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A Report on Guest Lecture
"(Bio) Electrochemical Solutions for Environmental Sustainability: Water Remediation, Biohydrogen Production and Soil Enhancement"
Organized by Department of Civil Engineering
in association with ASCE MITS Student Chapter and Builders Club
on 10.10.2025

Report Submitted by: Dr. Priyam Nath Bhowmik, Assistant Professor, Department of Civil Engineering; Mr. Vinoth Kumar R, Assistant Professor, Department of Civil Engineering.
Resource Person Details: Dr. Sovik Das, Assistant Professor, Department of Civil & Environmental Engineering, Indian Institute of Technology Delhi, New Delhi, India.
Attendees: 114 participants
Mode of Conduct: Online
Time: 11:00 am – 1:00 pm (Online)
Venue: Seminar Hall – B
Report Received on 11.10.2025.

Objective of the Programme

The primary objective of this expert lecture was to expose Civil Engineering students and faculty to the latest advancements in bio electrochemical systems (BES) and their applications in environmental sustainability, particularly focusing on:

- Water remediation and wastewater treatment through microbial electrochemical technologies,
- Biohydrogen generation as a renewable energy source, and
- Soil enhancement using electro-bioremediation processes.

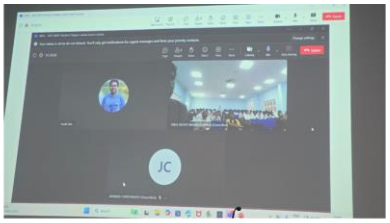
The session aimed to bridge the knowledge gap between theoretical environmental engineering concepts and modern electrochemical technologies applicable to sustainable civil infrastructure development.

Programme Highlights

- Insightful presentation on bio electrochemical system mechanisms, such as microbial fuel cells (MFCs) and microbial electrolysis cells (MECs).
- Discussion on coupled biological and electrochemical processes that simultaneously achieve pollutant degradation and energy recovery.
- Case studies on industrial and municipal wastewater treatment using BES technologies.
- Detailed explanation of biohydrogen production pathways, and their integration with existing wastewater infrastructures.
- Interaction session focusing on soil enhancement and heavy metal recovery through electrode-assisted microbial reactions.
- Real-world examples from IIT Delhi's ongoing research projects emphasizing scalability, cost optimization, and sustainability metrics.

Sustainable Development Goals (SDGs) Targeted

The guest lecture primarily aligned with the following United Nations Sustainable Development Goals (**SDGs**):



SDG 6: Clean Water and Sanitation – promoting innovative water treatment and reuse technologies.
SDG 7: Affordable and Clean Energy – highlighting biohydrogen as a green energy vector.
SDG 11: Sustainable Cities and Communities – integrating sustainable remediation practices into urban infrastructure.
SDG 13: Climate Action – reducing carbon footprint through waste-to-energy solutions.

Alignment with SDG Goals

The lecture showcased how bio electrochemical technologies directly contribute to achieving **SDG 6** and **SDG 7** by:

- Treating wastewater while simultaneously generating clean energy (biohydrogen or electricity).
- Enabling circular economy models within urban infrastructure.
- Demonstrating carbon-neutral remediation pathways in line with India's climate commitments.
- It also reinforced academic and research awareness towards climate-resilient and sustainable engineering practices.

Outcomes of the Programme

- Participants gained a comprehensive understanding of the interdisciplinary applications of environmental biotechnology and electrochemistry.
- Students could identify research opportunities in microbial electrochemical technologies and their role in sustainable civil engineering.
- Faculty members were motivated to explore collaborative projects and funded research related to bioenergy recovery and sustainable wastewater management.
- The session encouraged innovation and entrepreneurship in developing low-cost bio electrochemical solutions for rural and urban water systems.

Programme Outcomes (POs) Achieved

The event contributed to the attainment of the following Programme Outcomes (POs):
PO1: Engineering Knowledge – Application of scientific principles in environmental sustainability.
PO3: Design/Development of Solutions – Conceptualizing sustainable electrochemical remediation systems.
PO5: Modern Tool Usage – Awareness of advanced experimental and computational techniques for environmental modeling.
PO7: Environment and Sustainability – Understanding the societal, environmental, and economic context of civil infrastructure.
PO12: Lifelong Learning – Motivation to pursue research and innovation in emerging environmental technologies.

Knowledge Outcomes (KOs)

After attending this lecture, participants:

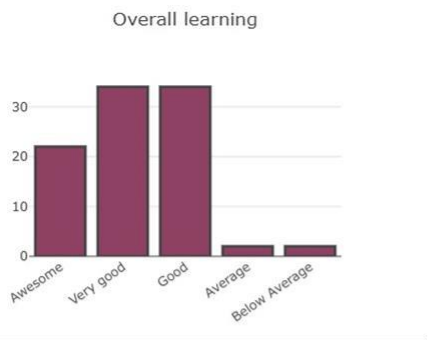
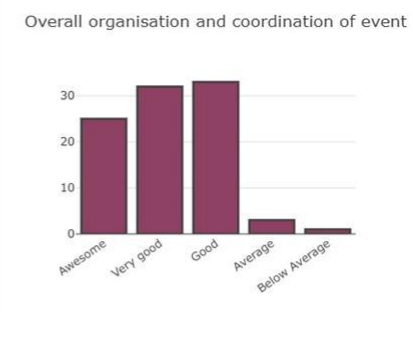
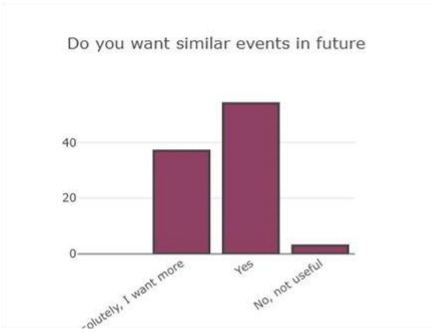
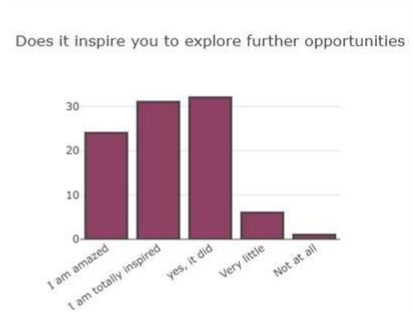
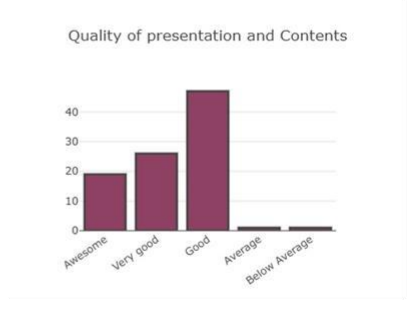
- Understood the fundamentals and working principles of (bio)electrochemical systems.
- Learned how microbial interactions can drive electrochemical reactions for pollutant degradation and hydrogen generation.
- Recognized the integration potential of such systems within existing wastewater treatment plants.
- Identified key parameters influencing system performance, efficiency, and scalability.
- Acquired research insights into soil bioremediation and resource recovery frameworks.

Domain Specific relevance

This lecture was highly domain-specific as it directly pertained to the core areas of Civil and Environmental Engineering:

1. It emphasized water and soil management, crucial components of sustainable infrastructure development.
2. The application of bio electrochemical processes represents a paradigm shift from traditional physico-chemical treatment methods toward nature-inspired, self-sustaining systems.
3. The topic bridged environmental engineering principles (mass transfer, microbial kinetics, electrochemistry) with civil engineering objectives (waste minimization, resource recovery, sustainable design).
4. Such technologies have growing importance in decentralized wastewater treatment, sludge valorization, and green energy production, all integral to modern civil engineering practices.
5. By exposing participants to real-world research at IIT Delhi, the session reinforced the connection between academic learning and applied environmental innovation.

Conclusion

The guest lecture by Dr. Sovik Das proved to be an enlightening and impactful session that broadened the participants' understanding of bio electrochemical innovations in environmental engineering. The talk effectively demonstrated how scientific research can be transformed into practical, sustainable solutions addressing global challenges in water purification, renewable energy generation, and soil rejuvenation. By linking advanced electrochemical principles with the goals of sustainable infrastructure, the event inspired students and faculty alike to pursue research and innovation in green technologies. Overall, the session reinforced MITS's commitment to promoting environmental stewardship, interdisciplinary learning, and alignment with global Sustainable Development Goals (SDGs) through academic and research excellence.

Feedback Analysis: