measures to reduce greenhouse gas emissions and improve air quality. Public health issues should be addressed for climate change as it can cause increased risk of heat stress, vector-borne diseases, and water-borne illnesses due to rising temperatures and precipitation variability. Adaptation strategies must prioritize improving water quality, ensuring food security, and enhancing healthcare services to manage climate-related health problems effectively. By combining structural and non-structural measures, the region can enhance its capacity to adapt to climate change. Collaborative efforts from government, non-governmental organizations (NGOs), and local communities are essential to effectively address the multifaceted challenges posed by climate change.

Keywords: Disaster-resilient infrastructure, environmental management systems, global warming, salinity intrusion, sea level rise, renewable energy.

ICEES-24/IP-005

ENVIRONMENTAL MANAGEMENT AND CONTROL: A CASE STUDY ON THE SUNDARBANS – THE WORLD LARGEST MANGROVE FOREST

Abdullah Harun Chowdhury

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Abstract

Sustainability of the management of the different environmental components are being considered environmental management i.e. confirmation and improvement of the provision for the human demands and needs by considering the physical, biological, technological, social, cultural, economic and political limitations to ensure minimum destruction to natural habitats and ecosystems. Globally all people are directly and indirectly depending on the different ecosystem services for their livelihoods, tourism, resources extractions, etc. However, unplanned resources collection and tourism activities increasing the critical situations for the ecosystems. Environmental management and control are a tool or technique depending on the continuous research findings, knowledge of wise use and conservation of natural resources, habitats protection, pollution control, EIA etc. through community participation. Research is closely depending on the academic knowledge of biology, chemistry, ecology, climatology, forest and fisheries sciences, environmental law, geo and information sciences, environmental engineering, economics and business, toxicology, public health, social affairs, etc. A detailed information on the status of any ecological area must be find out through research for the application of tool of environmental management and control. The Sundarbans is an ecologically critical area and the largest mangrove forest in the world, which is very rich with 66 species of plants, more than 200 fish species, 42 mammals, 234 birds, 51 reptiles, 8 amphibians, a lot of invertebrates etc. Almost 500 thousand peoples are directly and indirectly depending on the Sundarbans for their livelihoods. Physico-chemical conditions of water and soil; status of micro and macro flora and faunal composition i.e. ecological conditions, habit and habitat, relative abundance etc.; and climatic conditions of the Sundarbans were studied to develop a sustainable tool of environmental management and control. The research findings indicate that the micro and macro floral and faunal composition like phyto-zooplankton, benthos, macro algae, regeneration of the Sundari and other trees, eggs and hatchlings of different fishes, mudskippers, mud crabs, snails, monitor lizards, birds, fishing cat, otter, dolphins, crocodile and other aquatic lives of the Sundarbans are being changed due to macro and micro climatic changes and related some environmental threats like increasing of salinity in soil and water, natural calamity, land erosion, siltation of the river beds, decreasing of up streams fresh water flows, oil spills, industrialization, etc. The population of some high saline tolerant plants like *Ceriops decandra, Excoecaria agallocha* etc. are increasing day by day in the low saline areas due to increasing of salinity. Whereas the number of population of low saline tolerant plants likes *Heritiera fomes, Xylocarpus granatum* etc. are decreasing and some climbers are covering the many places of the Sundarbans in absences of low saline tolerant trees. Populations of some floral and faunal diversity are being decreased. People livelihoods are being affected directly due to decreasing the shrimp and fish fries gradually in and around the Sundarbans. A sustainable management plan should be developed to protect the degradation of the ecosystem and biodiversity of the Sundarbans, and an international program must be launched as early as possible to mitigate the climatic and environmental hazards. Some areas to be classified as habitat of threatened and rare species, and their breeding ground. All kinds of activities must be prohibited inside the classified areas. Participatory community management should be ensured for sustainable environmental management and control issues; awareness rising to be continued among the people about the impact of climatic and environmental changes on the Sundarbans.

Keywords: Mangrove Forest, Environmental hazards, Management, Control

ICEES-24/IP-006

APPLYING NANOTECHNOLOGY FOR ENVIRONMENTAL BLISS: AN AGRICULTURAL PERSPECTIVE

Dr. Biplab Sarkar

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Abstract

Nanotechnology thrives innovative tools of delivering agricultural inputs in minimal quantity with maximum efficiency for achieving a sustainable agricultural system. Agricultural deliverables, i.e., fertilizer, pesticide, medicines, feed, fodder etc. add productivity in terrestrial as well as aqua based farming systems but also create havoc to environment. To this end, nanoparticle inspired delivery of agri-input appears efficacious and environmentally safe. Our research initiatives depicted that plant tissue derived green silver nanoparticle inferred low cytotoxicity to zebrafish (*Danio rerio)* in comparison to chemically synthesized nanosilver. Solid waste like fish residual tissues can be used for synthesizing silver nanoparticles having propensity to heal non-specific bacterial infections in fish. Low doses of nanosilver stimulated larval growth in zebrafish which was deciphered through oct-4 expression profiling whereas nanosilver delivered through hydrogel nanocomposite showed healing at incision wounds in fish. Nano lime applied in place of routine lime for counteracting soil acidity in chickpea (*Cicer arietinum*) cultivation appeared safe to rhizosphere microbes, exhibited higher biodistribution as well as biological activities at $1/50^{th}$ to $1/100^{th}$ doses when analyzed through metagenomics sequencing, ICP-MS profiling as well as transcriptomics analysis respectively. Semiconductor nanoparticle degraded methylene blue in water through photocatalysis property which denoted an alternative safe method of nano-remediation. Hence, nanotechnology derived formulations and products can be useful and safe to environment due to its minimal application dose and higher efficacy as observed in fish and different cropping systems for achieving sustainable goals.

Keywords: Nanotechnology, environment, molecular tool, toxicity, fish and crop

ICEES-24/IP-007

ARSENIC CONTAMINATION IN THE AGRICULTURAL FIELDS OF LOWER BENGAL AND ITS MITIGATION

Arup Kumar Mitra

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Abstract

The problem of arsenic contamination in lower Bengal was reported in the 70's, but it was initially not taken seriously and even it was not understood that the problem was geologic, later it was clear that due to gradual movement of the Bengal plate containing arsenate, which gradually came up with deep tube well and get deposited in the agricultural crops. As a result of this, the contamination is not in situ, but it spreads with food grains to other part of the state or even the country. Arsenic being a cumulative poison, the toxic implications are manifested very slowly and after it has reached a certain threshold in blood and soft tissue, the external manifestation of the disease is apparent. So even if the household has a reverse osmosis system installed, the exposure occurs through food. Thus the mitigation has to be carried out at the source, so that the exposure is minimized. Moreover, it has to be cost effective for people living in the rural fringes of our country. Some of these methods include boring dug well in the arsenic free zones, regular monitoring of the drinking water and sealing off the potentially risky ones, use of surface water and also rain water harvesting. Some other solutions include the transgenic crop plants where the transporter proteins are modified. But the most important and cost effective one is the microbial alleviation. Through bio-augmentation, the microflora may be modified which can immobilize the arsenate. Some of these microbes are efficient enough to bring about the change of state to gaseous arsine, as a result of which the dreadful heavy metal can be kept away from the soil for a relatively long period of time. But the most interesting of the is modification of the Rice rhizosphere by introducing novel arsenic tolerant bacteria in the *Azolla* rhizosphere, which is actually grown in the paddy field as a bio-fertilizer, utilizing the service of the endophyte *Anabaena azollae* as potential nitrogen fixer. This technique has a remarkable role in mitigating arsenic in the paddy field and also promoting the growth of rice plant.

Keywords: Arsenic, Bengal plate *Azolla* rhizosphere

ICEES-24/IP-008

ONE EARTH AND ONE FAMILY: ENVIRONMENTAL RESILIENCE AND SURVEILLANCE TOWARDS UNIVERSAL WELLBEING IN LINE WITH 'ONE HEALTH'

Snehasish Mishra

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Abstract

Ecological and environmental degradations are domain and dimension defying by nature. Ecotoxicology derails the delicate environmental balance and impacts the health and wellbeing of each participant in the ecosystem, be it living or non-living. Environmental resilience and surveillance is increasingly being prioritised across the biosphere wherein biotechnological interventions have a critical role to play. Often environmental factors such as the abiotic components and the biotic communities including the wildlife are overlooked, although each of these plays a crucial role in delicately balancing the complex health challenges that are increasingly affecting the humans, animals and others, as was initially identified by the Wildlife Conservation Society (WCS) in 2004. Indigenous communities across the globe have identified, acknowledged and applied holistic, nature-based and community approaches to ensure a delicate albeit sustainable balance between humans, animals and plants in the ecosystem. Such practices are progressively being emulated by other communities globally. In the late 1990s and early 2000s, the idea of addressing health issues at the interface of humans, animals and environment was widely promoted by international health agencies, government and academic stakeholders, which also became a core agenda in the recent G-20 summit hosted by India. The importance of such integrated approaches is acknowledged by both mainstream scientific communities and policy makers to address health, social, financial and ecological issues. Global agencies like the World Health Organisation (WHO), World Organisation for Animal Health (WOAH), Food and Agriculture Organisation (FAO), United Nations Environment Program (UNEP), Convention on Biological Diversity (CBD) and the United Nations System Influenza Coordination (UNSIC) have come together to work in this line. The efforts have gradually evolved into the 'One Health' concept, currently widely recognised as a useful approach to address complex health issues and ensure universal wellbeing. It is high time to visualise environment and ecotoxicology from the broader perspectives and work towards it to achieve global health and wellbeing while complying with the UN's efforts towards global sustainable development. The lecture shall cover the one health approach and its broader significance and relevance.

ICEES-24/IP-009

ANTIOXIDANT ENZYMES AND CELLULAR TOXICITY: EXPLORING CASTOR GROWTH DYNAMICS UNDER CADMIUM STRESS

Riya Mary Cherian[1] and **Manoj Kumar[2]***
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Abstract

Cadmium (Cd) is a hazardous, non-nutritive metal that is fatal to living organisms. Owing to the undesirable consequences of Cd in the ecosystem there is an inevitable need for its removal from the soil. Castor (*Ricinus communis* L.) is a biofuel-producing crop with metal-accumulating capabilities that could be utilized for the reclamationof metal-contaminated soil. In this study, the responses of Gujarat Castor Hybrid-2 (GCH-2) and Western Maruti (WM) (a Cd sensitive & a Cd tolerant castor genotypes respectively), during Cd exposure on the growth attributes, photosynthesis-related parameters, cellular toxicity, and the antioxidant enzymes were examined. A significant decline was observed in all the growth traitsand photosynthesis-related parameters studied for Cd-exposed GCH-2 compared to the control, resulting ina significantly low tolerance index (TI). No major changes were observed in the biomass production and photosynthesis parameters of WM treated with Cd. Cadmium stress led to a substantial reduction in cellular viability and an elevation in hydrogen peroxideand membrane lipid peroxidation levels in castor plants. However, the enhanced activities of antioxidant enzymes in WM during Cd stress can be ascribed to the adaptability and improved tolerance observed in this genotype. Overall, differential responses observed towards Cd stress by the castor plants studied indicate the existence of genotype-dependent variation in stress modulation and growth dynamics. The selection of appropriate plant type, activation of the precise tolerance mechanism, and the implementationof effectivetolerance-enhancing strategies are very crucial in aiding castor-mediated restoration of polluted sites.

Keywords: Antioxidant; Cadmium; Castor (*Ricinus communis* L.); Phytoremediation

ICEES-24/IP-010

IMPACT OF CLIMATE CHANGE AND NEOTECTONIC FORCES IN SHAPING LANDFORM HETEROGENEITY AND FLUVIAL GEOMORPHOLOGY IN DARJEELING-JALPAIGURI, EASTERN HIMALAYA

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Abstract

The Subhimalayan region of Darjeeling and the adjacent Jalpaiguri piedmont are key areas for studying the effects of global warming and neotectonism on fluvial geomorphology. The study integrates GIS and remote sensing techniques to map these geomorphic changes and quantify sediment dynamics. Tools such as digital elevation models (DEMs) and satellite imagery plays a crucial role in documenting the ongoing shifts and subtle neotectonic imprints in landform and drainage patterns. Significant changes in morphometric parameters across the Mountain Front Thrust (MFT) ridge indicate tectonic uplift, which has impacted river gradients and fan development. The uplift has resulted in shorter, steeper, and coarser-grained fans over time, distal crystalline rocks in a vertical succession of sediment piles consistent with the southward migration of the thrust shoulder along with enhancement of sedimentation rate upstream and channel incision. The analysis of fan systems of Rivers Tista, Mahananda, and Chel highlights the evolutionary history of these fans, their genetic classification, and their recent degradation. This uplift of the MFT also recorded the basin subsidence in fluvial sequence building with thinning of valley cycles through vertical stacking of warped and tilted multi-generated terraces along River Tista in the Sub-Himalayan region. This tectonic activity has led to the accumulation of approximately 2.84 metric tons of sediment, with around 1.93 metric tons subsequently eroded. The merger of the plains-fed River Tista with glacier-fed drainage, likely around 1787, caused a six-fold increase in discharge, deeply incising the channel and altering regional hydrology. The work also addresses the broader implications of climate change, which exacerbates erosion and sediment transport, and discusses potential mitigation strategies, such as river management and sustainable land-use practices, to reduce the impacts of these geomorphological processes on the region's landscape and communities.

Keywords: Landform-Drainage-Sediment, Morphometric Parameters, Fluvial morphology, Global warming, Neotectonism, Subhimalayan-Piedmont, Remote Sensing and GIS, Darjeeling-Jalpaiguri.

ICEES-24/IP-011

MICROBIOME IN AQUATIC ECOSYSTEMS- EXPLORING FUNCTIONAL INTRICACIES TO ADDRESS SDGs

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Abstract

Biodiversity sustains ecosystem functioning and contribute to the gross domestic product (GDP) of a country. The blue ecosystems (freshwater and marine) are key to shaping regional and global climate processes as well as drive blue economy. Microbiome in these ecosystems is essential to maintaining functional biodiversity and overall 'ecological health'. Using ecological-time series, mechanistic understanding about the structure and function of specific constituents of aquatic microbiome in relation to biogeochemical cycling have become clearer across blue ecosystems. Human activities have resulted in generation of plethora of pollutants including anthropogenic forms of nitrogen along with microplastics. The functional microbiomes are exhibiting attributes to such stressors and offer cue to remediate many of these pollutants. These attributes are being harnessed to improve 'ecological health' of blue ecosystems towards attaining sustainability goals of the United Nations.

Keywords: microbiome, blue ecosystem, biogeochemical cycling, pollutants, sustainability

SAFETY EVALUATION OF CONTAMINANTS IN FOOD – HEALTH AND HYGIENE

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Abstract

The safety evaluation of contaminants in food is a critical aspect of public health and hygiene, aiming to safeguard consumers from potential risks associated with dietary exposure to harmful substances. This evaluation process involves identifying, quantifying, and assessing the impact of contaminants such as pesticides, heavy metals, mycotoxins, and industrial chemicals present in food products. Nowadays, intelligent food packaging systems enhance the safety evaluation of contaminants in food by incorporating advanced technologies like sensors and data analytics. These systems continuously monitor environmental conditions such as temperature and pH, detect specific contaminants, and provide real-time feedback on food safety. They also enable detailed traceability of food products from production to consumption, allowing for swift identification and recall of contaminated items, ultimately protecting consumer health. In this regard, Carbon dots (CDs), a novel class of fluorescent nanomaterials, and offer significant potential in enhancing the safety evaluation of food within intelligent packaging systems. Their unique optical properties, including high fluorescence, stability, and biocompatibility, make them ideal candidates for integration into food packaging. CDs can be employed to develop advanced sensors capable of detecting a range of contaminants such as heavy metals, ammonia, changes in pH. The integration of CDs with data logging and communication technologies further enhances their utility by providing detailed insights into food safety over time. In our lab, a novel green fluorescent carbon dot was developed from *Ziziphus jujuba* seed powder via hydrothermal process. It is worth noting that the proposed R-CDs demonstrate a particular response to Fe^{3+} metal ion over other competitive species by fluorescence quenching effect. The as developed CDs also displayed a significant naked eye color change from yellow to red over pH changes from pH 1 to pH 13. This pH responsive CDs was also applied to ammonia detection with a broad range of 10–500 mM. Therefore, the developed CDs could be hypothesized to build a smart phone imaging colorimetry platform for portable recognition of food spoilage on the basis of pH changes and ammonia formation. In conclusion, integration of carbon dots with advanced sensing and data communication technologies, intelligent packaging can deliver timely and accurate safety assessments, improve contamination management, and ensure higher standards of food safety. This innovation not only facilitates immediate consumer and supplier alerts but also supports comprehensive, proactive measures in safeguarding public health.

ICEES-24/IP-013

TOXICOGENOMICS AND NETWORKING STUDIES OF BIOLOGICAL MACROMOLECULES IN FISH BODY (*Danio rerio*) IN PRESENCE OF TOXICANTS

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Abstract

Molecular understanding has demonstrated that environmental factors along with stress-induced biochemical changes, that includes aberrant protein aggregation, high production of reactive oxygen and nitrogen speciesand neuroinflammation, can cause harm to growth cells which in process can kick start various illnesses. Numerous natural events, industrial effluents, herbicides, pesticides and other human mediated toxic elements poisoning air, soil as well as water bodies in our planet. To study the adverse effects of toxicity, fish model (*Danio rerio*)can significantly advance our understanding of metabolic and genetic diseases, providing insights into molecular mechanisms and potential therapeutic interventions. Nowadays, *Danio rerio* has emerged as a valuable model organism for studying nutrition, toxicity, and physiological processes due to its genetic similarity to humans, rapid development, and transparent embryos, which facilitate large-scale genetic screenings.Exposure to the toxic environment during the life cycle can influence a fish's growth and disease outcomes. These windows probably map onto developmental stages during which particular genes and gene pathways that interact with harmful substances are expressed and further can be studied through toxicogenomic and system biology approaches.

Keywords: Nanoparticles, Toxicogenomics, System biology, toxicity

ICEES-24/IP-014

MICROBIAL SOLUBILIZATION OF METALS FROM ELECTRONIC WASTE (E-WASTE)

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Abstract

It is believed that biotechnology is one of the most promising technologies in metallurgical processing. For many years, bioleaching has been used for the solubilization of metals from ores. Bioleaching is useful for treating ores with low concentrations of metals; it is also simple and cheap to operate. It has been successfully applied toward the leaching of metals from ores, though it has not yet been commercially applied toward the recovery of metals from printed circuit boards (PCB). Several authors have recently published studies on the bioleaching of metals from electronic waste. The aim of the study was to formulate microbial consortium for solubilization of metals from waste PCB and evaluate its efficacy. For this purpose, a microbial consortium from bauxite and pyrite ore samples was obtained using a simple 'top down' approach. Essentially, printed circuit boards (PCB) were obtained and used as representative samples of e-waste. Various concentrations (1–5%) of PCB powder were subjected to bioleaching, and the effects on metal solubilization, changes in pH and concentration of ferrous iron produced were assessed. It was observed that a maximum of 96.93% Cu and 93.33% Zn was solubilized by microbial consortium from 10 g/L of PCB powder, whereas only 10.26% Ni was solubilized from 30 g/L of PCB powder. For lead, only 0.58% solubilization was achieved from 20 g/L of PCB powder. An analysis of the precipitate formed during bioleaching using scanning electron microscopy with energy dispersive X_ray analysis revealed the presence of Tin (59.96%), Cu (23.97%), Pb (9.30%) and Fe (5.92%).

ICEES-24/IP-015

USE OF GIS AND RESISTIVITY SURVEY TECHNIQUES IN GROUNDWATER EXPLORATION – A REVIEW

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Abstract

The complexity and diversity of the subsurface makes it challenging to identify and characterise groundwater resources and reservoirs. This is because of the subsurface. Throughout the course of history, exploratory tactics have emerged as a response to various issues. In addition, the advanced groundwater research and management technique that it employs makes it easier to accurately identify groundwater zones. This is achieved through the combination of geophysical approaches and technology that utilise remote sensing applications. The following review illustrates how geophysical and remote sensing technologies can help lower the costs of exploration as well as the amount of uncertainty involved. Considering the present understanding of these methodologies and strategies, this researchincorporates them.

Within the scope of this review, case studies derived from sedimentary and non-sedimentary rocks are conducted. In addition to this, it examines the potential prospects, as well as the difficulties and constraints that are involved with the combination of resistivity survey and remote sensing technologies. The strategy was successful in choosing groundwater study zones, as proven by its effectiveness. Additionally, it illustrates the process by which satellite data was utilised to build theme geology, structural, and geomorphological maps. The research area was subjected to an evaluation of its geo-electrical resistivity. Using geological, geomorphological, structural, and geophysical data, analytical techniques involve, among other things, the evaluation of the groundwater potential of every given location. Local groundwater and geo-electrical resistivity data serve as the basis for the needs for geographic information system (GIS) analysis. Each information layer has been given a weight that is proportional to the amount of contribution it makes to the outcome that is desired. The presence of groundwater was found to be more dependent on fractures in basaltic and lateritic environments, according to the findings of the examination. To determine the potential of groundwater, the findings suggest that remote sensing, geographic information systems, and electrical resistivity investigations should be utilised.

Keywords: Groundwater Exploration, Remote Sensing, Geophysical Techniques, Geographical Information System and Hydrogeology.

OVERVIEW OF ENVIRONMENT FRIENDLY TASAR SILK INDUSTRY FOR CREATION OF SUSTAINABLE LIVELIHOOD IN RURAL INDIA

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Abstract

Sericulture in one of the very prominent environment friendly sector which provides the focused green livelihood in rural India. Interestingly, silk has been intermingled with the life and culture of the Indians. It is important to note that, India has a rich and complex history in silk production and its silk trade which dates back to 15th century and Indian Sericulture industry provides employment to approximately 9.48 million persons in rural and semi-urban areas in India. Of these, a sizeable number of workers belong to the economically weaker sections of society, including women. India's traditional and culture bound domestic market and an amazing diversity of silk garments that reflect geographic specificity have helped the country to achieve a leading position in silk industry. India has the unique distinction of being the only country producing all the four known commercial silks, namely, Mulberry, Tasar (tropical and Oak), Eri and Muga, of which Muga which is produced only in India with its golden yellow glitter is a prerogative of India. Tropical tasar is also unique and is profoundly environment friendly in nature and its rearing is an important tribal occupation in India, which is particularly prominent in tropical regions. The silk industry plays an important role in the trade of mulberry and non-mulberry silk varieties, especially tasar silk, which is known for its distinctive colour and coarse texture. Around 3.5 lakhs families in 10 states of India are associated with tasar silk industry. However, due to complete outdoor rearing, especially tasar silk industry faces many problems, such as changing climate patterns, erratic environmental condition, declining production, and limitations of traditional methods. The growth and development of silkworms is being affected due to the increase in temperature and uncertainties of weather due to climate change. The lack of use of existing traditional methods and equipment and inconsistency in production is also a challenge. Infestation of diseases and parasites in tasar silkworms also affects production. In addition, the lack of availability of plants required for silkworms and fluctuations in their quality are also a cause of problem. Despite these problems, there are many possibilities in the tasar silk industry using environment friendly approaches. Using green shed net for grainage, the various environmental linked stressed are being dealt at greater extent. Increasing production and improving quality with environment friendly approaches is possible by using advanced agricultural green technologies, such as agro-machinery and agro-forestry models. Huge *Terminalia arjuna* plantation planned through financial support and government schemes, CSR funds, NGOs and other research funding which can support the industry. Along with this, by-product utilisation and promotion for zero waste industry and green marketing of tasar silk can be promoted through online platforms and commercial portals. Under Vision@2047, a comprehensive action plan is needed to improve the tasar silk industry with green environment friendly technology in collaboration with forest department. This plan includes development of food plant nurseries, seed production facilities and new technological interventions for quality improvement. Along with this, a comprehensive approach should be adopted to ensure the sustainability and growth of the tasar silk industry with environment friendly lucid and adoptable approaches.

Keywords: Tasar culture, environment friendly, silkindustry, sustainable livelihood, rural

ICEES-24/CP-(DS)

JOURNEY OF RICE RESEARCH FROM SALINITY TO FLUORIDE STRESS

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Abstract

Abiotic stress, including salinity, drought, high and low temperature, toxicity due to heavy metals/ metalloids, including arsenic, and more recently, fluoride cumulatively pose an enormous threat to the global agricultural production due to severe contamination in soil and ground water. Rice (*Oryza sativa* L.), the staple food crop in South East Asian countries, is also a water-intensive crop, requiring bulk of irrigation water for its proper growth. Use of salt-arsenic-and fluoride-contaminated ground water for irrigating rice fields, therefore, impose severe oxidative damages in rice, compromising their growth, yield and overall production. At the same time, the toxic metals and fluoride also bioaccumulates in the herbivores (feeding on contaminated rice straw) and human population (consuming contaminated rice grains or cowmilk), leading to a massive environmental biohazard. Therefore, it is imperative to decipher the physiological and molecular responses of rice to such stress, that would enable us to come up with effective strategies to mitigate such damages in rice, increasing global rice production and stopping the biomagnification. Rice exhibits a huge varietal difference in terms of tolerance mechanism, with some varieties being tolerant and some extremely sensitive to such stress. Searching for novel genes from the tolerant varieties through transcriptome analysis, their expression profiling and their introgression in susceptible varieties through genetic engineering would allow us to enhance tolerance in the sensitive varieties. The other cost-effective strategy is to explore novel protective, environment-friendly chemical agents that could be directly applied in the agricultural field, either in the form of foliar spraying or via seed priming, to promote tolerance. Since almost last twenty years, my field of research is focused upon understanding the biochemical and molecular response of rice to salinity, arsenic and fluoride stress and generating tolerant plants by exogenous application of ecofriendly chemical agents and cloning target genes, responsible for tolerance through transgenic approaches. The highlights of all such works and the milestones achieved will be discussed in my lecture.

ICEES-24/CP-(YS) 001

REVEALING THE SECRET OF HIMALAYAN POLYEXTREMOPHILIC MICROBES IN SCIENTIFIC ADVANCEMENT

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Abstract

The concept of polyextremophily has captivated scientists, referring to the ability of organisms to flourish in diverse sets of extreme conditions. The implications of this phenomenon in agriculture, medicine, and industry have the potential to create a novel pathway for resources. The 5 bacterial strains in this study, isolated from the waters of Gangotri and Yamunotri showed incredible properties of Polyextremophily like tolerance to temperatures as high as 70°C, pH range (4-10), saline, drought, UV and heavy metals such as mercury, iron, silver and arsenic. They elevated levels of biofilm formation when subjected to stress revealed their property of using biofilm as their shield against harsh conditions. Furthermore, they were studied for their plant growth promotion (PGP) like nutrient sequestration (N, P, K, plant hormone production etc.) biocontrol properties (cell wall degrading enzymes, siderophores, VOCs etc.) and the ability to confer abiotic stress resistance (ACC Deaminase) to plants. The in-vivo experiments conducted on *Zea mays. L* and *Oryza sativa* yielded conclusive and promising results. The 5 bacterial strains were further assessed for their pharmaceutically and industrially significant metabolites using ESI-MS direct infusion study both under mesophilic and extremophilic conditions that showed both variation and increased numbers of metabolites of interest validating their polyextremophilic nature. Then a Linear regressor and an Ada Boost Regressor model of machine learning was developed, by training the machine with the stress tolerance data set and the PGP dataset, such that it could accurately predict the PGP activities and corresponding agricultural productivity of the 5 bacteria in these harsh environmental conditions. The predictions were in accordance with the results of PGP experiments with *Oryza sativa* under abiotic stress concluding the journey of this 5 polyextremophilic bacteria as a hub of multifaceted resources and applications.

Keywords: extremophiles, plant growth promotion, stress alleviation, biofilm, application.

ICEES-24/CP-(YS) 002

BIFENTHRIN-INDUCED OXIDATIVE STRESS AND TOXICITY IN *Tubifex tubifex*: A TIME-DEPENDENT AND CONCENTRATION-RESPONSE ANALYSIS

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Abstract

Our current study examines the severe impact of frequently used pesticides, such as bifenthrin, on the freshwater bottom dwelling annelids *Tubifex tubifex*. In an acute toxicity test, bifenthrin's 96-hour LC_{50} values against *Tubifex tubifex* were determined to be 3.5 µg/L. GUTS simulation, in which the GUTS-SD model is superimposed on top of the GUTS-IT model, was used for verifying the overall survival of the test organism in outcome of bifenthrin exposure at the acute level. After 14 days of treatment with 10% and 20% of the bifenthrin's 96 h LC_{50} values, long-term bioassays showed modifications in protein levels and oxidative stress enzyme levels. Total protein concentration (µg/ml) dropped during this bioassay, while levels of the antioxidant enzymes CAT, SOD, GST, and MDA rose. Using the Pearson correlation matrix and the Integrated Biomarker Response (IBR) index, respectively, the relationship between biomarkers, toxicants, and stress production by phenol was examined. The results suggest that phenol exposure has a detrimental effect on *Tubifex tubifex*'s survival rate and overall health.

Keywords: bifenthrin; *Tubifex tubifex*; oxidative stress; acute toxicity; benthic annelid; Integrated Biomarker Response; survival rate

ICEES-24/CP-(YS) 003

INVESTIGATION OF VOLATILE ORGANIC COMPOUND EMISSIONS FROM INCENSE STICKS FOR INDOOR AIR QUALITY ASSESSMENT

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Abstract

Incense burning is a common practice in various religious and work environments or as home fragrance. Fragranced consumer products, such as incense, have been identified as a major source of indoor Volatile Organic Compounds (VOCs). Research has shown that during combustion, incense can release various VOCs, such as benzene, limonene and α-pinene. These has led the scientific community to focus on that indoor environment where incense burning is involved. Of particular concern, due to its health risks, are the BTEX compounds (benzene, toluene, ethylbenzene and xylene) which are frequently found at elevated levels in indoor air. Prolonged exposure to VOCs, especially benzene, has been linked to reproductive issues, respiratory problems, immune system suppression, and increased cancer risk.

This study aims to evaluate the VOC emissions from burning incense sticks in an indoor environment, utilizing a controlled chamber test. The clean room where the experiments were conducted had a total volume of 85.8 m^3. A chemical desorption VOC sampler, equipped with a RAD130 adsorbent cartridge, was used to capture VOCs from the air. The VOCs collected were desorbed from the activated carbon phase using 2 mL of carbon disulfide (CS_2), and the analysis was carried out using a gas chromatograph coupled with a flame ionization detector (GC-FID).

The results revealed that ten different types of incense stick emitted benzene at concentrations ranging from 11.1 to 66.5 μg m^{-3}, which is 2.5 times lower than the recommended non-occupational indoor exposure limit of 160 μg m^{-3}, as set by the American Association of Industrial Hygienists (ACGIH). Additionally, a minor correlation was observed between the size (diameter and length) of the incense stick's combustible portion and the amount of benzene emitted.

Given benzene's significant health impact and the absence of strict regulations on indoor air quality in residential environments, this research offers a preliminary insight into the effects of incense burning in private and public indoor spaces.

Keywords: Indoor air quality; Incense; VOC; Benzene; Risk; Human health.

ICEES-24/CP-(YS) 004

MICROSCOPIC INTRUDERS: PYROLYSIS GC-MS DETECTS MICROPLASTICS IN DAIRY PRODUCTS

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Abstract

Human exposure to microplastics through food consumption has garnered significant attention. Most studies on the occurrence of microplastics in food matrices have focused on seafood and sea salt, which have been the primary subjects of global research. In contrast, dairy products, generally considered less susceptible to contamination, have been comparatively understudied. A very limited number of studies focusing on milk samples stated the occurrence of microplastics, mainly due to the release of some tiny plastic particles from the tubes of the milking machine. In addition to this, the analytical challenges associated with the quantification and characterization of microplastics in these matrices have received limited attention. In the current scientific scenario, there is not standardised methodology for the extraction and chemical analyses of microplastics from cheese.

This study is the first to explore the presence of microplastics in cheese. We present a novel analytical approach for cheese sample preparation prior to conducting a chemical analysis for microplastics detection. Various digestion methods were evaluated, with alkaline digestion (5 M KOH at 50 °C for 48 hours) demonstrating a digestion efficiency of 97.5±0.8 %. To validate the proposed preparation technique, polystyrene microbeads (~10 µm) were spiked into samples, yielding a recovery rate of 98.5±0.4 %. Additionally, the impact of the digestion process on the microbeads was assessed. To further verify the plastic nature of microparticles, pyrolysis–gas chromatography–mass spectrometry was used to successfully identify spiked microplastics, including polystyrene (150 µm) and polyethylene terephthalate (300 µm).

This study was carried out under the grant BRIC.INAIL ID 14/2022 “Approccio integrato per la determinazione e la caratterizzazione di microplastiche aerodisperse in ambienti di lavoro”. Project title: “Caraterizzazione delle Emissioni in Luoghi di LavOro di microPlasticHe Aerodisperse e Nanoplastiche – CELLOPHAN”.

Keywords: Microplastics; Food; Pyrolysis; GC-MS

ICEES-24/CP-(YS) 005

AQUATIC WEEDS AS RESOURCE OF BIOENERGY AND FERTILIZER: A SUSTAINABLE APPROACH FOR RURAL DEVELOPMENT

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Abstract

Aquatic weeds in rural ponds present serious challenges, such as obstructing water flow, reducing water quality, disrupting fishing activities and local ecosystems. Aquatic weeds have exceptionally high reproduction rates, are rich in cellulose and hemicellulose, and contain a negligible amount of lignin, making them an ideal crop for the next generation of biofuels. The current study focused on the Biomethane potential (BMP) of aquatic weeds such as *Eichhornia crassipes, Pistia stratiotes, Vallisneria spiralis, Spirodela polyrhiza, Lemna minor* available in Santiniketan, West Bengal, India. The BMP test of the aquatic weeds was carried out in batch mode at 2:1 inoculum to feedstock ratio over a period of 45 days using cow dung as an inoculum using AMPTS II instrument. The BMP yield from *Eichhornia crassipes, Pistia stratiotes, Vallisneria spiralis, Spirodela polyrhiza, Lemna minor* were 220.01 ml /gm Volatile solids (VS), 190.60 ml/gVS, 69.49 ml/gVS, 155.40 ml/gVS, 180.63 ml/gVS respectively. The maximum reduction in chemical oxygen demand (COD) during the BMP test observed in *Spirodela polyrhiza* and *Eichhornia crassipes*, achieving reductions of 88.10% and 87.36%, respectively. The highest reduction in VS during anaerobic digestion was achieved with *Pistia stratiotes*, i.e. 83%, followed by *Eichhornia crassipes*(78%), *Spirodela polyrhiza*(73%), *Lemna minor* (71%), and *Vallisneria spiralis* (62%). There was a significant reduction in volatile fatty acids for all the weeds.The theoretical potential for electricity generation from the biogas produced was evaluated, with *Eichhornia crassipes* and *Pistia stratiotes* exhibiting the highest electricity output. These species exhibit great potential as feedstocks for biogas production, supporting sustainable biogas and electricity generation, particularly in rural areas. The digestate slurry produced from anaerobic digestion contains a substantial amount of nutrients, making it suitable for use as fertilizer. *Pistia stratiotes* exhibited the highest total nitrogen content (2179.2 $kg.ha^{-1}$), followed by *Eichhornia crassipes*(1748 $kg.ha^{-1}$) and *Spirodela polyrhiza* (1378.4 $kg.ha^{-1}$), all with elevated levels of organic carbon.Biogas and renewable electricity enhance energy security in rural communities, reducing reliance on traditional fuels. Nutrient-rich digestate as fertilizer boosts agricultural productivity, supporting sustainable practices and local economies.

Keywords: Invasive Aquatic Plants, Biogas, Clean Fuel, Women Empowerment

EXCEPTIONAL COMPATIBILITY WITH COMMERCIAL DETERGENTS AND ENSURING SUPERIOR CLEANING PERFORMANCE OF PROTEASE ENZYME

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Abstract

Lonar Lake lies within the only known extraterrestrial impact crater found within the great Deccan Traps, a huge basaltic formation in India. The lake was initially believed to be of volcanic origin, but now it is recognized as an impact crater. The *Bacillus pseudofirmus* produced protease at a maximum rate after 72 h of incubation at 37 °C with an agitation speed of 120 rpm and 5 of starter culture. It was set up that those proteases from *Bacillus pseudofirmus* showed advanced comity with Nirma, Surf Excel, Sargam Plus, and Active Wheel and remained lower in Tide, Ariel and Rin at zero time. The *Bacillus pseudofirmus* strain demonstrated optimal protease production after 72 hours of incubation at 37°C, with an agitation speed of 120 rpm and 5% starter culture. The study revealed initial compatibility trends, where the proteases showed varying degrees of effectiveness with different detergent brands. However, after incubation with detergents at specific conditions, the compatibility of the proteases shifted, indicating potential for enhanced performance under certain circumstances.

Keywords: Alkaline Protease, *Bacillus pseudofirmus*, marshland performance test, compatibility test

ICEES-24/CP-002 (AP)

MEDICINAL BIOTECHNOLOGY: PRODUCING THERAPEUTIC DRUGS FROM PLANT SECONDARY METABOLITES

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Abstract

The world of medicine is always looking for new ways to fight diseases, and one key way is through the magic of plants. This chapter takes a deep dive into how the blend of plants and tech leads to new drugs. For ages, plants have been treasure chests of healing powers. Now, with tech on our side, we can dig deeper into plants to pull out special bits called secondary metabolites. These are the secret ingredients we use to make powerful medicines. We clean, shape, and change these plant parts into drugs that are safer and work better. This trip into the plant world shows us the tools and tricks of turning plants into medicines. It covers how we grow plant cells in labs, tweak their building blocks, and even use cutting-edge tech like synthetic biology to make drugs in a precise and big-scale way. Plus, it looks at how these plant-based drugs can fight a wide range of health problems like cancer, heart disease, brain issues, and infections. It points out how important these natural bits are in making medicines that can truly change lives for the better. To wrap it up, this chapter really shows the huge role that tech plays in turning plant secrets into powerful drugs. By mixing what nature gives us with the latest tech, experts are making new drugs that are safe and work well. This is great news for anyone looking to have a healthier and longer life.

Keywords: New tech in biology, finding new drugs, drug-making with biology, plant special parts, drug treatments.

ICEES-24/ CP- 003 (RS)

STUDY OF ANTICANCER ACTIVITIES OF SOME MEDICINAL PLANTS AGAINST DMBA-INDUCED BREAST TUMORS IN RATS

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Abstract

Breast cancer is the most common and frequent malignancy in women and its metastatic state represents the second most cause of mortality. Breast cancer is one of the main threats to women around the world. As per WHO data there were 2.3 million women diagnosed with breast cancer and 6,85,000 deaths globally. At the end of 2020, there were 7.8 million women alive who were diagnosed with breast cancer in the past 5 years, making it the world's most prevalent cancer.

It can occur at any age but the incidence rates in India begin to rise in the early 35 and peak at the age between 50-64 years. (DMBA) 7, 12-Dimethylbenz(a)anthracene among the various risk factor, the environmental factors have also been known as a possible contributing factor for the potential development of breast cancer.DMBA is a type of PAHs, widely and best used to induce mammary cancer in experimental rat model. DMBA is a chemical carcinogen that gets metabolically activated inside the body to the active form DMBA-3, 4- dihydrodiol-1, 2-epoxide (DMBA-DE). 7, 12-Dimethylbenz(a)anthracene (DMBA) is a type of polycyclic aromatic hydrocarbon (PAH). It is regarded as an important environmental pollutant. It is a chemical carcinogen. In laboratory condition, it is widely used to induce breast cancer in model animals. There are drugs for the treatment of cancer but they are costly and have very intense side effects. The best alternative is the use of traditional Indian medicine. A lot of literatures are available supporting the key role of medicinal plant extracts for the treatment of breast cancer.

Some medicinal plants like {Aegle Marmelos(Wood Apple), Ocimum Sanctum(tulsi), Amomum Subulatum(Black Cardamom), Mangifera Indica(Mango),Bombax Ceiba(Simal) and Cinnamomum Verum} have anti-cancerous properties. This will be a safe, effective and economical treatment of the disease.

Keywords: Breast Cancer, Metastatic, Environmental Factors & Pollutants, Carcinogenic Chemical, DMBA, Polycyclic aromatic hydrocarbon (PAHs), Medicinal plant extracts.

ICEES-24/ CP-004 (P)

SITE SPECIFIC AND SEASONAL VARIANCE IN ODONATE SPECIES DIVERSITY: A CASE STUDY FROM WEST BENGAL

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Abstract

Odonates are predominantly dependent on the aquatic habitats, be it seasonal or perennial. Starting from egg laying to development of larvae, they remain close to water. In West Bengal, there are three major seasons with a four month long monsoon creating several seasonal water bodies which might impact the diversity as well as abundance of odonates. While previous studies documented odonate diversity, there remains a notable gap in understanding the seasonal pattern of the abundance and diversity of these species. This study aims to address this gap by examining the seasonal variation in odonates across five distinct sites within Purba Barddhaman, each characterized by unique topographical features. We employed direct and opportunistic search for data collection for two consecutive years, providing comprehensive data on odonate diversity and distribution patterns across different seasons. We calculated the diversity indices and also did pair wise comparison across seasons regarding species abundance.

We documented 47 odonate species, with high species diversity indicated by a Shannon diversity index (H' = 3.21966) and a Simpson diversity index (D = 0.95077). These indices suggest a high likelihood of encountering different species from random samples. To compare the difference in total number of species encountered across seasons, we performed Friedman test, chosen for its suitability with non-normally distributed and paired data (Shapiro-Wilk test: p = 2.116e-14). The test revealed significant seasonal differences in species abundance (Friedman chi-squared = 46.139, df = 2, p-value = 9.574e-11). Subsequent pair wise comparisons using the Wilcoxon signed-rank test indicated significantly higher species abundance during the monsoon compared to pre-monsoon and post-monsoon periods (Pre-monsoon vs. monsoon: p = 3.8e-07; Monsoon vs. post-monsoon: p = 3.8e-07).

These findings highlight the dynamic nature of odonate populations in response to seasonal changes, with monsoon season fostering higher species abundance. The results also indicate importance of seasonal water bodies and probably seasonally occurring hydrophytes and can prove to be crucial for effective conservation and management of odonate habitats.

Keywords: Species abundance, purba bardhaman, monsoon, seasonal and perennial water bodies

ICEES-24/ CP-005 (AP)

POSITIVE EFFECT OF UV RADIATION ON THE QUALITY OF TEA

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Abstract

Tea is famous as beverage worldwide as well as it has immense ethnomedicinal value. Quality of tea is controlled by various biotic and abiotic factors. Due to Global climate change the elevate dose of UV radiation is hitting over the Earth's surface through ozone holes of the atmosphere causing oxidative damage in various forms of living systems. Plants are having stationary lifestyle which are exposed to various doses of natural UV radiation causing not only negative impact as oxidative damage but also is upregulating the quality parameters as antioxidants which in turn serve as antimicrobial and anticancer agents. High altitude grown tea is also susceptible to the various doses of natural UV radiation which is the causative factor to up regulate commercial and therapeutic quality parameters as secondary metabolites. Such components include flavonoid glycoside as Rutin which is cleaved by enzyme Beta D Glucosidase to release the volatile aroma components as linalool. Seven valleys of Darjeeling receives differential doses of UV radiation having different zenith angels. The optimum dose is received at around 4500 ft msl Kurseong South gardens mainly Castleton. The altitudinal and seasonal variation of natural UV dose can significantly vary to upregulate different quantity of quality parameters (assessed with ANOVA analysis). The same dose as artificial UV exposure could be replicated to add secondary values as aroma and therapeutic components like antioxidant, antimicrobial potential in potted tea plant in laboratory. The quality parameters as upregulated secondary metabolites in tea could be analysed by FTIR, HPLC, Spectrophotometric and Spectrofluorimetric scan, TLC analysis. The upregulated compounds could be isolated and purified for the formulation of modern neutraceutical. Post harvest tea during manufacturing could also be exposed to artificial UV radiation dose to enhance commercial and therapeutic quality parameters in tea.

Keywords: UV radiation, tea, High altitude, antioxidant, Rutin, aroma, antimicrobial potential

ICEES-24/ CP-006 (P)

CONFIGURATIONAL DEPICTION OF DIFFERENTIALLY EXPRESSED *13-LIPOOXYGENASE* AND *12-OXOPHYTODIENOATEREDUCTASE GENE* UPON PATHOGEN INFECTION IN LEGUMES

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Abstract

Biotic agents such as viruses and fungus are the main cause of decline in productivity of economically important plants worldwide. Plants like *Phaseolus vulgaris, Vigna mungo, Cicer arietinum* are the important crops fall in Leguminosae family are severely affected by these agents.

Legumes are rich in dietary fibers and a reliable source of proteins that enhances the cereal-based diet. Being a cost-effective commodity for farmers, makes it one of the most important crops in Asian countries. Henceforth, it's crucial to understand the molecular mechanism of pathogens, like bean common mosaic virus (BCMV) associated with legumes and to identify the genes involves in the plant-pathogen interaction. Thus, knowing thestructural characterization of genes namely 13-LOX and OPDA reductase, an important enzyme in jasmonic acid metabolism, may help us to understand the molecular interaction linked with pathogens.

In the present work, we have tried to understand the structural similarities and relationship between differentially expressed 13-LOX and OPDA reductase gene in legumes upon BCMV infection. The sequences were extracted from the Phytozome v13 and the structural analysis was done using in-silico analysis tools. The structural information obtained will decipher the basic understanding of the structural changes and the evolutionary relationship of 13-LOX and OPDA reductase upon BCMV infection in *Phaseolus vulgaris.*

Keywords: legumes, bean common mosaic virus, plant-pathogen interaction, jasmonic acid metabolism, Phytozome v13, in-silico analysis tools.

ICEES-24/ CP-007 (RS)

STUDY OF CHANGE IN WATER BODIES AND ITS EFFECTS DUE *EICHHORNIA* IN PURULIA TOWN, WEST BENGAL

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Abstract

Eutrophication is a global issue now a days and due to excessive nutrient load in water bodies it provides luxurious water environment for water hyacinth. It affects the complete pond ecosystem and may damage the plants or other organisms of these ponds.

Lakes and Ponds are among the most important freshwater habitats because of its ecological importance and traditional uses in India. Ponds are used for various purposes like bathing, drinking, washing cloths and utensils, feeding animals, irrigation, and other anthropogenic activities. All these activities apparently increase nutrient load in water bodies. Surface water pollution is a major issue which leads to eutrophication in ponds. Eutrophication due to Eichhornia leads to disruptive effects on the ecosystem. Eichhornia is an invasive plant also known as 'Terror of Bengal" because of its unstoppable growth and distribution. The objective of this study is to detailed investigation of water pollution due to Eichhornia and other anthropogenic activities in different ponds in Purulia town.

The methodology for research involves field surveys, water sample collection and laboratory work etc. The field surveys show the changes in the pond ecology during time period. Water samples give results of changes in many parameters like pH, temperature, conductivity, Turbidity, Chloride, Floride, Iron in water due to pollution.

The research shows the effect on other aquatic plants due to Eichhornia and other anthropogenic substances which possess significant threat to ecology of these ponds. The ponds eventually convert into swamp with loss of many water organisms and plants which changes the utilization of these water bodies.

The outcomes will assist to identify priority areas where measures and precautions can be taken to control pollution and help sustainable water management studies. By reducing nutrient load in water bodies eventually reduce the growth of water hyacinth and other invasive plants. Wastewater should not be drained into the ponds; erosion controls and pollution prevention strategies and strict rules and regulations should be applied. This paperwork gives awareness about the water pollution, its consequences and how to mitigate the severe effects of water pollution.

Key words: Surface water pollution, pond ecosystem, nutrient load, Eichhornia, eutrophication.

ICEES-24/ CP-008 (P)

MITIGATION OF ALUMINIUM TOXICITY BY SYNERGIC INTERACTION OF *Pseudomonas putida* & *Glomus etunicatum* IN ACID SOIL ON PHYSIOLOGICAL CHARACTERISTICS OF SEEDLING GROWTH IN *Arachis hypogaea* L.

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Abstract

The aluminium (Al) toxicity particularly in acid soil exerts significant phytotoxic effects which limits the plant growth, development and yield all over the world. In acidic soil (pH < 5.0) conditions, the highly soluble forms of aluminium (Al^{3+}) primarily inhibits root growth and disrupt the uptake of water and nutrients thereby causing adverse alteration in physiological, biochemical and molecular processes of plants. So this study aims to conceptualize the use of beneficial microorganisms that would be one of the most promising solutions for this problem. These are the microorganisms that interact with plant roots and modulate different activities in soils and plants which help the plants to grow better in stress conditions. The objective of this study is to analyse the effects of soil acidity induced Al toxicity with or without the co-inoculation of microorganisms on biochemical & physiological changes in groundnut seedlings at different concentrations of $AlCl_3$. The effects of these treatments were studied on 14days and 25days old seedlings. The root and shoot growth, content of chlorophyll, carotenoid, MDA , H_2O_2, proline , soluble protein and anti-oxidant enzyme activity assay (CAT, SOD, POD) were analysed to evaluate the effects of Al-toxicity. It was observed that the amount of total chlorophyll and carotenoids decreased gradually whereas amount of MDA, H_2O_2, proline, soluble protein increased with increasing concentration of $AlCl_3$. A gradual significant increase in catalase activity (CAT), peroxidase activity (POD) and superoxide dismutase (SOD) activity was also observed with an increase in Al concentration. But, the significant positive impact had observed when seedlings were grown with the co-inoculation of *Pseudomonas putida & Glomus etunicatum*. The results of this study clearly showed that the co-inoculation of these microorganism, significantly ameliorated Al toxicity-induced changes in the above-described parameters. Our approach to this formulation could be a non-toxic, economical, and eco-friendly alternative for reducing the detrimental effect of Al-toxicity on crop performance and help in overall sustainable agriculture development in India and the world.

Keywords: Al toxicity, Groundnut (*Arachis hypogea L.*), Soil acidity, *Pseudomonas putida, Glomus etunicatum*.

GREEN SYNTHESIS OF METAL NANOPARTICLES AND NANO-REMEDIATION OF WASTEWATER; A REVIEW.

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Abstract

Green synthesis of metal and metal oxide nanoparticles has been a highly attractive research area over the last decade. Numerous kind of natural extract have employed as efficient resources for the synthesis or fabrication of these material. It is based on bio component derived materials. Nanoparticles is likely to be applied extensively both in the field of environmental remediation and in the other important areas. It offers a possible platform for improving water and wastewater treatment process at the nanoscale .Green nanotechnology enables the translation of existing green chemistry principles and engineering for the delivery of nano product for environmentally friendly applications. The major objective of green nanotechnology is the sustainable production of nanomaterials and products by cost effective non- toxic, environment friendly and more stable when compared to other physical, and chemical methods. The green synthesized metallic nanomaterial are now being extensively used for various applications such as water treatment, agricultural industries, textile industries etc due to their greener approach and properties. Green synthesis methodology based on biological precursors depend on various reaction parameters such as solvent temperature, pressure, PH condition etc. For the synthesis of metal or metal oxide nanoparticles plant biodiversity has been broadly considered due to their availability of effective phytochemicals in various plant extracts especially in leaves such as ketone aldehyde ,amide etc which are capable of reducing metal salt into metal nanoparticles . Nano- remediation currently refers to the application of nanotechnology that contains the use of fabricated nanomaterial to clean contaminated water and other resources. Nanoparticles have remarkable potential for use in environmental scanning application nanomaterials offers the potential for treatment of surface water groundwater wastewater and other environmental materials contaminated by toxic metals ion, organic and inorganic solute and microorganism . They can act as good nano-adsorbant used for wastewater treatment. They have been found to be very highly effective in removal of pollutants from waste water.

Keywords: Green nanotechnology Nanoparticles, Waste water, Remediation.

ICEES-24/ CP-010 (AP)

BIOREMEDIATION AND BIOSORPTION OF CHROMIUM (VI) BY BREVIBACILLUSBREVIS US575 ISOLATED FROM TANNERY EFFLUENTS AND THEIR POTENTIAL INDUSTRIAL APPLICATION

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Abstract

West Bengal has several leather industries and as such huge amount of leather are processed every year. The tannery effluents are discharged into the land and open water causing soil and water pollution respectively. Chromium is one of the most toxic inorganic contaminant which is well known for its carcinogenicity. Thus, our study focuses on investigating the bioremediation potential of common microflora isolated from tannery wastewater. In our study, Isolate 1 has the highest ability to reduce chromium (Cr^{6+}) as compared to others. Isolate 4 has the highest protease, lipase and leather degradation activities. Isolate 1 shows the maximum keratinase activity making it an effective strain for keratinase production. Also, it has been found that pH 8 and temperature 40°C was most suitable for keratinase production. Owing to the multidimensional ability of these two isolates, they were identified by 16S rRNA sequencing and it reveals that Isolate 1 and Isolate 4 belong to *Bacillus cereus* F4810/72 and *Brevibacillus brevis* F4810/72 respectively. *Brevibacillus brevis* US575 has a high tolerance level to Cr6+ ions. Utilizing microorganisms that can withstand high metal concentrations may emerge as a promising tool for the remediation of contaminated water sources. The Cr(VI) adsorbed from the solution in the aqueous phase during the 60-min contact period in this experiment was nearly 78%. Studies on the concentration of biomass, pH of the medium, and the starting concentration of metal ions have also been seen to afect the rate of biosorption. The biosorption efficiency of *Brevibacillus brevis* US575 at optimized conditions of initial metal concentration of 200 µg/mL, 3 g/L of biomass dose, pH 2.0, 45 °C, for 60 min at 60 rpm was 78.58% and the biosorption capacity (Qe) is 108.48 mg/g of the biosorbent. According to the desorption investigation, 1 M HCl outperformed all other concentrations of HCl, NaOH, and pure water. The highest capacity of adsorption of the bio-adsorbent was calculated using the Langmuir model. The monolayer adsorption process was determined, and since the Freundlich model's 1/n value fell inside 1, favorable adsorption has been postulated. According to the results of this study, the bacterium isolated from tannery wastewater was found to be the best alternative and could be used to create plans for bioremediation and biosorption to combat current environmental pollution.

Keywords: tannery, chromium, biosorption, bioremediation

ICEES-24/CP-011(RS)

JURASSIC-CRETACEOUS TRANSITION IN THE KUTCH BASIN: INSIGHTS INTO GLOBAL CLIMATE, BIODIVERSITY SHIFTS, AND SEA-LEVEL CHANGES

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Abstract

The Katesar and Ghuneri Members belonging to the underlying Jhuran and overlying Bhuj Formations respectively in the Kutch Basin of western India offer crucial insights into the interplay between global climate change, depositional environment fluctuations, and biological diversification during the Mesozoic era. The Kutch Basin, a prominent sedimentary basin, captures a rich record of the Jurassic to Cretaceous period particularly through these two formations. The Katesar Member, part of the Jhuran Formation, is characterized by its marine depositional environment, indicating a period of high sea levels and warmer global climates. Sedimentological evidence suggests a fluctuating environment with both transgressive and regressive phases, likely driven by global sea-level changes, groundwater table sway and regional tectonic activity. These shifts had a profound impact on the marine ecosystems, fostering conditions that supported diverse marine life, including ammonites, belemnites, and other marine invertebrates. In contrast, the Ghuneri Member, belonging to the Bhuj Formation, represents a transition to more continental and fluvial depositional environments, reflecting a shift towards a relatively cooler and more arid climate during the Early Cretaceous. The shift from marine to continental environments during this period correlates with significant changes in faunal assemblages, particularly with the emergence and diversification of marginal marine to terrestrial life forms. A comprehensive analysis of stratigraphic architecture in relation to palaeogeographic variations and global climate changes in the Kutch Basin had a profound impact on the biodiversity of the region. This study contributes to our understanding of the complex interactions between climate, tectonics, and biotic assemblage in the geologic past, offering valuable insights into the factors that have shaped the Earth's evolutionary history. Modeling the breakup of Gondwanaland and subsequent developments along the West Coast, the research highlights the Jurassic sea-level changes and the final phase of drifting of the Indian plate reflects the influence of Jurassic climatic fluctuations on tectonic processes. This study adds a crucial dimension to the discourse on climate change by linking ancient geological processes to present-day environmental shifts, providing insights into how past climate changes can inform current climate change with its potential impacts and predictions.

Keywords: Global climate change, Jurassic-Cretaceous transition, Sea level changes, Biodiversity shifts, Kateswar and Ghuneri Members, Kutch.

ICEES-24/CP-012 (RS)

ICHNOFABRIC TIERING IN WAVE DOMINATED SHELF DELTA AND ITS SIGNIFICANCE: A STUDY OF THE HAMIRA MEMBER, JAISALMER

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Abstract

The ichnological analysis of the Middle Jurassic wave-dominated shelf delta of the Hamira Member, within the Jaisalmer Formation, sheds light on the intricate relationships between depositional environments and biogenic activity. The study addresses identification of ichnoguilds and ichnological events underscores the vulnerability of ecosystems to changes in physico-chemical conditions. The reconstructed palaeoecological framework reveals how shifts in oxygen levels and substrate types influenced trace-maker diversity, mirroring modern challenges faced by marine and coastal ecosystems. Threats such as ocean acidification, pollution, and habitat degradation are modern analogs to the dysoxic and oxic profiles that shaped the Middle Jurassic biota. The findings contribute to our understanding of ancient biodiversity patterns, offering parallels to modern ecosystems. By studying these ancient environments, it can be inferred potential threats to contemporary biodiversity, such as habitat fragmentation and climate change. Conservation efforts should focus on preserving diverse ecosystems that are resilient to such disruptions, informed by the lessons of past biogenic and depositional processes, managing environmental stressors. Mitigation strategies should prioritize maintaining environmental stability, protecting critical habitats, and fostering resilience in ecosystems to counteract these threats, informed by the long-term ecological impacts observed in the fossil records and to ensure the survival of trace-making communities as well as other biota in contemporary settings.

Keywords: Ichnofabric, Tierings, Wave-dominated, Shelf-type delta, Bio-diversity, Threats, Hamira Member, Physico-chemical characteristics.

ICEES-24/CP-013 (RS)

BIOCHEMICAL AND MOLECULAR CHARACTERIZATION OF BACTERIAL DIVERSITY PRESENT IN CURED CHEWING TOBACCO LEAVES AND GREEN TOBACCO LEAVES.

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Abstract

Tobacco use in any form is a global health concern, with smokeless tobacco (SLT) containing harmful chemicals and carcinogens like tobacco-specific nitrosamines (TSNAs). This study examines the microbial diversity in green and cured tobacco leaves, particularly khaini of Jharkhand, India. Green leaves harbour microbes essential for fermentation but can also produce harmful compounds like TSNAs and lipopolysaccharides (LPS) during curing and storage of tobacco products. Culture-based methods and biochemical analysis was employed to assess bacterial communities' physiological activities, complemented by 16S rRNA gene sequencing for molecular characterization. Cultural, morphological, and biochemical data were encoded in binary form and analyzed with the NTSYS-pc software package. A similarity matrix was generated by calculating a simple matching coefficient, and the UPGMA algorithm was used to conduct hierarchical cluster analysis and construct dendrograms. Few isolated strains were finally identified by 16s rRNA sequence analysis. These findings underscore the need for assessing microbial risks in SLT products to enhance public health safety.

Keywords: Smokeless tobacco (SLT), khaini, Bacterial diversity, Tobacco-specific nitrosamines (TSNAs), Culture-based methods, 16s rRNA sequencing.

ICEES-24/CP-014 (P)

BIOPESTICIDES: A DOUBLE-EDGED SWORD - UNVEILING THE TOXICITY OF MACROCYCLIC LACTONES THROUGH BIOINFORMATIC ANALYSIS

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Abstract

While widely used in agriculture, macrocyclic lactones have been relatively understudied in terms of their potential environmental impacts. The potential carcinogenic effects of macrocyclic lactones raise significant concerns, emphasizing the importance of further research into these alternative biopesticides. To better understand the toxicity of these compounds and mitigate potential risks, we conducted a comprehensive bioinformatics analysis to identify their targets within the human body. By characterizing the proteins that interact directly or indirectly with macrocyclic lactones, we aimed to elucidate the biological pathways involved in their toxicity and identifying the proteins that can interact with them directly or indirectly using the STITCH and STRING platforms. An enrichment analysis was performed on those overrepresented proteins/genes associated with the category “Biological Process” and “KEGG PATHWAYS” from the Gene Ontology and SHINYGO databases respectively. It was found that, in general, these biopesticides could affect both signaling pathways related to cell proliferation, programmed cell death, stress response, as well as the cellular response to xenobiotics, processing, maturation and biogenesis of ribosomal RNA. In addition, possible associated pathologies were found, such as neuro-degeneration, Lupus and cancer. These findings can give an account of their potential to produce diseases such as different types of cancer.

Keywords: macrocyclic lactones; carcinogenic effects; protein targets; bioinformatics analysis; gene ontology

ICEES-24CP-015 (AP)

DEVELOPMENT OF BIOFERTILIZER USING ISOLATED AND CHARACTERIZED PLANT GROWTH PROMOTING STRAIN OF *ENTEROBACTER SP.*

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Abstract

A strain of Plant growth promoting bacterium was isolated from the irrigation well water of Chakdah Block of Nadia District, West Bengal, India. Biochemical analysis of the bacterial strain followed by 16S rDNA sequencing, Phylogenetic analysis and Scanning electron microscopy identified the bacterium as *Enterobacter sp.* The bacterium showed plant growth promoting properties like nitrogen fixation, potassium and phosphate solubilization, and auxin (indole-acetic acid), siderophore, acetoin and ammonia production, in *in vitro* condition. Sequencing and analysis of the bacterial genomic and plasmid DNA showed the presence of gene, gene clusters and operons responsible for plant growth promotion and further classified the bacterial strain as *Enterobacter sichuanensis* strain WCHECL1597. Pot experiments and field application of this bacterial strain showed increase in plant height, dry weight of root & shoot, chlorophyll content, root length, fruit weight, fresh weight of plant and branches per plant. Leaf curl is a common viral disease of chili plant. Whitefly is the vector of the Leaf curl disease. Whitefly infestation can be minimized by spraying aquatic suspension of this bacterial culture once in 2 weeks. Therefore, we propose to patent the biofertilizer made from this bacterium for sustainable agriculture.

Keywords: 16S rDNA sequencing; Whole genome sequencing; *Enterobacter* sp.; Plant Growth Promoting Bacteria; Biofertilizer; Leaf curl disease management

ICEES-24/ CP-016 (W)

APPLICATION OF *Microbacterium paraoxydans* AS BIOFERTILIZER FOR SUSTAINABLE AGRICULTURE

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Abstract

A bacterium was isolated from garden soil of Mahishasthali village of Bhagwangola I block of Murshidabad district. Through biochemical test, 16S rDNA sequencing & subsequent phylogenetic analysis, and scanning electron microscopy, the bacterium was identified as *Microbacterium paraoxydans*. The whole genome sequencing showed that isolated strain consisted of several genes associated with plant growth promotion, including those involved in auxin biosynthesis, siderophore production, phosphate acquisition, etc. The bacterium was capable of producing indole acetic acid and siderophores in the culture medium. It can also solubilize insoluble phosphate sources in Pikovskaya medium. These traits significantly enhanced the plant growth. The plant growth-promoting potential of the isolated bacterium was further validated through pot experiments using Chilli plant (*Capsicum annuum* L var Tejoswini). Treatment of chilli seedlings with a bacterial suspension (1% of 10^8 cfu/ml) resulted in increased root and shoot dry weight, plant height, number of branches, and overall plant weight, as well as higher chlorophyll content and fruit yield. These results suggested that the plant growth-promoting genes of *Microbacterium paraoxydans* strain DSM 15019 positively impacted the growth and yield of chilli plants. The findings of this study emphasized the bacterium's potential as a plant growth promoter, which could be further explored in field trials. After successful field trials, the bacterium could be applied as a biofertilizer to boost plant growth and yield in an eco-friendly and cost-effective manner.

Keywords: 16S rDNA sequencing; *Microbacterium paraoxydans*; Whole genome sequencing; Plant growth-promoting bacterium; Biofertilizer

SUB-CHRONIC TOXICITY STUDY OF *CLERODENDRUM INFORTUNATUM* IN RATS

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Abstract

Clerodendrum infortunatum [Family :Verbenaceae] is commonly known as Bhandi in *Sanskrit* and popularly called Bhatesh in Hindi grown in temperate zone of India. Leaves have been used as Ayurvedic remedy for fever, antipyretic, antihelminthic, antidiabetic and skin diseases.

The present study investigates the safety and efficacy of *Clerodendrum infortunatum* [Leaves] on Sub-Acute toxicity in rat.

Albino rats (Wistar strain) weighing 100-120g were divided into 4 groups. The each group contains equal male and female (5M + 5F=10), was treated with *Clerodendrum infortunatum* at the dose level of 200, 100 and 20 mg/kg daily for 28 days. Group I received double distilled water in same ratio served as control (vehicle). The mortality rate, behavioral changes, if any was recorded during the experimentation. The body weight of animals, measured food and water were recorded weekly upto 28 days. Investigation of all animals in each group for the blood haematology (RBC, Hb, Prothrombine time, W.B.C., TC, DC, MCV, MCH, MCHC) and blood biochemistry (Blood glucose, SGOT, SGPT, Serum creatinine) on 28th day. All animals in each group have been sacrificed on 30th day, the following vital organs *viz*., liver, kidney, lungs, spleen, ovaries, testes, stomach and intestine were separated, weighed for histopathological investigation of toxicity of the drugs, if any. The result was statistically analyzed by student't' test and one way ANOVA.

Clerodendrum infortunatum shows no significant effect in the blood haematology (RBC, Hb, Prothrombine time, W.B.C., TC, DC, MCV, MCH, MCHC), blood biochemistry (Blood glucose, SGOT, SGPT, Serum creatinine) body weight, weight of vital organs in comparison to control.

The Sub-acute toxicity studies indicate that *Clerodendrum infortunatum* has safe upto the doses of 200 mg/kg caused no mortality and normal behavior in rats .The results shows that *Clerodendrum infortunatum* may be used for pharmacological testing.

Keywords: Sub-Acute Toxicity, Clerodendrum infortunatum

ICEES-24/ CP-018 (P)

UNRAVELLING THE COMPLEXITY OF THE MICROBIOME OF PERIPLANATA AMERICANA: A DIVE INTO THEIR INTERACTIONS

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Abstract

American cockroach (*Periplaneta americana)* is considered to be the largest species of common cockroach. Studies show that there are more than 4000 species of cockroach out of which 40 species are considered as pests. They tend to survive in warm and humid areas as well as in cooler conditions. Furthermore, they are potential carriers of organisms that can cause diseases like cholera, typhoid, and gastroenteritis just to name a few. In India, the two commonly found cockroach species are *Blatta orientalis* and *Periplaneta americana.* This paper aims to look into the diverse interactions that takes place in a cockroach's (*Periplaneta americana*) microbiome obtained from an urban metropolitan area in Kolkata, India and investigate its microbiome. For this experiment, the hind gut of the cockroach was mainly taken into observation along with some of it's external parts such as it's wings, legs, etc. The microbiome isolated from the gut revealed the presence of various bacteria which were observed under various differential media such as HiCrome UTI, HiCrome Bacillus and Maconkey agar, as well as various fungi, which were grown for observation in PDA media. Hence, the presence of both bacteria and fungi in the cockroach's gut itself suggested that there is a coexisting relationship between the gut bacteria and fungi of the cockroach, which was studied. Furthermore, the interaction of *Aspergillus niger* with the bacteria isolated from the wings, legs and antenna of the cockroach was studied, and it was found that it did not hinder their growth. In other words, *Aspergillus niger* showed associative growth with the microbiome of the cockroach. However, when *Aspergillus niger* was interacted with laboratory strains of other bacteria such as *S aureus*, *B subtilis*, *Enterococcus sp* and *Streptococcus sp*, it had hindered their growth. To conclude, it is proved that there is indeed a diverse microbial interaction that occurred within the microbiome of the cockroach wherein a fungus showed associative growth with only the bacteria indigenous to the microbiome of the cockroach.

Keywords: *Aspergillus niger*, associative growth, gut microbiome, cockroach

ADDRESSING THE CHALLENGES OF MDR BACTERIA AND ATCC STRAINS: THE POTENTIAL OF *PASSIFLORA FOETIDA* IN ANTIMICROBIAL THERAPY

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Abstract

Antimicrobial resistance (AMR) is a critical global health concern under the present clinical scenario. Along with overuse in the healthcare sector, the misuse of antibiotics in agriculture further aggravates the transmission of resistant bacteria to humans through the food chain. In medical epidemiology, the rise of multidrug-resistant (MDR) bacteria and the presence of American Type Culture Collection (ATCC) strains pose significant challenges in treating microbial infections. Methicillin-resistant Staphylococcus aureus (MRSA), Vancomycin-resistant Enterococci (VRE), and Carbapenem-resistant Enterobacteriaceae (CRE) are some of the common MDR pathogens, resistant to multiple antibiotics, which cause severe bloodstream infections, pneumonia, and urinary tract infections and lead to prolonged illnesses and increased mortality. The minimum inhibitory concentration (MIC) values for the MDR strains often exceed those of ATCC strains, highlighting the need for more potent and effective antibiotics. ATCC strains, though not typically resistant, possess lower MIC values which provide critical baseline data and are essential for antimicrobial susceptibility testing and serve as reference strains for monitoring the efficacy of new antibiotics and therapeutic agents. The evolving resistance patterns among these reference strains can influence clinical breakpoints and treatment guidelines. This research is aimed to investigate potential alternative therapies to combat the impact of these common MDR and ATCC strains on human health. Mitigation strategies aim to identify novel antimicrobial agents through bacteriophage therapy, antimicrobial peptides, and plant-based antimicrobials to overcome bacterial resistance mechanisms. Under this study, *Passiflora foetid*a, or stinking passion flower, well-known in traditional medicine for its safety and efficacy, was investigated as a possible plant-based antimicrobial agent. The MIC values of *Passiflora foetida* leaf extract ranged between 5-10 mg/ml for different MDR and ATCC bacteria, indicating its potential as an effective antimicrobial agent. The findings of this study emphasize the need for continued research and innovation in plant-based alternative therapy for antimicrobial resistance. Future research should focus on optimizing extraction methods of plant-based bioactive agents demonstrating antimicrobial effects, to maximize efficacy in animal models and clinical trials. Additionally, responsible use of antibiotics and alternative comprehensive strategies are essential to mitigate the impact of MDR bacteria and ATCC strains on human health.

Keywords: Antimicrobial resistance, Antimicrobial agents, MDR, ATCC, Infections, Antibiotics.

ICEES-24 /CP-020 (UG)

BIODIVERSITY OF AIR-BORNE BACTERIA CAUSING RTI IN HEART OF SOUTH KOLKATA

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Abstract

Airborne microorganisms, notably pathogens like Streptococcus pneumoniae and Mycobacterium tuberculosis, pose a significant public health threat. When infected individuals cough, sneeze, or speak, these bacteria are released as tiny respiratory droplets and aerosols. Upon inhalation, they settle within the respiratory system, heightening susceptibility to infection. The identification and characterization of these airborne microorganisms are of utmost significance for the prevention and treatment of respiratory diseases they may cause. Our research utilized various methods, such as Hichrome agar assay, Gram staining, and Chocolate agar assay, alongside biodiversity indices like the Shannon-Weiner index, Simpson Index, and Margalef Index, to comprehensively profile them treatment Our initial findings confirmed the presence of common airborne bacteria like *Enterococcus*, *Escherichia coli*, *Bacillus megaterium*, *Bacillus coagulans*, *Staphylococcus species*, and *Enterobacter species*. This underscores the importance of understanding these microorganisms and informs the development of effective preventive and therapeutic.

Keywords: Biodiversity, Air Microflora, Respiratory Tract Infection, Susceptibility, Identification, Characterization, Gram Negative.

IDENTIFICATION, CHARACTERISATION AND EFFICACY OF HIGH ALTITUDE PGP IN THE PLAINS

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Abstract

The Shimla Summer Hill is home to a vast variety of plants, ranging from medicinal leaves and herbs to flowering shrubs. The prime flowering plants include the diverse species of orchids growing there. Naturally, the rhizosphere microflora of such is just as diverse. PGPRs living in association with the roots of these plants are presumed to have a hand in enhancing and maintaining their sustainable growth through the methods of phosphate solubilisation, siderophore production, facilitating macronutrient uptake or increasing their plant hormone levels. In this experiment bacteria were isolated from the rhizosphere of the orchid of family Iridaceae named Iris tectorum. The plant growth promotion ability of the bacterial isolates were tested. The PGPR which contained some species of *Bacillus* sp. were found to have the image ability to fix nitrogen and solubilise potassium and phosphorus. The bacterial isolate SH3 were found to solubilise 98.6 microgram/ml of phosphate. The bacterial isolate SH5 was able to synthesise 8.40 microgram/ ml of IAA. The selected bacterial isolates were added as a consortium to *Gladiolus* sp. (a member of Iridaceae family), whereas the leaves showed a 20.5 % increase in length , upon addition of bacterial consortia about 3.5 mL/2 Kg of soil .The plant treated with bacterium consortia consisting of all the isolates showed highest chlorophyll content.This serves as a strong prospect to the replacement of chemical fertiliser in their cultivation and essentially offers a better alternative to it. The four bacterial isolates, SH1 , SH2 , SH3 and SH5 were later identified using 16srRNA that were found to be *Bacillus pseudomycoides* , *Peribacillus frigotolerans* , *Bacillus velezensis* and *Bacillus amyloliquifaciens* respectively. The use of these PGPR is one of the most dependable methods for ensuring sustainable agriculture. Subsequently , the PGPR would be correlated with the agricultural sustainability and productivity of plants and can be an effective solution against the detrimental effects of chemical fertilisers in environmental pollution. This is not limited to a particular area of high altitude hills and can be used beyond its natural habitat area in the plains, that can be one step ahead towards a global biofertiliser.

Keywords: *Iris tectorum*, PGPR, *Gladiolus* sp.

ICEES-24/ CP-022 (UG)

COMPARATIVE ANALYSIS OF CHEMICAL- FERTILIZER & BIOFERTILIZER ON THE DEVELOPMENT OF PHYSIOLOGICAL & REPRODUCTIVE STRUCTURES IN MAIZE (*Zea mays Linnaeus)*

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Abstract

One of the most insidious crises that plague the modern world is the menace of food shortages.Global food shortages worsen annually, fueled by population growth.A country like India with many financially challenged farmers suffering from low crop yields would benefit from approaches focusing on fertilizers.Fertilizers are a promising solution to boost food production and address this threat. Biofertilizers are the substances containing variety of microbes having the capacity to enhance plant nutrient uptake by colonizing the rhizosphere and make the nutrients easily accessible to plant root hairs. A comparative analysis was carried out to investigate the effects of chemical fertilizer and biofertilizer on the growth and development of physiological and reproductive structures in maize plants. Four treatments were applied: T1 (garden soil), T2 (soil + compost), T3 (soil + biofertilizer), and T4 (soil + chemical fertilizers). The treatments were maintained for ten weeks. The biofertilizer mainly consists of three species of bacteria: *Bacillus subtilis*, *Bacillus vallismortis, Enterobacter hormachei*. Results showed that the treatment with chemical fertilizers (T4) led to the highest overall growth compared to other setups initially. The biofertilizer treatment (T3) exhibited the most significant growth at week 4, followed by a slight decrease, and then a subsequent increase in growth. By the end of week 7, the growth in the biofertilizer setup was comparable to that in the soil + compost setup (T2) but remained lower than the chemical fertilizer setup (T4). By at the end of week 9, The growth in biofertilizer set up is highest & growth in the chemical fertilizer set up is relatively lower. Due to adverse effects of chemical fertilizer on soil health & crop yield, biofertilizer is highly recommended. Biofertilizer offers a sustainable alternative to chemical fertilizer.

Keywords: Food Genaration, Biofertilizer, Chemical – fertilizer, *Zea mays Linnaeus*

ICEES-24/CP-023 (UG)

CHARACTERIZATION OF PGP FROM SUGARCANE RHIZOSPHERE IN VIDARBHA AREA, INDIA

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Abstract

Sugarcane, (Saccharam *officinarum)* member of the Poaceae family is a very economical cash crop that serves as an excellent bioresource in the production of alcohol and sugar. In India, around 60 million farmers are dependant on sugarcane cultivation thereby promoting a socio-economic development in the country especially in the rural areas. The major sugarcane producing states in India are Uttar Pradesh, Tamil Nadu, Maharashtra and Andhra Pradesh to name a few. Bagasse being one of the main by- product of sugarcane is widely used in paper industries for the production of various plastics, board papers, enzymes etc. This paper elucidates the characteristic properties of sugarcane bagasse obtained from the Vidarbha region of Maharashtra, India. Different Qualitative analysis on the soil sample like pH, electrical conductivity and organic carbon content were conducted. In addition to that, macro element contents in the soil were also observed. Further soil analysis revealed that the sample contained three different strains of bacteria including *Streptococcus pneumoniae, Enterococcus* and *Staphylococcus aureus* through Hichrome Staining. Remarkably, subsequent tests revealed that these strains acts as both facultative saprophytes and parasites, i.e., they exhibit dual properties. These bacteria can produce siderophores which were indicated by their iron uptake capacity and in addition to that they showed resistance towards antibiotic tests making them potential pathogens as well cellulolytic activities were also observed, indicating the production of cellulose that helps in degradation of sugarcane wastes. These microorganisms present in the environment exhibits reduced susceptibility to antibiotics but at the same time holds an important position in various industrial fields such as paper, food, textile etc due to their cellulose producing ability.

Keywords: Carbon content, Facultative Saprophytes, pathogens, siderophores, sugarcane bagasse.

ICEES-24/CP-024 (UG)

EMERGENCE OF BIOAEROSOL IN THE FRINGES OF EASTERN KOLKATA: A COMPREHENSIVE ANALYSIS

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Abstract

In recent medical epidemiology, 'Bioaerosols' or airborne biological particles including bacteria, viruses, fungi and pollen have gained attention due to their significant impact on public health, agriculture, and the environment. Along with industrial activities, local agricultural practices involve extensive use of organic materials in proximity to water bodies, amplifying the generation and dispersion of bioaerosolic pollutants. Understanding the sources and diffusion patterns of bioaerosols is essential for developing effective strategies to mitigate their detrimental effect on human health, food security and the environment. This research investigates the emergence and implications of bioaerosols in eastern Kolkata and associated regions, analysing the findings from a 550-bed tertiary care hospital in Kolkata. However, traditional culture-based methods for detecting bioaerosolic pathogens, are often limited by their sensitivity and delay in results and implementation of treatment. These limitations are particularly challenging in high-burden settings like the urban metropolitan landscape of Kolkata. The BioFire FilmArray Pneumonia Panel, offers integration of advanced diagnostic technologies to transform the detection and management of bioaerosol-related respiratory tract infections and illnesses by enabling rapid and accurate pathogen detection via multiplex PCR. Recent observations from the BioFire database, reveal a significant demographical transition in the infection rates indicating an increase in the geriatric population (above 70 years) and a decline in the paediatric population (below 5 years). While pneumococcal pneumonia, primarily caused by *Streptococcus pneumoniae* and *Staphylococcus aureus* demands significant attention in children, Hospital-acquired pneumonia by *Klebsiella pneumoniae* and *Haemophilus influenzae* remains a leading cause of mortality due to bioaerosol exposure in the aged population. This variability in the source and nature of microbial infestation patterns reflects broader shift in pathogenic exposure and vulnerabilities of respective age groups emphasizing the need for tailored diagnostic and prognostic strategies. Our study aims to understand age-specific microbial patterns and their health impacts to optimize targeted therapeutic interventions and reduce antibiotic misuse, integrating scientific research, public health policy, and community engagement for sustainable and resilient health outcomes.

Keywords: Bioaerosol, Environment, Pneumonia panel, Respiratory tract infections, Multiplex PCR, Bioaerosolic pathogen

BACTERIAL DEAMMONIFICATION FOR THE IMPROVEMENT OF PUBLIC UTILITY SERVICES

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Abstract

A common problem associated with public urinal in urban Indian cities is a pungent smell emitted from the breakdown of urea to ammonia. So, if by any means this ammonia may be removed or masked by any other vapour then it might help to mitigate the pungent smell. In this investigation the deammonification activity of the bacteria was tested and it successfully removed the ammonia produced by the bacteria from breakdown of urea using urease enzyme. A study was carried out to isolate and characterize bacteria that would be beneficial for deammonification in the public toilets. Three bacteria were isolated from water sample collected from the Rabindra Sarovar Lake (LC1, LC2 and LC3) and were identified using Gram staining and HiCrome Bacillus agar. While the fourth and fifth (G1 and G3) bacterial isolates were alkalophilic high altitude extremophile maintained in the laboratory. Biochemical characterization of the isolated strains including citrate utilization, urease production and nitrite reduction was carried out. The isolated strains that tested positive for biochemical characterization was further tested for pathogenicity. The strains were tested in chocolate agar for pathogenicity followed by antibiotic susceptibility test. In the interaction test of these three bacterial strains LC1, LC3 and G3 it was observed that they did not hamper the growth of one another. These strains have a good prospect to improve the ambience of public urinal when applied in a consortium.

Keywords: Urease, citrate, biochemical characterization, commercialization.

ICEES-24/ CP-026 (UG)

MITIGATION OF HIGH SALINITY STRESS ON AGRICULTURAL PRODUCTION IN THE SINKING ISLAND OF GHORAMARA

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Abstract

Situated in the Sunderbans of West Bengal, India, Ghoramara Island is part of the largest mangrove ecosystem in the world. Also known as the 'Sinking Island,' Ghoramara faces significant challenges today, due to the rising sea levels and climate change. The island is particularly vulnerable to the impacts of soil salinization, which aggravates soil erosion and degradation of cropland, thus threatening agricultural productivity. High saline stress reduces crop yield, limits the variety of cultivable crops and compromises food security. Development of salt-tolerant crop varieties and improved soil management practices are some of the adaptive strategies that must be undertaken to mitigate these issues. In this investigation, we attempt to enhance plant growth and crop productivity under saline conditions through microbial intervention. The soil samples were collected from the Island and their physicochemical parameters were analysed accordingly. Multiple rhizobacterial samples were isolated from the soil and selected based on their plant growth promoting capabilities. The PGPR flora was further assayed and were found to enhance plant growth by different mechanisms such as nitrogen fixation, phosphate solubilization, phytohormone synthesis, and siderophore production. The bacterial isolates, mostly of species *Bacillus*, exhibited high salt tolerance up to a concentration of 16%, in coherence with its geographical location and current environmental scenario. Based on the results, a unique biofertilizer is developed through administration of a consortia of these bacterial isolates with specific nutrient solution which can improve crop productivity in this saline infested region of India. This will have a tremendous impact on food production in the saline infested coastal plain surrounding the Indian subcontinent.

Keywords: Ghoramara, salt tolerance, PGPR, biofertilizer

ICEES-24/ CP-027 (UG)

FIRST REPORT OF NEW PLANT PATHOGEN INTERACTION FROM ECOLOGICALLY SIGNIFICANT ESTUARINE MANGROVE OF INDIAN SUBCONTINENT AND IT'S SOCIOBIOLOGICAL IMPACT

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Abstract

Heritiera (F. Huang, K.D. Hyde & H.Y. Li) is a dominant mangrove tree species of the Sundarbans of India. It comprises about 70% of the trees in the area, which belongs to Malvaceae family. In the study, infected samples of *Heritiera* leaves from mangroves of Indian subcontinent were found to have a different type of leaf spot disease. The spots appeared were small greyish and brownish. The isolated fungus showed furry white colonies. After 4 days of incubation mycelial growth, the colony ultimately turns white with a black tinge in the center. Microscopic characterization revealed septate hyphae. Cylindrical, straight conidia slightly tapered toward the apex. Through microscopic observation and ITS sequencing the organism was identified to be *Diaporthe discoidispora*. *Diaporthe sp.* was previously known for causing melanose and stem- end rot disease in citrus, cankers, leaf spots, blights, decay, and wilt on a variety of plant hosts and Koch's postulates were carried out and distinct symptoms were observed in *Heritiera.* This is the first instance of this host pathogen combination being separated in a mangrove, as there is no previous instance of it.

Keywords: Mangrove, leaf spot disease, conidia.

ICEES-24/ CP-028 (UG)

EFFECT OF *Bergenia ciliata* RHIZOME EXTRACT AND *Camellia sinensis* (WHITE TEA) EXTRACT ON IMPROVING THE EFFICACY OF AMPICILLIN, REDUCING BACTERIAL PERSISTER FORMATION AND RESUSCITATION.

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Abstract

In recent years, the balance of anti-microbial research has tipped off towards antibiotic resistance, leading to a void in research related to antibiotic persistence. Bacterial persisters are a non-growing/dormant, small subpopulation (around 1% of mid log phase) of bacteria who manage to evade death by high doses of antibiotics (though being genetically identical to the sensitive population) and can later re-start multiplying when antibiotics are removed (persister resuscitation). These subpopulations that survive super-lethal antibiotic challenge are the reason behind various re-calcitrant infections.

Bergenia ciliata have been utilized in traditional medicine since a long time. Out of their whole plethora of bio-active compounds there is bergenin and catechins which have significant anti-microbial activity. White tea on the other hand is a type of unfermented tea made using only leaf buds. They are also abundant in Catechins such as EGCG (Epigallocatechin-3-gallate), ECG (Epigallocatechin), etc. which are anti-bacterial in nature. Both EGCG and bergenin affect the cell wall and membrane integrity of the bacterium, irrespective of their metabolic state, crucial in killing the dormant subpopulation of persisters.

In our study, we have seen that, aqueous extracts of *Bergenia ciliata* rhizome and White Tea, in combination with ampicillin, can significantly increase the efficacy of ampicillin, thereby reducing bacterial persister formation, hence indicating that, usage of these in combination with the primary drug can reduce the formation of the persistent phenotypes in the first place. Further in our study we have found out that both of these extracts can even reduce the resuscitation of these persistent phenotypes, leading to conclusions that these medicinal extracts can have an effect in reducing the extent of re-calcitrant infections, post antimicrobial treatment.

Keywords: persistence, dormant, bacterial persisters, resuscitation, recalcitrant, bergenin, EGCG, EGC

ICEES-24/CP-029 (RS)

EFFICIENCY OF AZO-OXIMATE Fe(II) AND Mn(II) COMPLEXES IN THE SUSTAINABLE CONTROL OF WILD DRUG RESISTANT BACTERIAL AND PATHOGENIC *Candida* STRAINS

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Abstract

The current era of research and development in medical sciences has almost become a miracle in itself. Yet, the battle against multidrug resistant microbial infection is still matter of concern. Azo-oxime ligand framework Ar-HL^{Ph}, **1** (Ar = phenyl, pyridyl and naphthyl) and Ar′-HL^{py} **2** (Ar′ = phenyl, p-tolyl) were used to synthesize three trinuclear mixed valence iron complexes of type $[Fe^{III}(Fe^{II}(Ar\text{-}L^{Ph})_3)_2]ClO_4$ $\mathbf{3^+ClO_4^-}$ and four bis-chelates $[M^{II}(Ar'\text{-}L^{py})_2]$ (M = Fe, **4** and M = Mn, **5**. All seven transition metal complexes were found inhibitory to the wild multidrug resistant pathogenic bacterial strains (isolated from drainage water near hospital) and two pathogenic *Candida* strains microbial strains. The 16srRNA analysis of the selected bacterial colonies from the water sample revealed their identity as *Bacillus antracis, Stenotrophomonas maltophilia, Micrococcus luteus* and *Escherichia coli.* The two fungal strains were ATCC strains, *Candida albicans* and *Candida parapsilosis.* The bacterial strains appears to be resistant against multiple broad spectrum antibiotics viz., Clindamycin, Ceftazidime, Erythromycin, Amoxyclav. The test results of the investigation for the molecular mechanism of action of the complexes confirmed that they are not only inducing ROS generation and subsequent lipid peroxidation, the complexes are causing DNA damage and also affecting translation machinery in microbial strains. The test results also indicates towards membrane damage. Molecular docking method indicates that the metal complexes have high probability to bind with bacterial DNA gyrase and 30s ribosomal subunit. The 3d transition metal complexes are less toxic, economically cheap, easily available, effective on natural sample as a whole and due to multiple mode actions less susceptible to drug resistance, therefore suitable for industrial use in future to irradicate MDRs from water.

Keywords: Azo-oxime, Multi drug resistant, Lipid peroxidation, DNA gyrase, Translation machinary

ICEES-24/CP-30 (PG)

ECONOMICALLY IMPORTANT BACTERIA FROM THE FUR OF BACTRIAN CAMEL IN THE COLD DESERT OF NUBRA VALLEY

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Abstract

Wild Bactrian camels(*Camelus bactrianus*) are one of the critically endangered species whose habitat ranges between extreme environmental conditions as on a high altitude area in cold desert of Nubra Valley in Ladakh.These camels lose substantial amount of fur at the onset of summer(June/July) every year.Thus, making it a perfect source of keratinolytic bacteria capable of growing in extreme environmental conditions.Four distinct bacterial strains viz. BCF1,BCF2,BCF3,BCF4 isolated from fur and two strains viz. BCFR4 and BCFR6 from hair bulb were characterized by Gram staining as well as culture method on HiChrome Bacillus and HiChrome UTI agar plates through which probable identification of those were estimated.Qualitative assays of Protease,Amylase and Keratinase was performed to speculate their enzyme production.Gram characters of BCF1,BCF2,BCF3,BCF4 appear to be gram positive whereas, BCFR5 and BCFR6 showed gram negative characters.Moreover,the colony morphology of the gram positive ones viz. BCF1,BCF2,BCF3,BCF4 in *bacillus* Chrom agar indicate that these are under the genus of *Bacillus*.Qualitative enzymatic assays being the determining part of the project exhibit some electrifying results.For instance, all the strains indicate production of Keratinase enzyme in qualitative assay whereas in the estimation of Amylase production only BCF1,BC2 and BCF3 exhibited positive results.Additionally, BCF1,BCF2,BCF3 and BCF4 appears to be Protease producing bacteria in qualitative experiments of this study.Consequently, these bacterial strains own intense superiority in themselves being possibly sustainable in extreme environmental conditions and capable of producing pharmaceutically as well as industrially important enzymes which can be of immense economic importance.

Keywords: Bactrian camel fur, Indistrial enzymes, Bacterial survivability, *Bacillus* sp., Protease, Amylase, Keratinase.

EXPLORING EXTREMOPHILES FROM TSOMORIRI'S PRISTINE WATER: HARNESSING THEIR AGRICULTURAL BENEFITS

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Abstract

The remote and pristine Tsomoriri Lake in Ladakh, India, is characterized by its alkaline waters (pH 9.6) and extreme salinity, creating a harsh environment where only specialized extremophiles could survive. From this unique ecosystem, six bacterial strains—designated T1, T2, T3, T4, T5, and T6—were isolated from the lake's water. These strains were cultured on nutrient agar plates and underwent detailed characterization. Identification using HiChrome Bacillus and UTI media suggested that T1 and T6 were possibly *Bacillus* species, T2 and T4 were possibly identified as *Pseudomonas* species, and T5 was likely a *Staphylococcus* species. The antibiotic resistance profiles of these strains were evaluated using Meropenem (MRP 10), Tetracycline (TE 30), Ampicillin (AMP 10), Cotrimoxazole (COT 25), Erythromycin (E 15), Ciprofloxacin (CIP 5), and Minocycline (MI 30). Strains T1, T3, and T6 exhibited multidrug resistance, showcasing their resilience in this extreme environment. Using Jensen, Pikovskaya, and Aleksandrow media for the nitrogen fixation, phosphorus solubilisation, and potassium solubilisation experiments, respectively, the agricultural potential of these isolates was evaluated. Strains T2, T3, and T6 proved positive for all three experiments, suggesting their capacity to boost soil fertility. T1 and T4 did not demonstrate nitrogen-fixing capabilities. All six strains were tested for indole-3-acetic acid (IAA) synthesis, a plant hormone that stimulates root formation and overall plant growth. All strains were IAA-positive, highlighting their potential agricultural applications. Environmental stress resistance was also examined. All strains were alive following an overnight growth at 5°C, indicating cold resistance. The strains were also evaluated for salinity resistance, and all six strains were alive at 10% salinity while surviving at salinities as high as 16%, showing their resilience to the high-saline conditions found in Tsomoriri Lake. UV stress resistance was assessed by exposing the strains to shortwave UV (240 nm) for 18 hours and then observing overnight growth in nutrient broth. The strains survived in the nutrient broth, and the CFUs was above 100 which indicates the viability of the microorganisms. More research work is going on to fully understand the abilities of extremophiles, the initial study highlight their remarkable adaptability and potential agricultural uses. More research work is being done to understand their genetical and metabolic profiles. Research is being done to comprehend their potential in bioremediation and use them in increasing sustainable agricultural yields in extreme environment.

Keywords: Extremophiles, Multidrug resistance, Salinity, UV stress, Agriculture, Sustainable.

ICEES-24/CP-32 (PG)

CROSSTALK BETWEEN CORN AND AMARANTHUS VIA PLANT-GROWTH PROMOTING MEDIATOR IN EAST KOLKATA WETLANDS

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Abstract

The Ramsar site, East Kolkata Wetlands (22º27'00" N, 88º27'00" E) in West Bengal, has been known to treat wastewater from domestic and industrial sources naturally, it is also the location for the dumping ground Dhapa. Following land reclamation in some parts, the land has since been used for agriculture despite heavy metal contamination. *Zea mays* and *Amaranthus* sp. were grown together which seemed to enhance the physical parameters of the corn plant although a similar effect has not been reported previously. The isolated rhizospheric bacteria were characterized, which revealed Plant Growth-Promoting activity and Indole-3-Acetic acid production in some of them. These PGPRs, which included some species of *Bacillus*, were found to enhance plant growth by different techniques like nitrogen fixation, phosphate solubilization, phytohormone synthesis, and siderophore production. Phosphate production was detected from the bacterial isolates A1 (*Bacillus subtilis*) isolated from *Amaranthus* rhizosphere which produced 26.2 mg/l of phosphate, A3 (*Bacillus licheniformis*) and A4 (*Alcaligenes faecalis*) both isolated from the rhizosphere of corn growing in the presence of Amaranthus, produced 34 mg/l and 42.3 mg/l, respectively. All the bacterial isolates were found to be siderophore-positive. A1 and A2 (*Brucella pseudintermedia* isolated from *Amaranthus* rhizosphere) showed Indole-3-acetic acid production both in the presence and absence of Tryptophan in the medium at 24 hours. In the presence of tryptophan, A1 and A2 produced 10.78 µg/ml and 15.96 µg/ml respectively. In the absence of tryptophan, they produced 12.63 µg/ml and 20.78 µg/ml respectively. On the other hand, A4 showed IAA production, 7.44 µg/ml, in the presence of Tryptophan at 24 hours only. No IAA production was detected in A3. The height of corn plants, in the presence of *Amaranthus* sp. was found to be 181.6 cm, and 169cm in the absence of *Amaranthus* sp. Therefore, in the present investigation, plant-microbe and an inter-microbe interaction has been studied, to establish whether the root exudates have an integral role in the crosstalk between *Zea mays* and *Amaranthus* sp. that is evident because of the increase in the growth of *Zea mays* grown in the presence of *Amaranthus* sp.

Keywords: Maize, *Amaranthus*, East Kolkata Wetlands, PGP bacteria, crosstalk.

NOVEL PGPR FOR UNLEADED AGRICULTURE IN THE RECLAIMED SOIL OF EAST KOLKATA WETLANDS

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Abstract

Wetlands, refers to the confluence of land and water having a rich ecological diversity with multitudinous functions. As per Ramsar Convention, framed in the year August 2002, East Kolkata Wetlands have been considered to be of intercontinental importance. Although improper handling of these wetlands, has led to the gradual degeneracy of this wetland. In the presentinvestigation, the soil sample was collected from these reclaimed agricultural lands of Chowbaga area, of East Kolkata Wetlands and their physico-chemical parameters during the initial, peak and inter cropping periods of *Cucurbita maxima* and *Zea mays* were analysed.The difference in the values of their physico-chemical parameters indicated their influence in controlling crop productivity. Moreover, they also result in the variation of rhizospheric bacteria. The plant growth promotion properties of the lingering bacterial flora present in the soil surrounding the rhizospheric region of *Cucurbita* sp and *Zea mays* were analysed, followed by their enzymatic properties. These PGPR which includedsome species of *Bacillus*, that were found to uplift plant growth by different methodologies like nitrogen fixation, phosphate solubilization, phytohormone synthesis, siderophore production. These agricultural lands were found to have very high quantities of heavy metals, especially lead. Amongst the bacterial isolates, two of them were found to have great potential in lead mitigation, whereby they could adsorb 5.24% and 8.28% of lead respectively. The desired bacterial isolates were used as a microbial consortium and applied to *Cucurbita maxima* and *Zea mays* grown in the reclaimed soil of East Kolkata Wetlands and they were found to reduce the lead content in the fruit of the above plants by 9.8% and 10.7% respectively. The prospective potential of use of PGPR has gradually escalated, since it is one of the best substitutes against the constant usage of chemical fertilizers as well as pesticides. The use of these PGPR is one of the most reliable methods for ensuring sustainable agriculture in terms of pollutant free soil and availability of nutrients to green crop plants.

Keywords: East Kolkata Wetlands, *Cucurbita*sp,soil, *Zea mays*, lingering microbial flora, PGPR, lead mitigation.

ICEES-24/CP-034 (RS)

GENOMIC ASPECTS OF POLYEXTREMOPHILE IN ENVIRONMENTAL PURIFICATION

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Abstract

Hydrocarbons are recalcitrant hazardous environmental contaminants consisting solely of carbon and hydrogen. These are also chief components of many types of fuels because of the catenation property of carbon. There is an immediate need for remediation due to the rise in hydrocarbon-related environmental pollution brought on by society's modernization and rapid population growth. There are several chemical and physical techniques available to break them down into nontoxic products, but bioremediation, utilizing microorganisms, particularly hydrocarbon-degrading bacteria are cost-effective and eco-friendly technique. Hydrocarbon-degrading bacteria are ubiquitous and can use these substances as sources of carbon and energy. Bacteria exhibiting such potential are often exploited for environmental purification. Here, five polyextremophile strains isolated from river Ganga; Gangotri ghat, and Yamunotri; Surya kunda hot spring water are used. These isolates were identified with 16S rRNA as *Bacillus subtilis* BRAM_G1 (MW00633), *Bacillus subtilis* BRAM_G2 (MT998280), *Bacillus subtilis* BRAM_G3 (MT998617), *Mesobacillus subterraneous* BRAM_Y2 (MW002419), *Brvibacillus parabrevis* BRAM_Y3 (MW081864).The current investigation aims to identify and characterize the bacterial species, that can tolerate and degrade petroleum hydrocarbon and synthesize bio-surfactants.The isolates were examined for their petroleum hydrocarbon degradation ability in minimal salt media supplemented with hydrocarbon. Of these five isolates, *Bacillus subtilis* BRAM_G2 (MT998280) displayed the highest capacity for hydrocarbon utilization,and all the strains produced bio-surfactants. A more profound understanding of the genomic potential of these organisms for the degradation of hydrocarbons was carried out in the KBase Platform through gene annotation and associated degradation pathway identification. Moreover, genomic comparison with other hydrocarbon degraders showed a higher abundance of genes for lipid transport and metabolism, transcription, and translation in the *Bacillus subtilis* BRAM_G2 (MT998280) genome.Thusthese strains can be an excellent tool for the bioremediation of petroleum hydrocarbon contaminants; further investigations are in progress in this direction

Keywords: Petroleum hydrocarbon, minimal salt media, biosurfactant, gene annotation.

NICKEL (II) AZO-QUINOLINE COMPLEXES AS PROMISING ANTI-CANCER AGENTS: A COMBINED IN-SILICO AND IN-VITRO EVALUATION AGAINST HELA CELLS

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Abstract

The use of metal-complexes as chemotherapeutic agent against cancer has been extremely effective since its inception. Drugs like cisplatin, carboplatin and oxiplatin have accounted for about 50% of all cancer treatment. However, these Platinum based drugs are accompanied by a plethora of problems such as in-vitro cytotoxicity, acquired intrinsic and extrinsic resistances and restricted tumor restrictions. This has spurred the investigation for a newer and inexpensive anti-cancer drug involving transition metals like Nickel. The overall framework of the Nickel (II) complex in presence of electron poor ligands closely resembles the Platinum (II) complexin terms of square planar geometry and chemical properties. The newly identified complexes namely,[Ni(HL)(OAc)] and [Ni(HL)Cl], were investigated for their anti-cancerous properties.The cytotoxic effects of the complexes were assessed using the MTT assayusing HeLa cells which revealed significant damage to the cancer cells. The generation of ROS has been assessed by treating the HeLa cells with one of the Nickel (II) complexes, incubated further with 2,7-dichlorofluorescene diacetate (DCFDA) at different time intervals. The data revealed an incremental generation of green fluorescence after 3 hours, indicative of generation of ROS after 3 hours of treatment with the complex. To gain deeper insights into the molecular mechanisms underlying the cytotoxicity, molecular docking studies were performed to evaluate the binding affinity of the synthesized complex with DNA strands. The docking studies yielded DNA binding affinity scores of -8.3 and -8.0 kcal/mol for the complexes [Ni (HL)Cl]and [Ni (HL)(OAc)], respectively. These results suggest that the complexes possess significant anti-cancer properties and could serve as a viable alternative to conventional chemotherapy with reduced side effects. The integration of both in-vitro and in-silico approaches in this study provides a comprehensive understanding of the therapeutic potential of these complexes, laying the groundwork for future development and optimization as effective anti-cancer agents.

Keywords: cytotoxicity, transition metal, anti-cancer, MTT, ROS, docking.

ICEES-24/CP-036 (PG)

BIOAEROSOL DYNAMICS: UNCRAFTED INVESTIGATIONS OF ARTIFICIAL LAKE IN SOUTH KOLKATA

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Abstract

Bioaerosols present in the atmosphere comprises of bacteria, fungi, fungal spores, virus, algae, pollen and dust particles along with other atmospheric pollutants. Bioaerosol composition and viability depends on the variation of time and location . The bioaerosol plays an important role in transporting pathogenic bacteria in the atmosphere. The knowledge regarding the bacterial diversity would help towards better understanding of theambient environment. Hence the investigation was conducted to study the bacterial variety in the ambient atmospheric environment ofRabindra Sarobar Lake using a six stage TISCH Anderson sampler.The bacteria were isolated and characterised to study their impact on the environment and human health. The meteorological parameters have been measured to study their correlation with the bacterial dynamics in the bioaerosol.The isolated bacterial colonieswere morphologically characterised with the help of colony structure and cell morphology. The bioaerosol sample contained 66.67% of Gram-positive coccus in the month of November but absent in the month of December which was 100% dominated by the rod-shaped Gram-positive bacilli. The isolated bacterial strains were cultured on BHI broth thus exhibiting a fastidious nature and an indication of aprobable pathogenic natureas evidenced by the isolates exhibiting positive result for protease, lipase, DNase and Haemolysin. The biofilm production indicates the presence of a virulent property of the bacterial strains that would help them to adhere to the surface and survive in unsuitable environment. However, the isolated bacterial strain turned a negative result for the oxidative stress enzymes reducing their probability to survive against the natural immunity of the human beings.

Keywords: Bioaerosol; freshwater ecosystem;meteorology; bacterial dynamics.

ICEES-24/CP-037 (PG)

EVALUATING THE DIFFERENTIAL DISTRIBUTION PATTERN IN AMR PROFILES FROM RURAL AND URBAN WASTEWATER NICHES IN WEST BENGAL, INDIA

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Abstract

The unscrupulous and exploitative antibiotic abuse has ushered in the era of AMR (Antimicrobial Resistance) which threatens community health. Frequent wastewater surveillance to track the transition if any, in AMR profiling and differential distribution patterns of bacterial load in multiple community wastewater niches supports research initiatives to combat antibiotic resistance effectively. This study focuses on the thorough AMR profiling of wastewater and a subsequentcomparative analysis of antibiotic resistance load in a community sewer from an urban setting in Kolkata versus a rural, agrarian location in its vicinity, the Sundarbans, to find out if their AMR profile, is indeed, divergent.Both urban and rural wastewater samples were collected maintaining proper sterility.Subsequent to collection, the samples were transported within a 10-hour timeframe and maintained at -20°C until further processing for culture dependent studies. Conventional microbiological isolation methods were adopted to identify 21 and 26 pure bacterial isolates from urban and rural samples respectively of which9 and 4 strainswere found to be multidrug resistant (MDR). Notably, resistance to commonly used broad-spectrum beta-lactamantibiotics like Methicillin, Ampicillin, Cephalothin appeared as a common theme throughout the urban and rural wastewater flow. On the flip side, urban isolates exhibited unique resistance to fluoroquinolone, macrolide, aminoglycosides and lincosamide class of antibiotics including Ofloxacin, Erythromycin, Amikacin, Clindamycin whilerural MDR strains showedmore or less equivalent resistance to Ciprofloxacin, Nalidixic acid, Chloramphenicol, Imipenem. Our findings demonstrate that culture-dependent methods remain valuable for studying antibiotic resistance in wastewater by providing a foundation for understanding the prevalence and diversity of resistant bacteria and aiding in epidemiological tracking. When combined with culture-independent approaches, they can provide a more comprehensive view of the antibiotic resistance landscape in wastewater.

Keywords: AMR profile, antimicrobial load, waste water surveillance

ICEES-24/CP-038 (UG)

ISOLATION OF COMMERCIALLY VIABLE MICROBES FROM SUGAR

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Abstract

Commercial sugar, integral to domestic and industrial processes alike, has diverse microflora in both raw and processed forms, many of which may be added or removed during processing. During the production of commercial sugar, a viscous byproduct called molasse is also produced which is removed to give natural colour and taste to sugar. Although sometimes molasses are exported as raw material for animal feed, being a byproduct, a major part of it is discarded as normal waste. According to recent discoveries, molasses and pure sugar also contain an array of potentially useful native microflora. It is important to analyze the different microbial inhabitants of pure and impure sugar, in order to understand and utilize their potentially beneficial anti-carcinogenic and anti-oxidant properties. The indigenous microflora may be capable of producing protective bio-active compounds and can also act as cheap sources of industrial enzymes. This project aims to discover and utilize such properties in industrial processing to enhance product quality. Characterization and presumptive identification of the microflora were done by Gram's staining, endospore staining and culturing on HiCrome Bacillus agar. Enzyme assays were performed for amylase, protease, cellulase and lipase. Different non-pathogenic strains of *Bacillus* were found in both samples, with a higher concentration in impure sugar. Most strains from impure sample had amylase, protease, cellulase production capability, whereas only one from pure sugar could produce amylase and protease. Together with the results from ongoing experiments, it is possible to identify strains which have the potential to be commercialized for industrial use and also to explore the possibilities of transforming a waste or byproduct to some worthy material.

Keywords: Commercial sugar, molasses, anti-oxidant, industrial enzymes, commercialization.

ICEES-24/CP-039 (RS)

CORRELATION OF METAL POLLUTION AND THE CONSTITUENT FOOD CHAINS IN AN URBAN LENTIC WATERBODY

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Abstract

The urban lentic ecosystems of South 24 Parganas in Kolkata, including ponds, lakes, and reservoirs, are vital to the city's environmental health. These tranquil waters support rich biodiversity, offering essential services like water filtration, flood control, and livelihoods for local communities. However, these ecosystems face significant threats from urbanization, particularly from wastewater mismanagement due to unchecked agricultural and industrial growth. Pollutants enter these waters, leading to bio-magnification—where toxic substances accumulate in organisms higher up the food chain, posing severe risks to human health.Amid these challenges, nature offers a solution through bio-remediation involving microorganisms like zooplankton and bacteria to break down hazardous pollutants, transforming them into harmless substances and gradually restoring the water's purity. Zooplankton, as secondary consumers, are crucial to this process. They not only feed on phytoplankton, the primary producer powered by solar energy, but also serve as indicators of environmental changeand are then preyed upon by larger species, such as planktivorous fishes , which actually maintains the stability of the ecosystem. The food web within these ecosystems is intricate. Bacteria, playing a less visible but equally critical role, act as decomposers, recycling nutrients and driving the metabolic processes that sustain life in these waters.Seasonal changes affect how metals contents influence aquatic organisms in theses waters. Metals like Arsenic,copper, mercury and cadmium can be toxic and their effects vary with temperature; warmer weather often increases metal absorption. Essential metals such as iron impact phytoplankton growth, while toxic metals can inhibit it. Zooplankton and fish are also affected by seasonal changes in metal contents, influencing their health and behavior. Metals in sediments can resuspend with seasonal shifts, impacting water quality. Human activities and climate change further influence metal dynamics and organism responses in aquatic environments. To protect these ecosystems, it's crucial to understand the dynamics of their food webs and the impact of pollutants on them. By mapping species and food chains, scientists can trace bio-magnification, gaining insights into how contaminants move through the ecosystem. Thisinvestigation will develop sustainable strategies for managing these urban water bodies along with their bio-diversity and add to the environmental resilience of our city of joy, Kolkata.

Keywords: Lentic ecosystems, metal toxicity, biomagnification, phytoplanktons, zooplanktons, bacteria

ICEES-24/CP-040 (RS)

REPLACEMENT OF ANTIBIOTICS WITH NOVEL PLANTEXTRACTS: NEED OF THE HOUR

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Abstract

Plants present in the Eastern Himalayas are underexplored for their natural bioactive agents, including the neglected scope of inventing newer antimicrobials to combat the global crisis mediated by ATCC and MDR microorganisms. This study examines the antimicrobial properties of five plants from the biodiversity hot spot of the Eastern Himalayas, India: *Chromolaena odorata, Osbeckia octandra , Melissa axillaris ,Elatostema lineolatum* and *Daphne bhoula*. The plants were tested for their ability against *Staphylococcus aureus* ATCC,*E. coli* ATCC, *Candida albicans* ATCC, *Staphylococcus aureus* MRSA *and E. coli* MDR.

These plants were extracted in ethanolic, methanolic, aqueous and DMSO forms. The antibacterial activity of different plant extracts was assessed using the Disc Diffusion Method followed by determination of Minimum Inhibitory Concentration values. DMSO and aqueous extract of *Osbeckia octandra, Elatostema lineolatum* and *Daphne bhoula* revealed their promising antimicrobial activity even at low MIC value 39 µg/ml against *Staphylococcus aureus* MRSA, *E. coli* ATCC and *E. coli* MDR. The results also revealed that solvent extracts of novel plants exhibited efficacy with different commonly used antibiotics for human health like Polymyxin-B, Meropenem, Tigecycline, and Imipenem against E. coli MDR. DMSO and aqueous plant extracts of *Osbeckia octandra, Elatostema lineolatum* and *Daphne bhoula* along with Polymyxin-B and Imipenem antibiotics disc produced a larger zone of inhibition and showed more effective antibiotic resistance properties against *E. coli* MDR. Therefore, *these* novel plant extracts have tremendous future prospects for efficient modern drug development and use for reduction of menace of commercially available antibiotics.

Keywords: antimicrobial properties, antibiotic resistance, modern drug, *Osbeckia octandra, Elatostema lineolatum, Daphne bhoula*

ICEES-24/CP-041 (UG)

CREATION OF PLASTIVORE CONSORTIA IN EAST KOLKATA WETLANDS

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Abstract

Plastic pollution has been a huge environmental concern for many years. Plastics, even though being economical and useful, take anywhere from 20 to almost 500 years to effectively decompose, thus, continuing to remain in the environment for decades. Due to different erosive forces, they break down into smaller, microscopic plastic particles, and remain in the soil, water bodies, etc., eventually entering the food web. They also cause various health disorders. This study was aimed towards reducing plastic and microplastic pollution. Accordingly, soil samples were collected from the East Kolkata Wetland (EKW) municipal waste dumping ground and the presence of microplastics was analysed and demonstrated using FT-IR Spectroscopy. Bacteria were isolated from the soil sample, and microplastic degrading enzyme assays were conducted for the isolated bacterial strains. They were further sequenced and were found to be *Bacillus subtilis*, *Rossellomoreavietnamensis*, *Bacillus velezensis*, *Bacillus licheniformis*, *Bacillus altitudinis*, which were further used to develop a consortium.The consortium was added to pre-weighed Polyethylene (PE) and Polyethylene Terephthalate (PET) particles of size 1cm x 1cm in nutrient broth and minimal salt media (media devoid of any carbon source) separately, and in soil polluted with microplastics. The applied consortium was found to be effective since at the end of 45 days, the weight of PE was reduced by 9.18% in nutrient broth, and by 11.87% in minimal salt media. The weight of PET was reduced by 3.05% in nutrient broth, and by 6.28% in minimal salt media. Scanning Electron Microscopy revealed the extant and type of degradation in each of these cases. In the soil sample set-up, microplastics per 0.05 g of soil decreased by 76.19% during a period of 30 days upon addition of bacterial consortia. Therefore, this study was conducted to provide an insight about the impacts of unique plastic degrading bacteria isolated from EKW and their futuristic impacts upon reducing plastic pollution has also been studied.

Keywords: Microplastic, FT-IR Spectroscopy, Consortium, Microplastic degrading bacteria, Scanning Electron Microscopy

ICEES-24/CP-042 (UG)

THE ROLLING CIRCLE PATHOGEN PREVENTION IN THE RECLAIMED AGRICULTURAL WETLANDS OF EAST KOLKATA

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Abstract

The East Kolkata Wetlands (EKW) are a unique ecosystem located in Kolkata,India, at approximately 22°27'N 88°27'E. Covering 12,500 hectares, it is a ramsar site that serves as a natural sewage treatment plant and aquaculture system.They play a vital role in the environmental health of Kolkata and provide an important ecosystem.In this present investigation, Zea mays plants and its soil were collected from Choubaga, East Kolkata Wetlands. Bacterial strains were isolated from the rhizosphere of Zea mays and named as SCR-1, SCR-2, SCR-3, SCR-4, SCR-5 and SCR-6. Basic identification tests of the strains were done by culturing them in Hicrome UTI agar and Hicrome bacillus agar. Plant Growth Promoting (PGP) properties- Nitrogen fixation, Phosphate solubilization, Potassium solubilization and phytohormones of the bacterial isolates were tested. While all the six strains gave positive results for Phosphate solubilization, it was found that SCR-1, SCR-5 and SCR-6 gave positive results for nitrogen fixation and SCR-1, SCR-3, SCR-5, SCR-6 possessed properties of Potassium solubilization. Test for phytohormone Auxin(Indole 3-acetic acid) was performed in two sets- for 24 hours and for 48hours and OD values was taken. Comparing with the standard IAA curve at 530nm, among the bacterial strains incubated for 24 hours in TSB+ Tryptohpan medium, SCR-1 showed maximum auxin production(0.93 µg/ml). While, the strains incubated for 48 hours in TSB+Tryptohpan medium, SCR-4 showed maximum auxin production(4.18 µg/ml). The corn leaves were found to be infected with White rust fungus. It was found that SCR-1,SCR-3,SCR-5, SCR-6 showed antifungal properties against the white rust of corn leaves. Tests for Volatile Organic Compounds(VOCs) produced by bacteria were performed. It was observed that all the strains produced VOCs that inhibited the growth of fungus from corn leaves. It was found that SCR-1,SCR-5 and SCR-6 had the best PGP properties.For preparation of consortia T-test was performed whereby SCR-1 inhibited the growth of SCR-6. Hence, two consortia was prepared- Scr1 with Scr-5 and Scr-5 with Scr-6 and applied on plants. It was observed that the plant treated with the former consortia grew 21.5% more in length than the plant treated with the other consortia. In conclusion, the future of this research appears promising. With ongoing investigations, this research area will continue to be a valuable and fruitful pursuit.

THE EFFECT OF UV RADIATION ON TEA

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Abstract

UV radiation can show both positive and negative effects on living system. Different altitude grown tea plant could be selected as candidate plant which receives the different doses of UV radiation resulting different physiological and biochemical parameters. The key focus of this work is to understand the correlation between UV radiation and biochemical parameters of tea which not only serves as the protection strategy like antioxidants to combat the oxidative stress created by UV but also adds secondary values like aroma and therapeutic values like antimicrobial and anticancer potential. UV radiation doses could be artificially in exposed in laboratory to one year old potted plant which establishes the similar fact that is the upregulation of quality parameters preferentially polyphenols, flavonoids group of compounds. The characterization of such secondary metabolites by HPLC, LC MS, GC MS, FTIR, spectrophotometric and spectrofluorimetric scan could help to identify the marker metabolite like Rutin which could be further isolated to mix with gold nano particle to show better antioxidant and antimicrobial potential to serve as a potential drug.

The aim of this paper is to focus on the evaluation of the effects of natural and artificial UV radiation on tea to develop the therapeutic index (E sensor based) based on its upregulated quality parameters.

Keywords: UV Radiation, Rutin, therapeutic index, commercial potential

ICEES-24/CP-044 (P)

ELUVIATION OF ABIOTIC (ARSENIC) STRESS IN THE RICE PLANTS USING BIOGENICALLY PRODUCED COPPER-BASED NANOPARTICLE

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Abstract

Arsenic contamination of agricultural soils poses a significant threat to global food security and human health. Rice, a staple food for billions, is particularly vulnerable to arsenic uptake. This study investigates the potential of biogenically produced copper-based nanoparticle in mitigating arsenic stress in rice plants. It is conducted by the production of green Copper-Iron oxide (Cu-Fe(II)O) hybrid nanoparticle using the *Bacillussubtilis* bacterial enzyme and their application on rice plants (Miniket 4786) in mitigating arsenic induced abiotic stress conditions. The study aims to elucidate the mechanisms underlying this alleviation by evaluating changes in plant morphology, biochemical parameters, and antioxidant enzyme activity. Results indicate that Copper-based nanoparticles effectively reduced arsenic accumulation in rice plants as shown by our lab results. As compared to the control set-up, 25.65% growth in shoot height and a growth of 35.03% in root length was recorded when the arsenic (As(V)) stress induced rice plants were sprayed with the Copper-Iron oxide hybris nanoparticle. Simple infusions of AsV killed the plants at once. The ameliorative effects were attributed to the nanoparticles' ability to enhance antioxidant defence systems, as indicated by elevated proline and chlorophyll levels, and reduced lipid peroxidation. Additionally, an increase in superoxide dismutase (SOD) activity suggests improved reactive oxygen species scavenging. While this study provides promising insights into the potential of copper-based nanoparticles for Arsenic remediation in rice, this definitely opens up further prospect in future research. Understanding the underlying mechanisms of nanoparticle-mediated Arsenic detoxification is crucial for developing sustainable and effective strategies to address Arsenic contamination in agricultural soils. Future aspects will concentrate on breeding and genetic engineering, improving soil and water management, investigating biological methods, and fostering global collaboration to address the issue comprehensively.

Keywords: Arsenic, Copper-based nanoparticles, *Bacillussubtilis*, Rice, Proline, Superoxide Dismutase, Lipid peroxidation, Phytotoxicity, Genetic engineering.

ICEES-24/CP-045 (P)

SUSTAINABLE MAINTENANCE IN URBAN LENTIC ECOSYSTEMS

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Abstract

Sustainable maintenance of urban lentic ecosystems, such as ponds, lakes, and reservoirs, is essential for preserving biodiversity, improving water quality, and providing ecosystem services. Biodiversity conservation efforts focus on species monitoring and enhancing habitat connectivity.Urban agricultural and industrial growth has led to wastewater mismanagement, causing pollution and biomagnification in lentic waters of South 24 Parganas in Kolkata, which adversely affects human health. Bioremediation, using zooplankton and other microbes, is an effective method to remove hazardous impurities by degrading them into nontoxic substances. Despite the pressures of urbanization, Kolkata's lentic ecosystems remain crucial for water filtration, flood control, and supporting local livelihoods. However, they face significant challenges, including pollution, encroachment, solid waste dumping, overexploitation, and climate change. The impact of these factors on Kolkata's urban lentic ecosystems, both in domestic and industrial contexts are studied.In these ecosystems, solar energy drives the food chain. Phytoplankton act as primary producers, followed by zooplankton, macroinvertebrates, and planktivorous fish. Zooplankton, as secondary consumers, are vital indicators of environmental changes and play a crucial role in energy flow in the ecosystem. Bacteria act as decomposers by playing crucial role in lentic ecosystem metabolism via nutrient recycling. Species identification aids in mapping food chains and interrelated food webs, clearly illustrating the path of biomagnification. Understanding these food webs and pursuing related objectives will enhance our knowledge of the ecosystem's dynamics and support sustainable maintenance efforts.

Keywords: urban lentic waters,planktons, biomagnification, pollutants

ICEES-24/CP-046 (W)

MULTIFUNCTIONAL KADHA FOR OVERALL HUMAN HEALTH IMPROVEMENT

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Abstract

Kadha is an ancient Ayurvedic drink that is commonly consumed to provide relief from cough, cold and fever, which exploded in popularity due to the COVID-19 pandemic. It is still effective in the modern era despite being composed simply of herbs and spices.However,in light of modern knowledge regarding gut-microbiota and their effects on human health, the compositioncan be renewed to take advantage of these discoveries. Hence, we aim to presenta formulation that includes two probiotic microorganism strains to improve the vitality of a consumer to a greater extent compared to traditional kadha. The probiotic strains used have a synergistic effect between each other where the growth of both strains is more in the presence of one another, thereby the health effects provided by both will be amplified and longer lasting. To support the growth of these probiotic strains in the stomach, they are provided dietary fibre which has been included in the formulation.Dietary fibre is indigestible by humans so it provides a matrix for growth to the probiotic microorganisms and helps treat constipation as well. The formulation will be in the form of a powder, so it will have a long shelf-life. The efficacy of the formulation against pathogenic bacteria is established through data obtained from antibacterial assays and antioxidant assays to establish its efficacy against reactive oxygen species.

Keywords: kadha, gut-microbiota, probiotic, synergistic, dietary fibre, matrix, powder, antibacterial, antioxidant

ECOLOGICAL STUDY ON *TELESCOPIUM TELESCOPIUM* (LINNAEUS, 1758) FROMCHANDIPUR, ODISHA, INDIA

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Abstract

Telescopium telescopium (Linnaeus, 1758) is a Potamididae snail prevalent in the mud creeks of Chandipur, Odisha, India. The genus is monotypic and now confined to the Indo-West Pacific region. In Chandipur, the shells exist in two varieties: the conventional form and the smooth form. The polished shell features a robust columellar fold, a wide basal section, and an almost smooth outer surface, classified as a distinct species—*Telescopiummauritsi*—by Butot (1954). Subsequently, Brandt (1974) demonstrated that *T. mauritsi* is the mature form of *Telescopiumtelescopium*. Budiman (1988) corroborated this perspective and demonstrated that the shell's smoothness results from the secondary deposition of an organo-metallic complex (Fe, Mn) within spiral and sutural grooves, a characteristic prevalent among epifaunal molluscs in this environment. The species' behaviour was observed across various seasons over a 12-month period, and size frequency distribution was analysed. Multiple early hypotheses concerning the behaviour and ecological preferences of the species *Telescopiumtelescopium* (Linnaeus, 1758) were re-examined under meticulous observation during winter, pre-monsoon, and post-monsoon periods. Budiman (1988) states that typical forms inhabit open, unshaded locations, whereas adults favour shaded regions. This study aims to determine if the typical and smooth forms of *Telescopiumtelescopium* (Linnaeus, 1758) belong to the same species, as well as to examine the ecology, biogeography, and evolution of this species.

Keywords: *Telescopium*, Ecology, Biogeography, Behaviour, Chandipur, Odisha.

ICEES-24/CP-048 (UG)

PHENOTYPIC PLASTICITY STUDY ON TWO BIVALE SPECIES OF *MACTRA* FROM CHANDIPUR, ODISHA

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Abstract

The bivalve genus *Mactra*is a shallow infaunal form and to adapt an infaunal life mode it has developed several traits like moderately thin to thick shell, moderate surface ornamentation, and inflated form with shallow pallial sinus indicating short siphon. Often due to the overlapping of habitat, phenotypic plasticity and morphological convergence occurs. It seems that due to the above stated cause the species boundary between *Mactra mera* and *Mactra turgida*is difficult to define by only morphology. Thus, a case study of burrowing bivalve ecology from Chandipur, Odisha with a special emphasis on the genus *Mactra*(Linnaeus, 1767) is the main stay of this work. Morphometric analysis as well as Principal component analysis are performed here taking some parameters like shell length (L), shell height (H), density of the shell (D) and depth of pallial sinus (P) so as to enable easy differentiation of these two species in question. Also, the sampling of the six species of *Mactra* that are found along the beach of Chandipur was done and the seasonal variations of these species of *Mactra* were observed throughout the year.

Keywords: Phenotypic plasticity**,** *Mactra*, Bivalve, Chandipur, Odisha

ALKALINE-HYDROTHERMAL PRETREATMENT TO BIOGASIFY PADDY STRAW: OPTIMISING THE BMP

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Abstract

The simultaneous rapidly growth in human population and industrialisation complementing it contribute to high pollution as also the rising energy needs. Underutilisation of organic refuse of farming activities in India and poor handling in form of burning it is often sited. Such wastes are abundantly available source of bioenergy that could be revamped through various optimised physicochemical, biochemical, enzymatic and microbial interventions. Effect of hydrothermal-alkaline combined pretreatment by engaging pressure-steaming (autoclave) and alkaline (sodium hydroxide, NaOH; varying concentration) treatment for enhanced biogasification of paddy straw through anaerobiosis was assessed. The straw was treated (autoclaved; 121°C, 15psi) for 20 min, at varying (0–5%) NaOH concentrations. The total (TS) and volatile (VS) solids, Fourier-transform infrared spectroscopy (FTIR), thermo-gravimetric analyses (TGA), fluorescence and scanning electron microscopy (SEM) analyses were performed. The cumulative biogas production maximised (2873.33 mL) at 2% alkaline-hydrothermal pretreatment and the calculated/theoretical biogas and methane volume based on the volatile solids content were 268.23 and 161.94 mL/g VS respectively. The TS, VS, moisture and ash contents respectively were 91.3, 90.46, 8.7 and 9.53% in the same (2%) treatment. The cellulose, hemicellulose and lignin contents reduced to 54.5, 18.0 and 4.9% respectively, with 2.5 g/g water swelling capacity. The findings revealed that a 2% NaOH pretreatment was equally effective in alkaline-hydrothermal pretreatment to enhance biogasification. Pretreatments maximised lignocellulose utilisation for energy generation, carbon sequestration and environmental toxicity reduction. The altered surface structure observed at high-resolution microscopy further confirmed the findings.

Keywords: BMP, Biomethanation, biogas, sodium hydroxide, pretreatment, paddy straw, ecotoxicity

ICEES-24/CP-050 (P)

INHIBITION OF BIOFILM-FORMING PILAPROTEIN OFENDOCARDITIS-CAUSING *S. SANGUINIS* USING QUERCETIN

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Abstract

This studyhighlights the need to consider both biological and environmental factors in combating biofilm-associated *Staphylococcus sanguinis*infections, that leads to endocarditis.*S. sanguinis*, an oral cavitycommensal, isactively involved in quorum sensing and biofilm formation. It could progress to infective endocarditisonceit becomes bacteraemic. The aetiological agent migrates from the oral cavity to heart and forms biofilmthat progressively leads to serious cardiac infections. PilA protein is a critical virulence factor in *S. sanguinis*that also facilitates bacterial adhesion and biofilm development. The infection is further exacerbated byeco-toxins like heavy metals, air pollutants and industrial chemicals that weakens the immune system of the subject and thereby promote the proliferation of *S. sanguinis*and facilitate biofilm formation.Novel therapeutic measureshave become necessaryin face of the rising cases antibiotic resistance these days. Quercetin is a phytochemical in numerous fruits and vegetablesis allegedly a good antibacterial and cardio protectant,along with its derivatives. Its antibiofilm potential against PilA protein of *S. sanguinis*wasinvestigated in this study. Quercetin derivatives exhibited strong binding affinities to the PilA proteinas revealed throughdocking studies; the docking scores indicated high likelihood of inhibitory activity. Molecular dynamics simulations on the stability of the Quercetin-PilA interactions over time reinforced the potential of these phytochemicals as effective inhibitors. The binding stability suggestedtheir potential to prevent biofilm formation that could prevent or at least critically halt the progression of the infection in mouth to the heart.The stability during the simulations suggested that quercetin derivativescould maintain inhibitory activity even in a dynamic biological environment, that could be validated *invitro* and *invivo* later.The role of environmental toxins in increasing the virulence, creating favourable conditions for biofilm growth, and the role of quercetin and derivatives in ensuring oral healthshall be explored.

Keywords: *Staphylococcus sanguinis*, biofilm, infective endocarditis, quercetin, molecular dynamicssimulation

ICEES-24/CP-051 (P)

BIODIGESTATE FOR ENHANCED GRAIN YIELD AND SUSTAINABLE PADDY SYSTEM: MITIGATING GHGS EMISSION

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Abstract

In keeping with the UN's global sustainable development target, circular bioeconomy strategies could reduce organic waste and increase crop yields while benefiting soil health and reducing greenhouse gas emissions in paddy system. With the objective to evaluate the GHG emission and crop yield in a paddy cultivation system applied with biogas digestate, a comparative field study was carried-out with three simultaneous treatments, *viz.*, recommended dose of fertiliser (T-1), N-equivalent raw biodigestate (T-2) and N-equivalent composted biodigestate (T-3), along with a negative control (T-4), all in duplicates. For additional validation of the findings though altered ecological and cultivation conditions that predominantly dictate GHG emissions, flooded and alternate wet-and-dry conditions (two moisture regimes) were maintained in duplicate. Test plots were deweeded and disease-management measures were maintained throughout the study period. To estimate the emitted GHGs (N_2O and CH_4) on field, the released gas throughout the study was contained in manually-operated closed chambers and collected in regular intervals for gas chromatography. The highest methane emission (49.38 kg/ha) was recorded in the flooded test plot with T-2, while nitrous oxide (0.76 kg/ha) release was maximal in flooded T-1. The grain yield was the highest (368 tillers/m^2, 364 penicle/m^2, 128 grains/penicle, 20.3g weight of 1000 grain) in flooded T-1. Raw biodigestate application (T-2) had higher yield compared to the composted (T-3). The trend was similar in the 'alternate wet-and-dry' condition test counterparts. Overall, the yield remained comparatively high in flooded condition across all the tests compared to the 'alternate wet-and-dry' condition. Microbial diversity hinted at the abundance of *Micromonospora*, *Sphingomonas*, *Alistipes*, *Streptomyces* genera in T-4, T-3, T-2 and T-1 respectively. Organic inputs could help reduce GHG emission in paddy systems. Digestate facilitate immobilisation of heavy metals in the soil, preventing them from leaching, thus reducing the risk of bioaccumulating and contaminating the food chain. It enhances sustainable development scope with uncompromised ecotoxicological and environmental health risks.

Keywords: biodigestate, compost, sustainable environment, GHG emission, paddy system, grain yield

ICEES-24/CP-052 (RS)

NEOTETHYSINVASION AND ITS IMPACT ON JURASSIC PLANT DIVERSIFICATION IN THE JAISALMER BASIN: A FOCUS ON *OTOZAMITES*

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Abstract

The Jaisalmer Basin during the Early to Middle Jurassic period was a hotspot for plant diversification, with gymnosperms, particularly Bennettitales such as *Otozamites*, playing a crucial role in the region's palaeoecology. However, this period of floral prosperity faced increasing threats due to tectonic activities leading to the separation of India from Madagascar.The rifting between the Indian subcontinent and Madagascar resulted in the expansion of the Neotethys Ocean, significantly altering the region's paleogeography. *Otozamites*, a characteristic plant of this era, demonstrates the intricate evolutionary adaptations of flora in response to the prevailing climatic and environmental conditions. This tectonic shift had profound implications on the region's flora, resulting in habitat fragmentation and environmental stress. Biotic factors, such as competition among species and herbivory, also played a role in shaping plant communities during this period. The eventual fragmentation of Gondwana and the isolation of the Indian subcontinent further influenced the evolutionary trajectory of the flora, coupled with changing climate and sea-level fluctuations, posed substantial threats to the plant communities, ultimately leading to a decline in diversity and marking a significant transition in the palaeoecological history of the Jaisalmer basin.Understanding these ancient threats is crucial for comprehending the resilience and adaptability of plant life, which has implications for present-day biodiversity conservation efforts.

Keywords: Neotethys Invasion, Jurassic Plant, Palaeoecology, Environmental stress, Jaisalmer

ICEES-24/CP-053 (P)

HYDROTHERMAL PRETREATMENT AND ORGANIC AMENDMENTS TO ENHANCECOMPOSTING EFFICIENCY

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Abstract

Amelioration of large quantity of kitchen refuse (KR) through composting could be an alternate ecofriendly disposal solution as against incineration and land-filling. Although aerobic composting is often employedto decomposeKR, high salt and moisture content of KR affects the degradationrate and end productquality. Combined effect of hydrothermal treatment (HTP) and the addition of mature compost (MC) was evaluated. MC was added to KR at 10, 30, 50% (w/w, dry weight basis) to treat raw kitchen refuse (RKR) R2-R4 respectively. Similarly, MC was added to hydrothermally treated KR (HKR) in tests H2-H4, in similar proportion. KR with no added MC served as the control for RKR (R1) and for HKR (H1). Rice husk was added in all treatments in 2:1 ratio for bulking. The compost quality was determined by evaluating parameters like physical (colour, odour, mass, volume and density), chemical (temperature, pH, EC, TOC, TN, C/N, NO_3^- and NH_4^+), biological (bacterial, fungal and actinomycetescounts) and enzymatic activities (cellulase and protease). Compost maturitywas assessed from the maturity indices like C/N, water holding capacity, bulk densityand phytotoxicity of the resulting compost. Results indicate that HKR with 10% addedMC enhanced the decomposition rate, accomplished extended thermophilic stage rapidly,produced best quality compost in about 40 days and showed higher germinative index. Further, this study revealed that optimum MC addition and HTPimproved the physical structure of compostedKRthat favouredmicrobial growth andmetabolic activity that acceleratteddecomposition of recalcitrantsubstances in KR.Compost is a good substitute for inorganic fertiliser and reducesdependency on commercial alternatives. KR composting atlocal level couldreplace chemical fertilisers and save the cost ontransportation.Composting metamorphoses the waste to organic amendment, enriching soil health.Scientific composting mitigates ecotoxicological risk by stabilising organic matter, preventing leachate leakage and reducing pathogen contamination.

Keywords: Kitchen refuse, hydrothermal treatment, organic amendment, compost, mature compost

ICEES-24/CP-054 (RS)

IDENTIFICATION OF PATHOGENIC FUNGUS IN FRESH WATER FISHES OF MUNGELI DISTRICT OF CHHATTISGARH

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Abstract

Fungal diseases caused by heterotrophic organisms that are part of the biota of their surrounding fresh water environment. Study was conducted for identification of pathogenic fungus from *Anabas testudineus, Channa striata, Barbodes binotatus, Pethia conchonius, Barbonymus gonionotus, Oreochromis mossambicus, Clarias batrachus* and *Puntius sophore* and test was run for identifying the actual causative agent of the infection. The fish sample was collected from different aquatic ponds located in district Mungeli to Microbiology laboratory of the Dr. C. V. Raman University and placed in tray for taking sample from different part such as gill, fin, skin, whole body and barbells of the fish by using wire loop then there were taking in culture medium viz; PDA (Potato Dextrose Agar) and SDA (Sabouraud Dextrose Agar) used to observe fungus colony and growth. Pathogen status was observed in microscope. Biochemical tests for the colonies of fungus were carried out in which of MR (Methyl Red) and Indole (Kava's Indole) showed positive (+ve) but test of VP (Voges Proskauer) showed negative (-ve) result. The following diseases were observed EUS (Epizootic Ulcerative Syndrome), Saprolegniasis (CWD-Cotton Wool Disease), Barbell rot, Branchiomycosis by fungal pathogen viz; *Aphanomyces invadans, Saprolegnia parasitica, Branchiomyces demigrans* respectively. Fungal diseases are veryserious problem, prevalent and fatal. The control for fungal infectons is good water quality, proper nutrition and good management of fresh water pond.

Keywords: Pathogenic fungus, EUS, Branchiomycosis, Saprolegniasis, Biochemical tests.

ICEES-24/CP-055 (RS)

ANTIBACTERIAL EFFECT OF SOLANUM NIGRUM (MAKOI) MEDICINAL PLANT AGAINSTPATHOGENS OF URINARY TRACT INFECTIONS (UTIS) IN FEMALES

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Abstract

Urinary tract infections (UTIs) are a common health issue among females, often caused by bacterial pathogens. The most susceptible pathogens such as *Escherichia coli*, *Proteus species* and *klebsiella species*. This study evaluates the antibacterial efficacy of Solanum nigrum, a traditional medicinal plant, against these UTIs pathogens. Antibacterial effect of the aqueous extract of Solanum nigrum leaf was studied. Antibacterial activity was performed by agar well diffusion method. The effects of leaf extract on these microbes were compared against the standard antibiotics disc such as Amikacin 30 mcg/disc and Linezolid 30 mcg/disc. In this study, Solanum nigrum leaf extract results showed significant antibacterial activity, with the maximum inhibition against E. coli and minimum inhibition against Proteus and Klebsiella. These findings suggest that Solanum nigrum could be a potential natural remedy for treating UTIs in female patients, offering an alternative to antibiotics and reducing the risk of antibiotic resistance.

Keywords: Medicinal plants, Urinary tract infections (UTIs), Antimicrobial effects, Aqueous extract, Solanum nigrum, Antibiotic disc, GN bacteria, Well diffusion.

ICEES-24/CP-056 (RS)

INSIGHTS INTO THE EFFECTIVENESS OF CADMIUM UPTAKE, SEQUESTRATION AND TOLERANCE IN *RICINUS COMMUNIS* L.

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Abstract

Heavy metal(loid) (HM) contamination of soil and water resources is leading to significant environmental deterioration worldwide. Cadmium (Cd) is a non-essential and toxic metal pollutant causing several undesirable consequences on the health and survival of all living entities. Anthropogenic interventions such as mining, metal refining processes, chemical fertilizer applications, and several other industrial operations enormously contribute to the release of Cd into the environment. Phytoremediation is a promising and viable strategy for remediating polluted sites and hence several plant species are utilized for the reclamation of metal-contaminated soils. *Ricinus communis* L. (castor) is a plant with metal accumulating ability which makes it an efficient tool for phytoremediation. Castor can accumulate greater quantities of Cd in its roots in comparison to other plant parts and can tolerate elevated Cd concentrations to a certain degree. This bioenergy-producing plant is endowed with higher biomass production and improved photosynthesis, an efficient root network for better uptake of water and nutrients, andan effective antioxidant defence system that aids in the adaptation and improved tolerance to Cd. The plant tolerates high concentrations of HMs utilizing different mechanisms including exclusion and compartmentation of the metal in various sub-cellular components, activating antioxidant system, production of compounds like organic acids, amino acids, phytochelatins, metallothioneins, and many more strategies to chelate and sequester the metal. The mechanisms involved in the uptake, accumulation and sequestration of Cd by castor as well as the influences of Cd in the physiological, anatomical and growth attributes of castor are integrated into this review. An overview of the new avenues of strategies that can improve the Cd accumulation potential and tolerance of castor are also discussed. Moreover, the detailed molecular mechanisms of the response against Cd stress in castor are summarised with the aid of genomic, proteomic, and metabolomic approaches.

Keywords: Cadmium, antioxidants, phytochelatins, proline, catalase, phytoremediation, metal-accumulation, transporters.

ICEES-24/CP-057 (RS)

DISTRIBUTION OF MICROPLASTIC IN 'PRISTINE' FRESHWATER ECOSYSTEMS FROM THE FOOTHILLS OF EASTERN HIMALAYA

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Abstract

Plastic has become an inevitable part of human life and the widespread use of plastic is resulting in plastic pollution globally. Many rivers and rivulets that originate from the Eastern Himalaya and flow across the flood plains shape patterns of biodiversity including endemicity and also influenced by semi-urban to urban settings. To monitor distribution of microplastic in the post-monsoon period, 10 rivers, 1 aqueduct and 1 wetland were selected for sampling on the basis of close proximity to human dwellings. From these sampling points, 23 surface water samples were collected in the month of December 2023 and January 2024. The average abundance of microplastic encountered in Gajoldoba wetland and the studied rivers were 19.5±6.4 microplastic/L and 28.3±22.2 microplastics/L respectively. Using bright field microscopy, it was observed that fibers were the most dominant type of microplastic and fragments were only found in three sites. Various colours of microplastics were found including transparent, black, red and blue. Upon chemical characterization it was revealed that polyethylene terephthalate (PET) was most dominant and widespread while other polymer forms that also included ethylene-vinyl acetate (EVA), polyamide, polystyrene (PS), viscose rayon and polyacrylonitrile (PAN) exhibited distinct spatial distribution. In this study it was also observed that relative location of the site (upstream vs. downstream), vicinity to human settlements, flow rate of water and depth of the sampling station influenced abundance of microplastics. The study also shared evidence of the effect of glacial lake outburst flood (GLOF) event on the deposition of microplastic in Gajoldoba wetland.

Keywords: Microplastic, river, Himalaya, wetland, pollution

ICEES-24/CP-058 (RS)

SURFACE MODIFIED CELLULOSE REMOVES ARSENIC FROM GROUNDWATER USED FOR IRRIGATION IN PADDY FIELDS OF THE BENGAL DELTA PLAINS

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Abstract

The reducing conditions and shallow aquifers rich in arsenic (As) is used extensive used for paddy cultivation in the state of West Bengal of India and in Bangladesh within the Bengal Delta Plains (BDP). Arsenic can lead to bioaccumulation in paddy and ultimately biomagnification in humans. Surface modified iron doped cellulose, a type of polymeric scaffold, has been synthesised in the laboratory and evaluated for removal of As present in BDP groundwater and also from agricultural soil. The synthesised surface modified iron doped cellulose removed up to 11ppb arsenic from groundwater of BDP with an initial concentration of 13 ppb based on inductively coupled plasma mass spectrometry (ICP-MS). Besides, germination efficiency of three cultivars of rice grown in the BDP region was evaluated by spiking 10-100 mg/kg of arsenic (arsenate salt) and 1.5 g of polymeric scaffold. Under all arsenic spiked conditions, there was germination of the rice cultivar. As part of the experiment, two cultivars of paddy grown under laboratory conditions but spiked with 100 ppb As and polymeric scaffold (1-2.5 g per 6 kg of soil) showed growth and did not exhibit observable physiological abnormalities. The study indicates the potential extensive in field application of surface modified cellulose in agricultural fields of BDP for removal of arsenic as a cheap, cost-effective and sustainable translational approach.

Keywords: Arsenic, Aquifers, Biopolymer, Cellulose adsorbents, Bioremediation

ICEES-24/CP-059 (RS)

HISTOPATHOLOGICAL EVALUATION OF HEAVY METALS CU ON LIVER AND KIDNEY OF *CATLA CATLA*

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Abstract

The present study was under taken to assess safety and efficacy of Cu on fingerlings of *Catla catla*. Fingerlings of an average weight (10-15 gm) and average length 6-8 cm were selected from the stock and kept for laboratory condition in aquarium of size 60x30x30 cm with 30 L. capacity for one month. After acclimatization *Catla catla* fish (n=6) were exposed to Cu and Zn concentration for 10, 20 and 30days. Fingerlings in each group contains six were given graded doses of Cu (0.2, 0.4 and 0.6 ppm). First group received normal water (Tap water) as a control. The fingerlings were then maintained and observed daily for 10, 20 and 30days for further any toxicity. The numbers of survival were noted. Complete postmortem was done on all survivor or if any fingerlings found dead or moribund condition during the study period. Histopathological examination was performed on collected tissues liver and kidney of individual fingerlings Results will be discussed during the conference.

Keywords: Histopathology, Toxicity, *Catla catla*

ICEES-24/CP-060 (AP)

PATTERNS OF USAGE, STORAGE OF PESTICIDES AND THE DEGREE OF AWARENESS IN PRIMARY PESTICIDE HANDLERS OF HOOGHLY DISTRICT OF WEST- BENGAL IN PRE AND POST COVID CONDITION

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Abstract

Indiscriminate use of chemical pesticide is not only creating a havoc for non-arget organism but also affecting human health in progressively deteriorating pattern. This study conducted at the district of Hooghlyat 4 different sites (Singur, Haripal,Tarakeshwar and Srirampur Agricultural Office) in pre-COVID condition in 2019 to delineate the degree of overall awareness among farmers, field workers and primary workers about pattern of pesticide use in the chosen study area, choice of pesticide, safety measures and precautions adopted by all the primary users and role of education on the degree of awareness shown by primaryusers.Out of the 300 respondents chosen, sex ration of male : female is 77.67%: 22.33%. Mean age of the respondents were 41.64 ± 10.03.A total of 9 pesticides were found as most widely used by the farmers. Chloropyrifos (80%) followed by Cypermethrin (75%) was discovered as the most popular and effective fungicide while Malathione (70%) Mancozeb (69%) and carbendazim (69%) was found as the most commonly used. Farmers rarely used bio-pesticide because of its increased price range and slow rate of action. It is observed also that no precautionary measures is taken up by (90 %) of respondents across four study sites, except covering mouth withcloth. Sprayers obviously are found to be at a greater risk than non-sprayers. As a result of continuous and long-term exposure of the farm workers to chemical pesticides in various forms and conditions many interim as well as chronic health effects were confirmed by the respondents. The study suggest that there is lack appropriate knowledge and implementation of regulations associated with pesticide use pattern and practices, which in turn has adversely affected the health of farmers, field workers and primary users of pesticides. A distinct change in pattern is observed with respect to precautionary measure adoption in post COVID condition, when the survey was carried out in 2023.Primary pesticide handlers (about 50%) became aware about the effect of highly hazardous pesticides, which might be a direct fallout of contagious nature of COVID that has resulted into individuals being susceptive in all walks of life. These problems if dealt with proper attitude then sustainable agriculture will be areality.

Keywords: pesticide-use-patterns, choice of pesticide, effect on human health

DESIGNING A BIOFILTER USING BIOREMEDIATION POTENTIAL OF ARSENIC HYPER-TOLERANT BACTERIUM *Enterobacter sichuanensis* WCHECL1597 AND HYBRID COMPOSITE β-CYCLODEXTRIN EMBEDDED FE-OXIDE

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Abstract

An arsenic and iron hyper-tolerant bacterium was isolated from Parari village of Chakdah block, Nadia, West Bengal. 16s rDNA sequencing & subsequent phylogenetic analysis, scanning electron microscopy and other biochemical characterization methods identified the bacterium as *Enterobacter sichuanensis*. The bacterium showed unhindered growth at 1000 ppm of sodium arsenite, indicating towards assimilatory processes (arsenic bioaccumulation) or dissimilatory processes (arsenic biotransformation) occurring within the bacterium. *Enterobacter sichuanensis* exhibited arsenic biotransformation potential (conversion of arsenite to arsenate), and arsenic bioremediation potential of 90.6 %, 85.0 % & 79.8 % at 1 ppm, 3 ppm & 5 ppm concentrations of arsenic, respectively. The bioremediation parameters were optimized for the bacterium. The bacterium showed maximum percentage of bioremediation within 24 hours of incubation at 37°C and pH-7.0.Sequencing and analysis of the bacterial genomic and plasmid DNA showed the presence of gene, gene clusters and operons responsible for arsenic hyper-tolerance. The design of an arsenic biofilter was proposed using the biomass of *Enterobacter sichuanensis* strain WCHECL1597and a hybrid composite compound (β-cyclodextrin embedded Fe-oxide).Synthetic groundwater (with arsenic up to 10 ppm) was used to study the efficacy of the material (batch experiment). Results indicated arsenic removal up to 90% at a pH range of 7.0 - 8.5. Therefore, the bio-filter could provide a safe drinking water supply at the community level in arsenic-affected blocks of West Bengal.

Keywords: 16S rDNA sequencing; Genomic and plasmid DNA sequencing; Arsenic hyper-tolerant bacteria; *Enterobacter sichuanensis* strain WCHECL1597;Bioremediation; Hybrid composite compound; Biofilter

ICEES-24/CP-062 (P)

EVALUATION OF ZINC OXIDE NANOPARTICLES INDUCED DYE DEGRADATION IN WATER INFERRING PHAs ACCUMULATION IN BACTERIAL SYSTEM

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Abstract

Synthetic dyes are treated as a potential pollutant in aquatic ecosystem, widely used in industries such as textiles, leather, paper, and cosmetics. Several toxic components present in the synthetic dyes can harm aquatic organisms and disrupt the balance of the ecosystems. To address this concern, a remediation protocol is essential. However, a review of the literature reveals that only a limited number of protocols have been outlined for the degradation of synthetic dyes. The current investigation explores the photocatalytic degradation of methylene blue dye when exposed to zinc oxide (ZnO) nanoparticles under open sunlight with positive and negative control. Zinc oxide nanoparticles were synthesized using chemical precipitation method and characterized through UV-Visible spectroscopy, XRD, FTIR and FE-SEM. The dye solution was exposed to different concentrations of ZnO nanoparticles and analysed using conventional spectroscopic approaches like UV-Visible Spectroscopy. A bacteriological screening was performed using PHAs (Poly hydroxy alkanoates) synthesizing bacteria, i.e., *Bacillus megaterium* OUAT 016 and reported that degraded dye water elicited low PHAs accumulation as confirmed through confocal microscopic imaging. Proposed confirmatory method can be applied to evaluate other colour-based pollutants immensely present and pervaded in aquatic bodies.

Keywords: Methylene Blue Dye; Zinc oxide nanoparticles; Photocatalytic degradation; *Bacillus megaterium*; PHAs.

ICEES-24/CP-063 (P)

ASSESSMENT OF POLYCYCLIC AROMATICHYDROCARBONS IN THE STREET DUST OF RANIGANJ, WEST BENGAL

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Abstract

Polycyclic aromatic hydrocarbons are non-biodegradable, environmentally persistent, lipophilic and variably structured organic compounds containing two or more fused aromatic ring mainly of hydrogen and carbon atoms. These hydrocarbons are found in various environmental matrices, including air, soil, street dust, and water, often originating from several natural and manmade process. PAHs are significant pollutant due to their persistence in the environment, potential for bioaccumulation, and adverse health effects. Street dust is considered as an essential component of the urban landscape and acts as a direct sink of atmospheric PAHs, arises from various sources. Raniganj is an industrial town situated in West Bengal with several adjacent coalmines and is facing rapid and unprecedented environmental changes. We have collected street dust samples during winter and monsoon seasons from a total of 19 sites (divided into 5 land use types- residential, industrial, coal mine, commercial and busy traffic) of Raniganj and analysed the concentrations of PAHs in GC-FID after extraction of the components of the samples by Soxhlet. During winter, maximum and minimum concentration of PAHs was observed in the street dust as 7827 ng/g and 607 ng/g, respectively. The percentage total PAHs concentration was found as highest at coal mine area (49%) and lowest at busy traffic area (3%) during both the seasons.The level of PAHs got reduced in monsoon compared to winter; maximum concentration of PAHs was observed in the street dust as 5218 ng/g and minimum level of PAHs was observed in the sample as 405 ng/g. The average observed value of BaP TPE was 20.95 ng BaPeq/g in winter whereas, 13.98 ng BaPeq/g was the observed value during monsoon. Considering the Incremental life time cancer risk (ILCR), people of residential and coal mine area came under high risk while the people of busy traffic, commercial and industrial area came under potential risk. Taking altogether, our study has revealed the importance of considering the street dust of Raniganj as a potentially hazardous environmental component.

Keywords: Street dust, PAHs, Raniganj, ILCR, BaP TPE.

ICEES-24/CP-064(RS)

OPTIMIZING METHANE YIELD IN COW MANURE ANAEROBIC DIGESTION WITH BIOCHAR ADDITIVES AT DIFFERENT RATIOS

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Abstract

Recently, anaerobic digestion (AD) has garnered significant attention globally for its effectiveness in mitigating pollution and generating clean energy. Nonetheless, the anaerobic digestion of high solid cow manure comes across issues related to the inhibition and accumulation of ammonia. To enhance waste treatment efficiency and increase methane yield, the addition of carbon-rich raw materials is a viable strategy for optimizing the carbon to nitrogen ratio (C/N) of the substrate in anaerobic digestion systems. Biochar has recently emerged as a significant exogenous additive for mitigating ammonia inhibition in anaerobic digestion, attributed to its superior porous structure and adsorption capabilities. The buffering capacities, structural characteristics, and nutrient contents of these compounds can improve the efficiency of the microbial community in decomposing organic matter and producing biogas. Two different types of biochar (coconut and bamboo) pyrolyzed at same temperature were characterized through SEM, BET and EDX analysis for identifying pore structures, specific surface area and elemental content. Anaerobic digestion of cow manure was performed in Semi-Continuously Stirred Batch Reactors in AMPTS II with different biochar loadsfor enhancement of methane content of biogas analyzed in gas chromatography (GC). Coconut shell biochar with larger specific surface area showed the highest cumulative biogas production (167 L/kgVS$_{added}$) when added at a particular ratio of 0.6%. Interestingly, the same biochar when added at specific ratio of 0.3%, enhances the methane yield (62%), however the cumulative production decreases to 140L/kgVS$_{added}$. Bamboo biochar on the other hand has comparatively lower methane as well as cumulative production, which might be due to its non-porous structure, lower specific surface area and carbon content. The process parameters like pH, VFA, and COD were monitored at regular intervals for any kind of inhibition within the reactors.The findings suggest that the specific type and dosage of biochar significantly influence both methane yield and cumulative biogas production in anaerobic digestion of cow manure, offering a potential pathway for optimizing biogas systems.

Keywords: Anaerobic Digestion, Biochar, Volatile Fatty Acids, Biochemical Methane Potential, Methane Optimization,

ICEES-24/CP-065(RS)

GREEN SYNTHESIS OF AG-ZNO NANOCOMPOSITES USING *OCIMUM BASILICUM* (BASIL)LEAF EXTRACT AND THEIR ANTIBACTERIAL EFFECT

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Abstract

The eco-friendly, low-cost, green method has been used for the synthesis of silver-doped zinc oxide (Ag-ZnO) nanoparticles from the leaf extract of Ocimumbasilicum (basil) and check their antibacterial activity against *E. coli*, and *Staphylococcus aureus*. The synthesised nanoparticles were characterised through UV-visible, X-ray diffraction (XRD), Fourier TransformInfrared spectroscopy (FTIR), and Field Emission Scanning Electron Microscope (FESEM) with Energy Dispersive Spectroscopy (EDS) techniques. The XRD patterns confirmed the hexagonal wurtzite and face centre cubic structures of ZnO and Ag present in ZnO respectively. The band gap was decreased to 3.33 eV with an average crystal size of 30.05 nm. The morphology was analysed through FESEM, and the particles were confirmed to be cubic. The Silver (Ag), Zinc (Zn) and Oxygen (O) particles present in the prepared samples were confirmed through EDX spectra. The active biomolecules that act as capping and reducing agents have been confirmed in FTIR peaks. The Ag-ZnO shows good antibacterial effects so these can be used in the prevention of bacterial contamination.

Keywords: Ag-ZnO nanoparticles, *Ocimumbasilicum*, green method, Antibacterial effect.

ICEES-24/CP-066(RS)

EVALUATION OF HUMAN HEALTH RISK DUE TO PHENOL CONTAMINATED WATER USING COMPREHENSIVE FUZZY INFERENCE SYSTEM

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Abstract

This study evaluates human health risks associated with phenol-contaminated water using a novel fuzzy inference system, offering an alternative to conventional risk assessment methods. Groundwater samples from an industrial region revealed phenol concentrations averaging 197 times above the permissible limit set by IS:10500, raising significant public health concerns. The fuzzy-based Mamdani Hazard Quotient (HQ) approach was employed to assess the risk, with HQ values for adults reaching as high as 0.489. Notably, the Mean Hazard Quotient (MHQ) for children was found to be 1.07 times greater than for adults, indicating a higher susceptibility among younger populations.

The MHQ framework developed in this study generates outcomes using degrees of membership, expressed through linguistic variables, which offer a more refined and interpretable assessment of health risks compared to conventional models. The fuzzy inference system accommodates uncertainties inherent in environmental data, providing more accurate and reliable risk classifications. This method not only simplifies the complexity of phenol contamination risk analysis but also ensures a more stringent evaluation, particularly beneficial in decision-making processes related to public health safety.

The results demonstrate the potential of the fuzzy-based tool as an effective and comprehensive approach to water quality assessment, particularly in regions suffering from industrial contamination. Its ability to provide concise yet detailed risk evaluations suggests its viability for broader applications in environmental monitoring and health risk assessments.

Keywords: Phenol; Groundwater; Hazard Quotient; Fuzzy logic; Artificial Intelligence

ICEES-24/CP-067(RS)

GREEN SYNTHESIS AND CHARACTERIZATION OF GOLD NANOPARTICLES USING LEAF EXTRACT OF *Withaniasomnifera* AND THEIR IN VIVO BIOCOMPATIBILITY WITH EMBRYONIC ZEBRAFISH AND ANTIBACTERIAL STUDY

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Abstract

Concerns about the toxicity of Gold nanoparticles (AuNPs) to the environment and human health have arisen due to their widespread use in industrial and everyday products. Additionally, there is an increasing interest in finding new methods to produce biocompatible nanoparticles. This study examines the molecular toxicity of AuNPs while exploring environmentally friendly production techniques that use extracts from medicinal plants as stabilizing and reducing agents. The physical and chemical characteristics of the synthesized AuNPs were analyzed using standard methods such as UV-Vis spectroscopy, Dynamic Light Scattering (DLS), and Field Emission Scanning Electron Microscopy (FESEM). The role of hydroxyl (-OH) groups in the production of Gold nanoparticles (AuNPs) was confirmed through FESEM analysis. A Surface Plasmon Resonance (SPR) peak was observed at 548 nm, with the AuNPs measuring an average size of 99.8 nm and having a zeta potential of –23.0 mV. The lethal concentration of AuNPs in zebrafish embryos was determined to be 5 mg/ml to 500 mg/ml. It was found that concentration-dependent morphological defects in the Gold nanoparticles had immediate effects on cells. This analysis evaluated the nanotoxicity of the Gold nanoparticles and recommended using new, environmentally friendly manufacturing methods.

Keywords: Au-nanoparticles, *Withaniasomnifera***,** Green method, Antibacterial effect, Biocompatibility.

ICEES-24/CP-068(AP)

IMPACT OF CLIMATE CHANGE ON TASAR AND ADAPTATION STRATEGIES FOR COCOON PRODUCTION AND FARMERS INCOME

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Abstract

Tasar culture, primarily practiced in forested regions of India, is vital for rural and tribal communities, supporting approximately 3.5 lakh families. However, climate change poses significant challenges to this forest-based industry. Increased levels of greenhouse gases (GHGs) such as CO_2, CH_4, and NO_2 affect both the silkworm lifecycle and the nutritional quality of host plants like Arjun, Asan, and Sal, Elevated CO_2 levels may increase biomass but decrease the nutritional quality of leaves, leading to higher C ratios and lower nitrogen content. This impacts the growth, consumption, and digestibility of the silkworms, Changes in foliar chemistry may alter the interactions between silkworms and their pests, potentially increasing pest abundance and fecundity and high temperatures can lead to a 30% loss in tasar seed cocoon production, affecting the physiological and biochemical characteristics of silkworms, thus impacting yield and quality. Mitigation and adaptation are the two methods for minimizing the harmful effect of climate change. Mitigation approach is not affordable by the tasar farmers due to the cost involved. Adaptation against the climate change is the best policy to minimize the harmful effect in tasar culture. CSB-CTRTI, Ranchi has developed several technologies against the climate change for host plant *viz*., development of drought tolerant accessions number (525, 523,123 and 135), disease resistant accessions (83 accessions of Arjun and 57 accessions of Asan plants are leaf spot, black nodal girding & powdery mildew tolerant), identification of alternate host (*Lagerstroemia speciosa*) for silkworm rearing, rescheduling of pruning dates (first week of March for first crop & last week of April for second crop), Integrated farming (Horsegram, Ginger, Turmeric cultivation under wide spacing of Arjun/Asan plantation), integrated nutrient management (combination of chemical fertilizers, organic manure, crop, residues, N_2-fixing crops), integrated pest management (mechanical, biological & chemical), host plant advisory services through m-kisan (weather and schedule based) are effective approach for maintaining the quality leaf production and farmer's income under impact of climate change. Whereas in silkworm, strategies are developed for the selection of thermo-tolerant line through SCAR markers to overcome loss due to high temperature stress in tasar rearing hotter zones and expression of heat shock proteins (*hsp19.5, hsp19.9, hsp20.4, hsp21, hsp22.2, hsp27.4, hsp60, hsp70, hsp90* and *hspc3*) in a cellular protective mechanism during heat shock, rescheduling of brushing date (agro-climatic zones wise for BV & TV), integrated pest management (IPM for predators & parasitoids), Semi-synthetic diet to protect larvae in early stage from adverse environmental condition & predators, Heat Reflecting Paint for preventing erratic emergence of male moth due to high temperature and silkworm advisory through m-kisan (weather based) for enhancing the cocoon production and farmers income.

Keywords: Brushing date; drought and disease tolerance; thermo tolerant line; alternate host plants, integrated farming and IPM.

ROLE OF MICROBES IN TREATING INDUSTRIAL EFFLUENTS

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Abstract

The increasing population has resulted in the growing demands and needs of people. With the continuous improvement of human socialization and the increasing frequency of social and economic activities, the problem of environmental pollution is becoming more and more serious, and the pollution of water body is especially prominent. The elevation of industrialization and industrial activities has generated plenty of solid and liquid wastes. Water contamination is mostly caused by the discharge of household and industrial sewage. The biological treatment of sewage strengthens the water's ability to purify itself. The microorganisms in the sewage must first be isolated from the water once the pollutants have been removed. Microbes are environmentally, economically, and socially important. Enzymes, probiotics, biofuels like bioethanol, hydrogen gas, and many more from centuries. There are many bacterium uses the free oxygen within the water to degrade the pollutants in the wastewater and then converts it into energy that it can use to grow and reproduce. Waste management, wastewater treatment, and bioremediation all involve the use of microorganisms and their enzymes. The broad category of sanitation includes the treatment of wastewater. The primary agents in the breakdown of organic compounds in wastewater are microorganisms and their enzymes. They play a crucial part and serve as the primary engineers in controlling all ecological processes. Currently, on an industrial scale, these microbes are playing important roles to clean up the industrial waste.

Keywords: Microbes, Pollution, Industrial Waste, Wastewater, Biological Treatment

ICEES-24/CP-070(RS)

EFFECT OF ADDITION OF BIODIESEL HAVING KARANJA OIL ON EXHAUST EMISSIONS AND PERFORMANCE IN A DIESEL ENGINE WITH HYDROGEN AS A SECONDARY FUEL.

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Abstract

With a specific end goal to take care of the worldwide demand for energy, broad research is done to create alternative and cost-effective fuel. The fundamental goal of this examination is to investigate the performance, emissions and vibration characteristics of a single cylinder four stroke diesel engine, working in dual fuel mode with biodiesel of Karanja oil ((BKO) as a renewable fuel and hydrogen (H_2) as gaseous fuel on low (2%), intermediate between medium-high (53%) and high (69%) load conditions. Biodiesel of Karanja oil as 20% biodiesel and 80% diesel known as BKO20, while 30% biodiesel and 70% diesel known as BKO30. With 25% introduction of gaseous fuel (H_2) and biodiesel (10% to 40%) along with diesel showed an increase in brake thermal efficiency (BTE), 85.23%, 10.62% and 19.4% respectively as compared to parent diesel fuel operation. As far as emission is concerned, oxides of nitrogen (NO_x) decreased on higher load conditions with a variation of biodiesel (10% to 50%) in comparison to low load condition. However, the formation of monoxide (CO), carbon dioxide (CO_2) and un-burnt hydrocarbon (HC) decreases along with BKO50 using 25% hydrogen fuel substitution at high (69%) load conditions.

Keywords*:* Diesel, Karanja oil, hydrogen, Emission, performance.

IDENTIFICATION OF BIOACTIVE PHARMACEUTICAL COMPONENT PRESENT IN *AVICENNEAMARINA* – A MANGROVE FRUIT

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Abstract

There are several types of mangrove sp. are found in Sundarban area in West Bengal. Only limited number of plant sp. thrive in mangrove eco-system. In Indian Sundarban the mangal vegetation comprises of 94 intertidal sp. But less than 10 sp. Are utilized by the locals as food & fodder materials. The sp. Like *Avicenniaalba*, A.*marina* , A.*officinalis*, *Sonaratiaapatala*, S.*casiolaris*, *Heritiera fomes* are consumed either as vegetables or beverages .Fruits of *Avicennea marina* is popular as vegetables and it has become popular around Jharkhali area in Sundarban , West Bengal and some costal area of Gujrat. Identification of bio active pharmaceutical components present in *Avicennea marina* fruit from the above sp. have been under taken with proposal through GC-MS analysis.

Keywords: Mangrove fruit, Bioactive, Pharmaceutical, Human food, Indian Sundarban

ICEES-24/CP-072(P)

PHTO CHEMICAL-LOADED NANO COMPOSITE: AN IN-VIVO INVESTIGATION OF DIABETIC WOUND HEALING POTENTIAL

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Abstract

Wound healing is complex process, especially in the diabetic patients, nanotechnology enhances the drug delivery systems hold potential by incorporating phytochemical loaded nanocomposite. The rational delivery of these phytochemical loaded nanocomposite compound is essential to maximize efficacy of wound healing. Nano-formulations have the capability to target specific body area and regulate drug release, providing a more precise and effective means of delivering therapeutic compounds. This represents a significant advancement in medicine offering innovative solutions for improved patient care and treatment.The main goal of our study was to evaluate the efficacy of eugenol of eugenol-loaded nanocomposite in diabetic wound healing. We focused on formulating a nanogel for managing diabetic wounds in the *Wistar rat* model. Eugenol was used as a reducing agent and after synthesizing the nanocomposite, it was loaded with eugenol to reduce toxicity and enhance activity. Results showed that the eugenol-loaded nanocomposite exhibited the best activity compared to the other treated groups and controls. Physical, biochemical, histological and oxidative parameters all indicated that eugenol enhanced the activity of the nanocomposite. The present research work covers the latest advancements on innovative nano-based drug, these novel phytochemicals loaded nanocomposite have demonstrated their wound healing properties using in-vitro and in vivo study. We conclude that the eugenol-loaded nanocomposite has potential as a promising nanogel for diabetic wound healing.

Keywords: Wound healing, Nanoparticle, Loading, Animal study, Toxicity

ENVIRONMENT FRIENDLY APPROACHES IN POST COCOON SECTOR OF TASAR SILK INDUSTRY

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Abstract

Tasar silk industry spreads in various states of India, which provides employment to large population residing in rural area. This industry is having awe-inspiring impression, unique silk quality, and shiny surface as well as fundamental identity due to environment friendly culture, which provides customary livelihood for lakhs of tribal/women populace of India. Post cocoon sector is one of the vital sectors of tasar silk industry, which not only provide the product but also gives direct quantifiable employment mainly focused to rural women populace. Interestingly, this sector maintains the various postcocoon activities linked to traditional to modern having place/situation and time specific relevance. The post cocoon technology operations of tasar silk are energy intensive in all stages i.e. cocoon drying, cooking and reeling/spinning as well as during wet processing like bleaching, dyeing, printing and finishing. Being a cottage industry located mostly in small villages and towns, the industry depends on fire wood, cow dung and other biomass for energy needs.The higher dependence on fire wood and other agro residues by the silk industry has heavily taxed the forest cover and deprived the soil of valuable nutrients and organic conditioning material which have serious ecological implications. In addition, majority of the rural areas in India have scarcity as well as higher interruption of electric power supply. Use of Solar energy can prove to be cheap, localized source of energy for the silk Industry in India. In this regard initiative taken by post cocoon technology section of institute and installed solar power plant in collaboration with MNRE, Govt. of India, and developed a post cocoon operations lab which runs with the solar energy, all the reeling, re-reeling and spinning machines are operated by solar energy. Individual solar operated reeling and spinning machines were also developed by associated stakeholders of tasar silk industry. Apart from the use of renewable energy in post cocoon sector, proper management of silk waste and by-product utilisation work is also going on by the team of scientists of the institute.During the process of Tasar silk reeling & post-reeling process the different varieties of silk fibre waste like de-flossing waste,reelingwaste,basin waste, peduncle, pierced cocoon, cooking water, pupae etc.is obtained as by-products. It is an important asset for reelers to earn extra income out of it. To enhance the income of reelers research has been conducted to prepare spun yarn out of the deflossing, reeling, peduncles, pierced cocoons& post-reeling waste using various techniques. Each technique gives unique texture of yarn and has high demand in the market. Also, techniques have been developed to utilise cooking water for extraction of sericin and pupae for fish feed by the scientists of institute and they are working towards its validation and popularization in the field. Other environmentally friendly approaches are also in progress to make post cocoon sector of tasar silk industry sustainable.

Keywords: By products,environmentfriendly,solar energy, waste management

ICEES-24/CP-074(RS)

*ANTHERAEA MYLITTA*COCOONASE: A NATURALLY SECRETED COCOON DEGUMMING ENZYME

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Abstract

India is the second largest producer of silk, next to China.Tasar sericulture industry is widely accepted for its environment friendly soil to silk approaches. Usually to get silk from tasar cocoons chemical based softening/degumming techniques is in practice. Owing to the environmental friendly approaches in mind, the initiative was taken to use the *Antheraea mylitta*cocoonasefor its impending use in tasar cocoon degumming/softening. Therefore, efforts has been made to perform a methodical analysis of the characteristics of silk fibre obtained using this naturally secreted protease and the existing method. To proceed in this direction various parameters such as FT-IR, DSC, TGA, colorimetry, tensile strength, XRD, Yellowness Index, CHNS, and FE-SEM were used to characterise the silk fibres. The surface of the CDSF (Cocoonase degummed silk fibre) was shown by the FE-SEM images to be relatively smoother than the surfaces of the SDSF (Na_2CO_3+$NaHCO_3$degummed silk fibre) and HDSF (H_2O_2+Neutral soap degummed silk fibre). The absorption pattern in FT-IR indicated slight shifting or vibration of functional group in SDSF silk fibre. Furthermore, much variance was not observed in the mechanical characteristics of silk fibres. Slight fluctuation in the 2θ position is observed in the XRD plot of HDSF and SDSFsilk fibres. The DSC graph showed remarkable differences in the thermal properties of SDSF silk fibre comparatively to that of the HDSF and other silk fibre. TGA analysis revealed that CDSF silk fibre exhibited greater stability against degradation. The present study suggests that cocoonaseisefficient in degumming/softeningtasar cocoons to get tasar silk with environment friendly approaches. This study on enzyme based degumming indicates the possibilities for up-gradation of tasar silk to medical grade tasar silk after extensive evaluation and experimentation in future.

Keywords: Cocoonase, Tasar silk fibre, Degumming, TGA, DSC, XRD, Ecofriendly

ICEES-24/CP-075(AP)

IMPLEMENTATION OF TASAR SILKWORM DISEASE MONITORING AND MANAGEMENT MODULES IN 10 TASAR GROWING STATES OF INDIA

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Abstract

Tasar silk culture is an environment friendly industry which provides tribal and women centric employment to around 3.5 Lakhs peoples of India. It is estimated that around 30-40% loss occurs due to various diseases of tasar silkworm. Therefore, tasar silkworm disease monitoring and management modules has been prepared to minimise the loss caused by various diseases in 10 tasar growing states of India.Seed Act awareness programmes was also conducted at various locations for disease management in tasar silkworm rearing at tasar farmers level by involving the officials/officers of State sericulture department. DMC TEAM (CTRTI, DOS, BSMTC, BTSSO etc) constituted by CSB-CTRTI Ranchi visited 10 tasar growing states of India and conducted the disease monitoring work at PPCs, BSMTCs, BSPUs.In addition, theoretical and Practical information of Disease management Module which includes disinfection of the rearing field before rearing, during rearing and after rearing and the use of different products like Jeevan Sudha, LSM, Jeevan Suraksha etc. has been circulated and implemented for containment of diseases before, during and after the tasar silkworm rearing. In addition, printed material like booklets/brochureswerealso distributed to the farmers and DOS staffs. The Doordarshan based awareness event was also organised in Krishi Darshan programme. Disease monitoring awareness also implemented through Kisan Mela and during the farmers get-together at respective PPC in coordination of concern Scientists/DOS officialsfor conducting this programme. During 2024-2025 marked differences in disease intensities were observed in the state level PPCs. Maximum disease was observed in the state Odisha PPC, Harichandanpur-I.Lowest level of disease was observed in Andhra Pradesh, Bihar, Telangana and Madhya Pradesh.Disease monitoring was conducted in 10 states 91 centres.

The disease monitoring was conducted in 10 states. Disease incidence was observed low in Andhra Pradesh, Bihar, Telangana and Madhya Pradesh hence no cocoons were stifled.PPC, Harichandanpur-Igrainage of Odisha showed more disease followed by Jharkhand, Chhattisgarh, West Bengal and Maharashtra. The diseased lot of cocoon was rejected. The large number of tasarcocoons preserved in grainage of various states. In Jharkhand 90,25,883 cocoons were preserved, out of these 1,69,800 cocoons were stifled. In West Bengal 3,56,600 cocoons were preserved, out of these 57,000 cocoons were stifled. In Uttar Pradesh 1,35,000 cocoons were preserved, out of this 24,000 were stifled. In Chhattisgarh 37,56,136 cocoons were preserved and 107250 were stifled. In Orissa 32,54,690 cocoons were preserved and 4,96,000 were stifled. In Maharashtra around 7,782,25 cocoons were preserved and 5075 were stifled. However, in Andhra Pradesh 80,325 cocoons, Bihar 5,41,605 cocoons, Telangana 5,993,25, Madhya Pradesh 8,16,542 were preserved in grainage but no stifling was conducted due to zero incidence of disease in these regions. Out of total cocoons 193,123,31 preserved 8,59,125 cocoons were stifled and only 184,532,06 cocoons were used for seed production. Data revealed that, effective disinfection and microscopic examination suggested for seed cocoon preservation with stringent monitoring and strict enforcement of the disease module in the tasar growing states is needed.

Key words: Tasar silkworm, disease monitoring, modulesTasar culture, environment friendly, silkindustry

ICEES-24/CP-076(RS)

HANDIA – A DRINK OF THERAPEUTIC IMPORTANCE

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Abstract

Handia is a fermented rice beverage common to ethnic tribes of eastern region of India. It is prepared by application of an amylolytic starter culture called Bhakhar which is a dough like mixture of powdered rice and herbs and the exact composition varies from community to community. Malto-oligosacharides produced by the action of amylolytic starter culture compensate dehydration due to water retaining capacity. The microbial flora and antioxidant activity of Handia are attributed to the type of rice and herbs used. Most common types of microorganism found in Handia are yeast and Lactic acid bacteria exhibiting antimicrobial activity against gram positive bacteria viz. *Bacilus subtilis*, *Staphylococcus aureus* and *S. epidermidis*. Antioxidant activity like free radical scavenging and chelating activity has been observed but specific antioxidant has not been identified till date. There are traditional claims of its therapeutic use in several acute and chronic diseases. The health benefits of Handia and the presence of beneficial microflora in it, are suggestive of using it as probiotics.

Keywords: Handia, Bhakhar, microbial flora

ICEES-24/CP-077(P)

EVALUATING INDOOR REARING PRACTICES OF *ANTHERAEA MYLITTA* UNDER CONTROLLED ENVIRONMENTAL CONDITIONS

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Abstract

Tropical tasar silk is produced by the *Antheraea mylitta*isaimportant component of the Indian silk industry, providing livelihood opportunities for approximately 3.5 lakh individuals, particularly in rural areas. Traditionally, tasar silkworms are reared outdoors, where they feed on trees such as Arjun, Asan, and Sal. However, traditional outdoor rearing methods face significant challenges due to high larval mortality caused by environmental factors, pests, predators, and diseases. These losses severely impact the economic sustainability of Tasar silk production, necessitating the exploration of alternative rearing methods. This study investigates the potential of indoor rearing as a sustainable and commercially viable alternative to traditional outdoor rearing. Present study aims to rear 40 disease-free layings (DFLs) in an indoor condition under controlled environmental conditions. The indoor setup, covered with a green shade net, protects the silkworms from external threats such as pests and adverse weather conditions. Additionally, 20 DFLs are being reared outdoors using traditional methods to serve as a control group. Key parameters such as larval weight, cocoon characteristics, adult longevity, and silk qualityare being monitored to evaluate the comparative effectiveness of indoor rearing. Preliminary results indicate that indoor-reared larvae exhibited faster growth and a slightly higher weight during the early stages. For example, 2nd instar larvae weighed 0.45 g indoors compared to 0.25 g outdoors. However, outdoor larvae showed slightly higher weights in later stages such as the 3rd and 4th instars. The 5th instar larvae had nearly identical weights in both conditions, with indoor larvae weighing 26 g and outdoor larvae 26.28 g. Indoor-reared larvae also completed their developmental stages more quickly, with the 1st instar lasting 2 days indoors compared to 2–3 days outdoors, and the 5th instar taking 12–13 days indoors versus 10–12 days outdoors. Indoor rearing practices for *Antheraea mylitta* show possibilities in minimising the loss and enhancing the cocoon production. However its viable alternative to traditional outdoor rearing yet to established. But based on initial result it can be said that this approach has the potential to mitigate the risks associated with pest and predator attack, environmental challenges in order tocontribute the economic upliftment of rural communities dependent on Tasar silk production.

Keywords: Tasar silk, *Antheraea mylitta*, indoor rearing, controlled environment,silk quality, sustainable sericulture.

ICEES-24/CP-078(AP)

A STUDY ON METAL TOXICITY DUE TO CONSUMPTION OF CULTURED FISH FROM AN URBAN AQUACULTURE POND

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Abstract

Fish are one of the major sources of animal protein, Omega-3 fatty acid and other nutrients. On the other hand, consumption of metal contaminated fish produces carcinogenic effects on human health. Two fish species (*Labeorohita* and *Catlacatla*) were collected from Batam Pond, Ranchi, India. Metal (Cd, Cr, Cu, Pb, and Zn) concentrations were assessed in flesh part of both fish species. The result showed that the concentrations of Cd (21.25–19.44 mg/kg), Cr (487.81–451.91 mg/kg), Pb (69.00–63.82 mg/kg), and Zn (404.01–418.73 mg/kg) were higher than that of previous research and international standard. Waste effluent discharge from various industries, vehicular emission due to excess traffic jam, and domestic sewage disposal in the pond were the major causes of elevated concentration of these metals. The bioconcentration factors were generally higher than the reference value suggesting that Cr, Pb and Zn have the ability to cause detrimental effects on human being due to their consumption. Health risk assessment (Hazard index>1) shows that the local people consuming fish (especially children) are more susceptible to exposure of these metals. Hence, suitable measures should be adopted to combat with the metal pollution in the fastest growing capital city of India.

Keywords: Fish; Metal; Health risk assessment; *Labeorohita*; *Catlacatla*; Carcinogenic effects

ICEES-24/CP-079(P)

GLYCOLIPIDS FROM PSEUDOMONAS AND THEIR APPLICATION IN HEALTH AND MEDICINE

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Abstract

Glycolipids are molecules found in the cell membranes of the organisms. Glycolipids consists of a lipids tail that are linked to the carbohydrate groups. These are the essential molecules present in the organisms that play the vital role in various biological processes like; cell recognition, adhesion, and signaling processes. Glycolipids are crucial for cell communication and often found on the cell surface where they interact with other cells and molecules, whereas Pseudomonas bacteria are having lots of positive impact on human health and it also having the various impacts on biotechnology, environmental protection, agriculture and Scientific Research. Some strains of these bacteria are used to produce valuable products like; Enzymes, Biofuel, and other Bio-based products. These bacteria are also leading their existence in the field of industrial processes like Bioremediation (cleaning up the pollutants), Bioplastics production, and also the synthesis of antibodies. Glycolipids are the manifold group of molecules found in various organisms, including bacteria like Pseudomonas species. The glycolipids from Pseudomonas plays a vital roles in the cell membranes and can have applications in health and medicine, some potential applications are: Vaccine Development, Antibacterial agents, Anti – Inflammatory Agents, Cancer Research, Drug Delivery, Diagnostic Tools and many more. This paper presents the application of glycolipids from pseudomonas in health and medicine for the human being and it will also be helpful for the health of future upcoming generations.

Keywords: Glycolipids, Cancer Research, Drug, Bioremediation, Bioplastics.

ICEES-24/CP-080(P)

SICKLECELLANEMIA:AREPORTONNEGLECTEDCHRONIC DISEASE IN INCREASING GLOBAL HEALTH IMPORTANCE

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Abstract

Sickle cell anemia (SCA) is a hereditary blood disorder characterized by the presence of abnormal hemoglobin, leading to the deformation and fragility of red blood cells. Despite being one of the most prevalent genetic diseases worldwide, SCA has long been overlooked as a global health concern, particularly in resource-limited regions. This paper aims to shed light on the increasing global significance of SCA, emphasizing its impact on affected individuals and health care systems. A comprehensive literature review explores the epidemiology, clinical manifestations, and management strategies for SCA. A small population-based survey conducted in Ranchi, Jharkhand underscores the urgent need for increased awareness, improved access to health care services, and innovative research to alleviate the burden of SCA on individuals and communities. We can work towards a more inclusive and equitable global healthcare landscape by addressing this neglected chronic disease.

Keywords: Sickle cell Anemia (SCA), hemoglobinopathy, Genetic blood disorder, Red blood cell deformation, Global Health Concern, Epidemiology, Jharkhand Population study, Disease Awareness

SMALL PLASTICS, BIG CONSEQUENCES? EXPLORING FOODBORNE MICROPLASTIC CONTAMINATION AND ANALYTICAL CHALLENGES

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Abstract

The occurrence of microplastics in food products is a significant public health concern. Recent scientific findings have confirmed the contamination of food by tiny plastic particles. A review of the current literature reveals that 32 % of studies focus on microplastics in seafood, 20 % on sea salt, 9 % on drinking water, and 7 % each on honey, beer, and sugar. Additionally, 3 % of studies examine milk, 4 % meat, 5 % tea, and 6 % other foods. Various analytical methods have been used to detect microplastics in these matrices. For example, mineral bottled water contains microplastics ranging in size from 1.3 µm to 500 µm, with an average concentration of 6,296±10,521 microplastics per liter. Sea salt and fish products also exhibit microplastic contamination, predominantly in the form of fragments and fibers, with sizes typically between 110 and 300 µm. Other food products, such as beer, sugar, and tea, have been less studied, but contamination has been confirmed. Craft beer, for instance, contains an average of 29 fibers per liter, ranging from 40.3 to 769.8 µm in size, while sugar shows concentrations of 33±4.2 to 80±4.2 microplastics per kilogram, with an average of 55.1±43.7 microplastics per kilogram. Fragments (95 %) and fibers (4 %) are the predominant shapes. Teabags are a notable source of microplastics, with particles between 200.6 and 220.7 µm, primarily composed of polytetrafluoroethylene, polycarbonate, and nylon. Analytically, various methods are employed for sample preparation and chemical identification. The most common sample preparation method is digestion to remove organic matter, typically using a 1 mol L^{-1} potassium hydroxide solution. Spectroscopy is the most widely used technique to confirm the plastic nature of particles, though current methods face limitations in detecting particles smaller than 7 µm. Therefore, future optimization of analytical approaches should focus on the isolation and precise quantification of microplastic particles.

This study was carried out under the grant BRIC.INAIL ID 14/2022 “Approccio integrato per la determinazione e la caratterizzazione di microplastiche aerodisperse in ambienti di lavoro”. Project title: “Caraterizzazione delle Emissioni in Luoghi di LavOro di micro Plastic He Aerodisperse e Nanoplastiche – CELLOPHAN”.

Keywords: Microplastics; Foods; Contamination; Digestion; Analytical procedure.

ICEES-24/CP-082(RS)

CHARACTERIZATION AND IMMOBILIZATION OF CELLULOLYTIC BACTERIA (*ZHIHENGLIUELLA FLAVA*) FROM TERMITE GUT IN BIOCHAR FOR ENHANCEMENT OF BIOGAS PRODUCTION

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Abstract

This study investigates the enhancement of biogas production from water hyacinth (WH) through the immobilization of *Zhihengliuella flava* B10, a potent cellulose-degrading bacterium, on coconut shell biochar. *Z. flava* B10, isolated from the gut of the wood-feeding termite *Microtermesobesi*, demonstrated the highest cellulolytic activity among tested isolates, with an activity level of 2.20 ± 0.8 U/ml. Immobilizing *Z. flava* B10 onto biochar significantly improved biogas methane potential (BMP), achieving a maximum yield of 281.16 ml CH_4/gVS when incorporated into anaerobic digestion (AD) processes. The biochar served as a support for microbial colonization and enhanced the breakdown of lignocellulosic material. Advanced machine learning models—XGBoost, K-Nearest Neighbors (KNN), Adaboost, and CatBoost—were applied to the experimental BMP data to predict biogas production potential. Among these, the XGBoost model provided the highest predictive accuracy at 99.76%, affirming the reliability of the experimental data and demonstrating its potential for forecasting AD performance under varying conditions. This study also reports, for the first time, the isolation of *Z. flava* from a termite gut, adding novel insights into its role in cellulose degradation. Integrating biochar-immobilized bacteria with machine learning predictions offers a promising strategy for optimizing AD processes. These findings hold potential for scaling up microbial immobilization technologies, contributing to sustainable biogas production from lignocellulosic biomass like water hyacinth.

ICEES-24/CP-083(AP)

STUDY OF GENETIC VARIABILITY IN HORSEGRAM FOR YIELD AND NUTRITIONAL TRAITS

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Abstract

Horsegram (Macrotyloma uniflorum (Lam.) Verdc.) is an underutilized orphan legume. It is cultivated in different parts of country for food, nutrition and therapeutic uses.We report agro-morphological and nutritional variation in a set of 70 horsegram accessions. The experiment was conducted in randomized block designs with three replication and data was analyzed for tenagro-morphological and four nutritional quality traits. Wide range of variation was observed for almost all the yield and yield related traits. Moderate to high estimates of PCV, GCV, heritability, and genetic advance were observed for all the traits under the present study. At the phenotypic level, seed yield per plant had a significant and positive correlation with the, number of pods per plant, number of pod clusters per plant and number of seeds per pod. The genotypes showing maximum seed yield per plant were observed for IC-23441, IC-23440, Indira Kulthi, HPKM-11-56, and HPKM-317. We have identified promising accessions (IC-120826) for high Fe, Zn, Protein & Sulphur content. The lines having good agronomic features and balanced nutritional profile could be utililzed in biofortification programme.

ICEES-24/CP-084(UG)

CHARACTERIZATION OF ACTIN CYTOSKELETAL REGULATOR (ACR) GENEIN COTTON

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Abstract

The Actin Cytoskeletal Regulator (ACR) gene plays a pivotal role in orchestrating cellular processes by modulating the actin cytoskeleton in various organisms. In cotton (*Gossypium* spp.), a vital economic crop, characterization of the ACR gene highlights its significance in growth, development, and stress responses. Molecular analyses have revealed that the ACR gene encodes a protein crucial for actin dynamics, which is fundamental for cellular processes such as cell division, elongation, and intracellular transport. This gene sequence is conserved among different cotton species, underscoring its evolutionary importance. Moreover, the identification of the conserved protein domains highlights their functional conservation across diverse organisms. During cotton development, this gene exhibits differential expression patterns in various tissues, indicating its role in organ-specific growth. Additionally, ACR gene expression is influenced by abiotic and biotic stresses, suggesting its involvement in stress-adaptation mechanisms. Notably, ACR gene manipulation affects fiber development, an economically important trait in cotton, further emphasizing its agricultural relevance. The primary role of the actin cytoskeleton in plant cells is to regulate processes, such as organelle movement, membrane trafficking, and morphogenesis. Additionally, it enables cells to adhere to each other and the extracellular matrix. The arrangement and movement patterns of the cytoskeleton can potentially have a significant impact on bolstering plant resilience across different cellular functions.

Keywords: Actin Cytoskeletal Regulator (ACR) gene, Cotton (*Gossypium*), Stress Responses, Division, Intracellular Transport, Abiotic-biotic Stress, Morphogenesis.

ICEES-24/CP-85/P

COMMERCIAL SOIL AMENDMENT FOR *Capsicum* PRODUCTION

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Abstract

Capsicum frutescens or green chili, commonly known as 'Hari mirch' in India, is a widely used vegetable recognized for its fiery flavor and numerous health benefits. These berry-type fruits belong to the *Solanaceae* family, exhibiting variations in size depending on region and typically present a color ranging from bright to dark green. These chilies are cultivated year-round invarious Indian states. In this study, saplings of Jwala chili variety were selected since it is more locally available in West Bengal. Additionally, being a perennial crop, it could adapt to the changing weather conditions. The purpose of this study is to investigate the effects of different fertilizing agents on the growth and productivity of *Capsicum frutescens*. To ensure high production and rapid growth, various fertilizing agents such as manure, vermicompost, and specific biofertilizers were added in separate setups along with growing the plant in untreated soil. We aim to conduct comparative studies to observe growth rate alterations in *Capsicum frutescens* upon the usage of these fertilizers, compared untreated soil under identical conditions of temperature, pH, and humidity. Three replicas of plants were grown in 4 different setups that includes Control, Soil + Manure, Soil + Vermicompost, Soil+ Biofertilizer. The growth in height, number of leaves and stems were observed and noted for a period of 11 weeks. Simultaneously, the soil in which the plants were grown was analyzed and two microbes were isolated which was further characterized according to their Gram nature and ability to utilize macronutrients like nitrogen, phosphorus and potassium. To conclude, the setup having biofertilizer showed the best growth showing 223.46% increase in height, 109.09% increase number of leaves and 83.33% increase in number of stems and branches. This was only setup which showed reproductive growth in the form buds, which gave flowers in the time of extreme heat wave. These results indicate that the biofertilizer clearly has an upper hand over the other fertilizing agents in commercial usage.

Keywords: *Capsicum frutescens*, capsaicin, biofertilizer, vermicompost, consortium, *Rhizobium.*

Acknowledgments for Publication



Acknowledgments for Felicitation

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Acknowledgments for Printing

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