

Report on National Webinar

“Circular Economy Approach for Mitigation of Plastic Waste Challenges, Opportunities, and Future Prospects”

Background

The global consumption of plastics has been increasing over the years, particularly because they are lightweight, resilient, relatively low-priced and long-lasting. The plastic industry produced approximately 300 million tons of plastics in 2020. Of the total quantity of plastic waste generated, only 7% is recycled, about 8% is incinerated and the residual is landfilled. In the landfilling process, toxic chemicals leach out causing degradation of soil while incineration produces CO, CO₂, oxides of N₂, SO₂ and other toxic gases causing air pollution and global warming. To limit the global warming and achieve carbon neutral by 2050 or so, it is necessary to reduce the consumption of petroleum and other fossil related raw materials for the production of plastics and energy and replace to certain extent by renewable sources. Further, non-biodegradable plastics persist in the environment for centuries, causing a threat to the eco system. Therefore, to meet the growing consumption of plastics and sustainable environmental material usage in the near future, it is high time that the **circular economy approach** needs to be developed and plastics must be recycled or reprocessed to avoid problems in landfills, emission of greenhouse gases and reduce the production of virgin polymers.

India's Recycling Landscape

India's consumption of plastics is estimated at over 16 million tons annually. However, inadequate waste management systems lead to approximately 26,000 tons of plastic waste being generated daily, of which only a fraction is recycled. Much of this plastic waste ends up in landfills, water bodies, and oceans, causing severe environmental degradation and health hazards. Recognizing the urgency of addressing plastic pollution, the Indian government has implemented several initiatives to promote sustainable plastic recycling: a) Established the Waste to Wealth Mission in 2021 to leverage science, technology, and innovation to create financially viable and sustainable circular economy models. b) Amendments to the Plastic Waste Management Rules in 2022 to tackle plastic waste and move towards a more circular economy for plastics. c) Amendments to the Extended Producer Responsibility (EPR) guidelines which will drive market demand for good quality recycled plastics. These regulatory changes have set clear targets to drive up the use of recycled content in packaging and eliminate single-use plastic packaging. The market for recycling plastic waste in India reached 9.9 million tons in 2023. It is projected that by 2032, this figure could rise significantly to 23.7 million tons.

Over the last two decades or so, several studies have suggested alternatives to the conventional petroleum-based plastics. One such alternative is bioplastics, which are polymeric compounds that are both functionally like synthetic plastics and largely environmentally sustainable. A variety of bioplastics have been developed to address environmental issues associated with conventional petroleum-derived plastics and found that some bio-based plastics cannot be recycled and end up in landfills, which decompose gradually and produce methane gas. Further, the bioplastics may not replace petroleum-based plastics for all applications. For these reasons, people are starting to believe that bioplastics should be used only where suited, with tailor-made properties. Some studies show that the drawbacks associated with bioplastics are less severe when compared to conventional plastics. In order to confirm the eco-friendliness of new bioplastics, future studies need to be conducted through Life Cycle Assessments (LCAs) and Land Use Change (LUC) analyses to determine whether the use of new-generation bioplastics is indeed beneficial to the environment and become alternative to the virgin polymers based on petroleum.

The circular economy model has emerged as a promising approach to addressing the crises of plastic waste management. Unlike the traditional "take, make, dispose" model, the circular economy seeks to extend the life cycle of materials through reuse, recycling, and remanufacturing. This model is crucial for reducing plastic waste's environmental impact while unlocking new economic opportunities in waste management and material innovation. However, adopting a circular economy for plastics presents challenges, such as technological limitations in recycling, insufficient regulatory frameworks, and economic barriers to alternatives. Therefore, collaboration among academia, industry, and policymakers is essential to overcome these obstacles.

Against this backdrop, it was initially proposed to organize a two-day webinar including a special session for students to speak on the proposed topic. As the response from the students was poor, it was decided in the Executive Committee meeting held on 25.9.2024 to postpone the presentation of the technical papers by the students to a later date which will be notified in due course of time and to organize a one-day national webinar consisting of a series of expert lectures to get know the latest developments that have taken place in reducing plastic waste, the challenges, opportunities, and future prospects that exist in circular economy approach for mitigating the plastic waste.



Objective of the Webinar

The primary objective of this webinar was to convene experts from academia, industry, and research institutions to address the global challenge of plastic waste management through the lens of the circular economy. By focusing on resource optimization, recycling, reuse, and the development of biodegradable materials, the webinar aimed to explore innovative solutions that reduce plastic waste generation. The invited lectures are likely to be centered around technological, regulatory, and societal aspects of plastic waste management, providing a platform for students and professionals to contribute to a sustainable future.

Key objectives included:

1. Understanding the Circular Economy: To explain the principles of the circular economy and its potential in transforming plastic waste management by promoting reuse and recycling.
2. Identifying Challenges: To explore the challenges in reducing plastic waste, particularly single-use plastics, and examine the role of technology, policy, and public awareness.
3. Exploring Opportunities: To discuss emerging technologies such as biodegradable polymers and chemical recycling that can mitigate the plastic waste crisis.
4. Fostering Collaboration: To encourage dialogue between industry leaders, researchers, and students on innovations in sustainable plastic waste management.
5. Motivating the Student Community: To inspire the next generation of engineers and scientists to engage in sustainability-focused research and development.

IIChE Amaravati Regional Center, is very happy to inform you all that the one-day National Webinar on "Circular Economy Approach for Mitigation of Plastic Waste: Challenges, Opportunities, and Future Prospects" was successfully organized on 7th October, 2024 by IIChE Amaravati Regional Center in association with all student chapters under IIChE ARC and was hosted by National Institute of Technology Andhra Pradesh (NIT AP), Tadepalligudem. The event served as a platform for experts to share their insights into cutting-edge technologies, successful case studies, and innovative business models that support sustainable plastic waste management.

Organizing Committee

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Officiating Director, NIT Andhra Pradesh

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Assistant Professor & HOD, Department of Chemical
Engineering, NIT Andhra Pradesh

Dr. Dinesh P Shankar Reddy
Associate Professor, Department of Chemical
Engineering, NIT Andhra Pradesh

Chief Guests



Prof. B S Murthy
Patron Officiating Director,
NIT Andhra Pradesh



Smt. Sheela
Vice President,
IICHe

Guests of Honour



Mr. Dhawal Saxena
Honorary Registrar,
IICHe



Prof. N. Balasubramanian
Honorary Treasurer,
IICHe

Speakers



Dr. Sunil Pandey
Ph.D. Director
The Energy and Resources Institute



Dr. Pralash A. Walgankar
Ph.D. Emeritus Scientist
CSIR-National Chemical Laboratory



Dr. Vinendra Kumar Gupta
Ph.D. Head R&D, Polymer & Senior Vice President
Reliance Industries Limited Navi Mumbai



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Ph.D. Chief Scientist, Head
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Dr. Gourhari Chakraborty
Department of Chemical Engineering
NIT, Andhra Pradesh



Dr. Mahesh P.
Department of Chemical Engineering
NIT, Andhra Pradesh

Inaugural Session

After the prayer by the students of Chemical Engineering, NIT AP, Tadepalligudem, the inaugural session was started at 9.30 am with a warm welcome by the organizing committee, where the theme of the event mitigating plastic waste through the circular economy was introduced.



The dignitaries present on-line at the inaugural session included:

- Sri Jagarlamudi Murali Mohan, Chairman, IChE ARC and Managing Director, JOCIL Ltd. Guntur
- Smt. Sheela, Vice President, IChE and Former Deputy Chief Executive, Nuclear Fuel Complex, Hyderabad
- Prof. N. Balasubramanian, Honorary Treasurer, IChE, Department of Chemical Engineering, Anna University, Chennai
- Mr. Dhawal Saxena, Honorary Registrar, IChE and CEO & CTO, Bhumista Infra Services, Mumbai
- Dr. V. Govardhana Rao, immediate past Chairman, IChE ARC & Former Professor, IIT Bombay
- Dr. C.V.V. Satyanarayana, Vice Chairman, IChE ARC and former Chief scientist, CSIR-NCL, Pune
- Dr M Venkateswara Rao, Honorary Secretary, IChE Amaravati Regional Centre and Organizing Secretary for the National Webinar

The dignitaries present off-line at the inaugural session included:

- Dr. P. Dinesh Sankar Reddy, Associate Professor, Dept. Chemical Engineering NIT AP, Tadepalligudem
- Dr. Vinoth Kumar Raja, HOD, Department of Chemical Engineering, NIT AP, Tadepalligudem
- Dr. Gourhari Chakraborty, Adhoc Faculty, Department of Chemical Engineering, NIT AP, Tadepalligudem
- Dr. Mohanraj P Adhoc Faculty, Department of Chemical Engineering, NIT AP, Tadepalligudem

The National Webinar was inaugurated by Smt. Sheela Vice President, IChE & Former Deputy Chief Executive Nuclear Fuel Complex, Hyderabad and Prof. B S Murthy Officiating Director, NIT AP. Presiding over the Inaugural Session Sri J Murali Mohan Chairman, IChE ARC & Vice President, RVR & JC College of Engineering (A) narrated the programs organized by IChE ARC and conducted the proceedings. Prof. N. Balasubramanian, Honorary Treasurer, IChE, Department of Chemical Engineering AG Tech, Anna University, Chennai and Mr. Dhawal Saxena Honorary Registrar, IChE CEO & CTO, Bhumista Infra Services Vashi, Navi Mumbai blessed the inaugural function as Guests of Honour. Dr. P. Dinesh Sankar Reddy, Associate Professor, Dept. Chemical Engineering NIT Andhra Pradesh graced the Inaugural function as Special Guest. Dr Vinoth Kumar Raja, HOD, Department of Chemical Engineering, NIT AP welcomed the guests and participants.



Prof. V. Govardhana Rao, Former Professor at IIT Bombay and Immediate Past Chairman IChE ARC, welcomed the participants, briefly explained about the importance of the webinar in addressing the plastic waste management and encouraged the student community to engage in sustainability-driven research and innovation in handling the plastic waste.

Morning Session (Technical Session I)

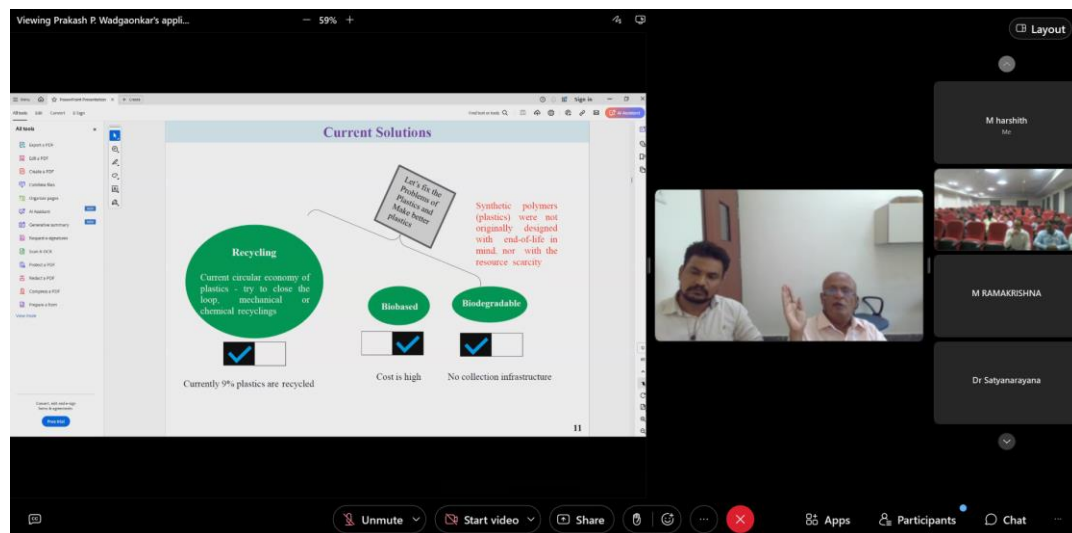
After the inaugural session at 10.30 am, Dr. V. Govardhana Rao, immediate past Chairman, IChE ARC & Former Professor, IIT Bombay Chaired technical session and conducted the proceedings. This

session of the webinar featured a series of insightful presentations by distinguished speakers, each addressing key topics related to plastic waste management and sustainability.

- **Dr. Sunil Pandey**, Director of the Circular Economy and Waste Management Division at TERI, delivered a presentation on "Plastic Waste Management in India with Reference to Single-Use Plastics." He emphasized the significant environmental impact of single-use plastics (SUPs), often referred to as "use and throw" items. Dr. Pandey discussed various techniques and strategies that can be employed to mitigate their harmful effects, focusing on regulatory frameworks, public awareness, and emerging technologies in the Indian context.



- **Dr. Prakash P. Wadgaonkar**, Emeritus Scientist at CSIR-NCL, Pune, spoke on "The Greening of Synthetic Polymers." He addressed the need to make synthetic polymers eco-friendlier, discussing strategies to reduce their environmental impact and develop more sustainable alternatives. His talk also highlighted the challenges and realities of promoting biodegradable materials as substitutes for traditional plastics.



Afternoon Session (Technical Session II)

After lunch at 02.00 pm, Dr. P. Dinesh Sankar Reddy, Associate Professor, Department of Chemical Engineering & Registrar, NIT AP Chaired the session and conducted the proceedings.

Dr. Gourhari Chakraborty, Adhoc Faculty at NIT Andhra Pradesh, focused on "Sustainable Plastics." He presented eco-friendly alternatives to conventional plastics that are designed to minimize waste and pollution. His presentation stressed the importance of promoting a circular economy through the recycling and composting of biodegradable polymers and polymer nanocomposites.



- **Dr. Mohanraj P** delivered a presentation on "The Application of Polymers in Electrochemical Reduction for Wastewater Treatment." He discussed how certain polymers can enhance the efficiency of pollutant removal by acting as conductive or catalytic materials, improving the treatment of wastewater.



- **Dr. Sanat Kumar**, Chief Scientist and Head of Upstream and Wax Rheology Division at CSIR-Indian Institute of Petroleum, Dehradun, presented on "Chemical Recycling of Waste Plastics." He explained how this process breaks down plastic waste into its original chemical components, enabling its reuse and helping to reduce the burden on landfills.

**Chemical recycling
of waste plastics-
opportunities &
challenges**

Speaker :
Dr. Sanat Kumar



Evening Session (Technical Session III)

After Tea break at 04.00 pm, Dr C.V.V. Satyanarayana, Vice Chairman, IChE ARC and former Chief scientist, CSIR-NCL, Pune Chaired the session and conducted the proceedings.

- **Dr. Virendra Kumar Gupta**, Head of R&D Polymer and Senior Vice President at Reliance Industries Limited, spoke on "Circularity in the Plastic Economy." He described how a circular economy aims to create a closed-loop system in which plastic materials are continuously cycled back into production, conserving resources and minimizing environmental impact.



These presentations collectively highlighted innovative approaches to reducing plastic waste, promoting sustainability, and advancing a circular economy in the plastics industry.

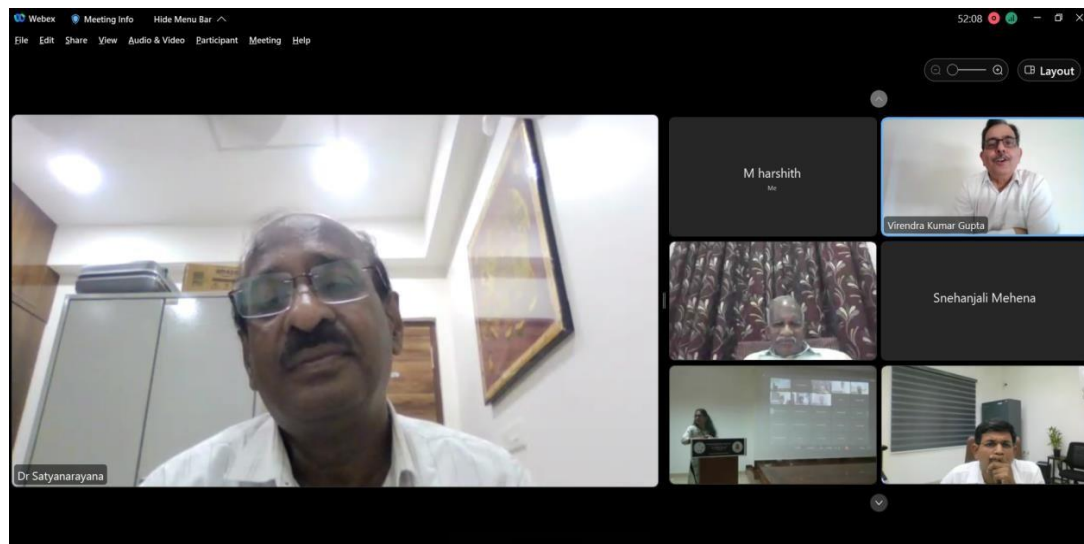
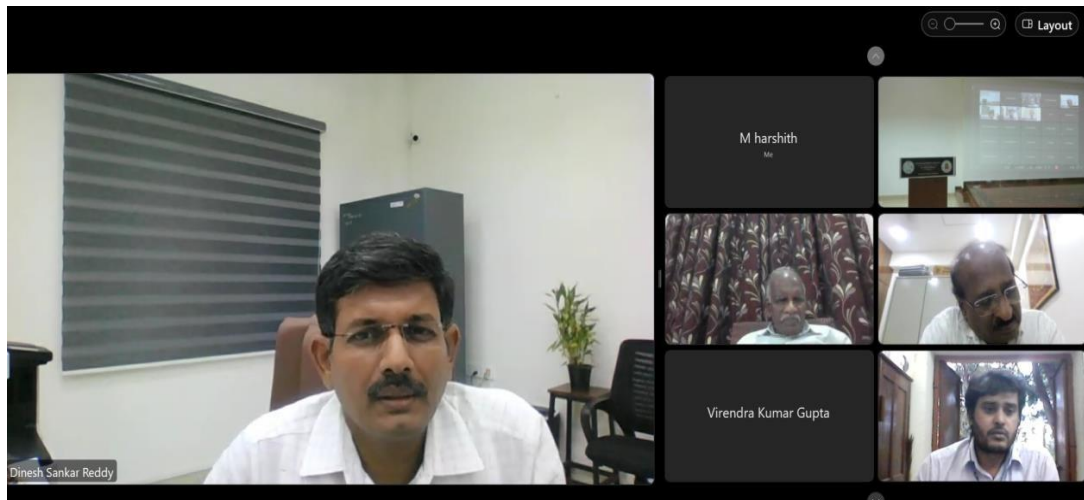
Magazine and Merchandise Launch

During the event, the Department of Chemical Engineering launched its departmental magazine, "Absorb 3.0", featuring research and achievements of students and faculty. The department also revealed its new merchandise, symbolizing pride and unity within the Chemical Engineering community at NIT Andhra Pradesh



Query Sessions and Interactions

Each session included an interactive Q&A segment, where participants engaged with the speakers on topics such as the large-scale adoption of sustainable materials, technological innovations in recycling, and the role of policy in advancing circular economy models.



Closing Session

The event concluded with a closing address by Dr Dinesh P Shanker Reddy, who summarized the key takeaways and encouraged continued exploration of the circular economy model as a solution to global plastic waste issues. Dr M Venkateswara Rao, Honorary Secretary, IChE Amaravati Regional Centre and Organizing secretary for the National Webinar proposed the vote of thanks, expressing gratitude to the dignitaries, speakers, participants, and the organizing team for their valuable contributions towards the grand success of the event.



Conclusion

The National Webinar on "Circular Economy Approach for Mitigation of Plastic Waste" was a significant success, offering a platform for knowledge exchange and collaborative discussions. The event reinforced the critical need for innovation, policy support, and industry-academia collaboration to promote the transition toward a circular economy. As global efforts to mitigate plastic waste intensify, webinars like these highlight the importance of collective action in achieving sustainable development goals. The event attracted eminent experts, faculty members, and students, who gathered to discuss the pressing issue of plastic waste management and explore sustainable solutions through the circular economy approach.

Total number of registered participants = **599** including **100** offline participants (students, faculty and working professionals). The huge response from the participants across many regions of the country is the testimony how curious and enthusiastic the participants are to listen to the expert lectures.

As per the feedback from the participants, all the speakers delivered highly informative, inspiring and thought-provoking lectures of the alarming impact of the plastic waste on the eco-systems and the necessity of circular economy model in addressing for the mitigation of the plastic waste, the on-going developments in this direction and the challenges and opportunities in implementing the circular economy for the plastic waste management in the years to come. They suggested the organizers to conduct many more such webinars in future.

(Dr. M.Venkateswara Rao)
Honorary Regional Secretary, IChE Amaravati Regional Center