नवीन और
नवीकरणीय ऊर्जा मंत्रालय
MINISTRY OF
NEW AND
RENEWABLE ENERGY
सत्यमेव जयते

# SARDAR SWARAN SINGH NATIONAL INSTITUTE OF BIO-ENERGY

(An autonomous institute of Ministry of New and Renewable Energy, GoI)


Quarterly Newsletter

# Bio-ऊर्जा

**October 2025**

**Issue 12**

# *Word from the Director General, SSS-NIBE*

*The Twelfth Issue of SSS-NIBE's Quarterly Newsletter marks the completion of the second quarter of the financial year 2025–26.*

*This quarter was notable for the successful conduct of the 41st Governing Council meeting under the newly constituted Council chaired* ***by Sh. Santosh Kumar Sarangi, Secretary, MNRE, Government of India.*** *I had the privilege of presenting a comprehensive overview of the research activities across all five R&D divisions of the institute, which received appreciation from the Council.*

*A major milestone during this period was the rapid progress in installing the 2G Ethanol Process Validation Pilot Plant in collaboration with our industry partner. The plant is expected to become operational by the end of 2025, marking the second technology developed at the institute to transition from the laboratory to the field—a proud achievement for the SSS-NIBE team.*

*Looking ahead, the institute is actively preparing for the 5th International Conference on Recent Advances in Bioenergy Research (ICRABR 2025) scheduled for October 2025. The response from researchers, academicians, and industry has been highly encouraging, with nearly one hundred and fifty abstracts expected and significant international participation anticipated.*

*Dr. G. Sridhar*
*(Director General)*
*SSS-NIBE*

# Research and Innovation

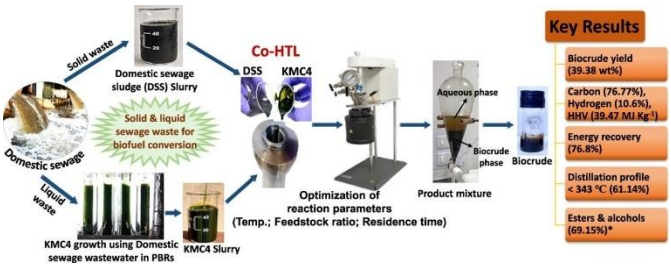
## From Waste to Watts: Algae and Sewage – A Sustainable Duo for Biofuel

*Swati Kumar, Senthil Nagappan, Sanjeev Mishra*

The specter of global warming looms large, driving an urgent global quest for sustainable energy alternatives. Among the promising solutions, biofuels derived from algae have garnered significant attention. Algae, with their rapid growth rates and high oil content, present a compelling pathway to renewable energy. However, a major hurdle in large-scale algal cultivation is the immense demand for freshwater, a precious resource already under strain.

This is where a truly innovative and sustainable approach emerges: leveraging wastewater for algal cultivation. Among various wastewater streams, sewage wastewater stands out as an exceptionally viable option. It is rich in organic content, nitrogen, and phosphorus—all essential nutrients for algal proliferation. By utilizing sewage wastewater, we not only reduce the demand for freshwater but also provide a natural and efficient bioremediation process for the wastewater itself, effectively tackling two environmental challenges simultaneously.

Furthermore, the potential for resource recovery extends beyond just the algal biomass. The solid waste component of sewage, known as sewage sludge, also possesses a high organic load. When algal biomass and sewage sludge are subjected to co-hydrothermal liquefaction (HTL), a thermochemical process that converts organic matter into liquid fuel, the synergy is remarkable. This combined approach can significantly enhance biocrude yield and improve its quality, offering a truly circular and sustainable pathway for biofuel production.




Co-hydrothermal liquefaction of algal biomass with sewage sludge.

Our research[a] explores a groundbreaking method that takes this concept a step further. There was a significant biocrude yield of 39.38 wt% and the biocrude demonstrated excellent properties with high carbon (76.77%), hydrogen (10.6%), and a high heating value (HHV) of 39.47 MJ $Kg^{-1}$, indicating its potential as a high-quality fuel. The process boasts an impressive



a. Mishra, S., & Mohanty, K. (2020), *Energy Conversion and Management*, *204*, 112312.

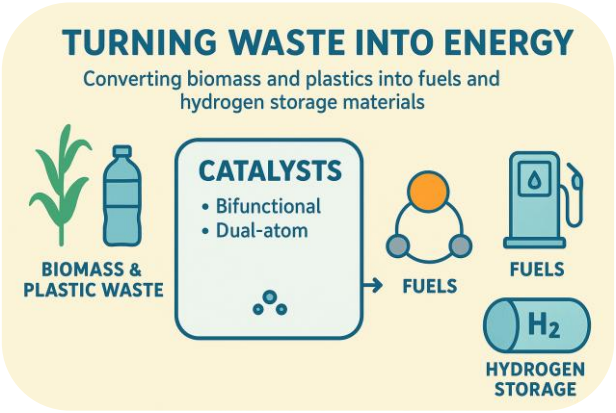
energy recovery of 76.8%, underscoring its efficiency.

Embracing wastewater-fed algal cultivation for biofuel production represents a paradigm shift in our approach to energy and waste management. This innovative research demonstrates a powerful synergy between waste management and renewable energy production. By transforming readily available sewage wastewater into a resource for algal growth and subsequently converting this biomass, along with sewage sludge, into biocrude, we are paving the way for a truly sustainable biofuel future. This approach not only addresses the urgent need for alternative fuels but also offers a viable solution for wastewater treatment and resource recovery, creating a win-win scenario for our environment and energy security.

## Turning Waste into Energy: Innovative Catalysts for a Sustainable Future

Senthil M. Arumugam, Ashish Bohre

The growing accumulation of agricultural residues and plastic wastes poses a serious and multidimensional threat to the environment, contaminating soil and water, releasing greenhouse gases, and overwhelming global waste management systems. These persistent pollutants contribute to climate change and resource depletion, demanding urgent technological solutions. To address these challenges, researchers at our institute are developing advanced catalytic technologies that can transform waste carbon sources into renewable fuels and hydrogen storage materials, thereby creating tangible opportunities for a circular and low-carbon energy future. The research focuses on integrated catalytic valorization, where biomass-derived molecules such as levulinic acid and furfural are selectively converted into value-added chemicals like γ-valerolactone and δ-valerolactone.




Conversion of biomass and plastic waste into value added chemical

These cyclic compounds serve as vital intermediates and can be further hydrogenated to produce diols capable of acting as hydrogen carrier molecules, which is an advanced materials that can store and release hydrogen safely and efficiently. This process not only

converts agricultural residues into renewable energy carriers but also establishes a sustainable cycle linking biomass utilization and hydrogen energy systems. Simultaneously, plastic wastes such as PET, PC, PPO are being catalytically depolymerized into smaller aromatic and cyclic intermediates, which are subsequently upgraded into clean liquid hydrocarbons and hydrogen-rich oxygenates compatible with modern fuel infrastructure. These approaches maximize carbon recovery and minimize environmental pollution by integrating biomass and plastic conversion within the same catalytic framework. At the core of this work are bifunctional and dual-atom heterogeneous catalysts composed of earth-abundant metals including Cu, Ni supported on metal oxide, carbon, or zeolite-based materials. These catalysts combine redox and acid–base properties, allowing simultaneous bond activation, hydrogen transfer, and molecular rearrangement under mild, energy-efficient conditions. Their design ensures both high catalytic activity and long-term stability, making them suitable for scalable, real-world applications. The team employs in-situ spectroscopy to monitor intermediates and active sites, enabling catalyst optimization for enhanced selectivity and performance. By uniting waste reduction, green catalysis, and hydrogen energy storage, this research provides a sustainable technological solution to two pressing global issues—plastic pollution and carbon emissions. The outcomes align with the institute's mission to advance renewable bio-energy innovation, circular chemistry, and environmental resilience, positioning these catalytic technologies as a cornerstone for a hydrogen-powered and resource-efficient future.

# News and Events

### Two-Week Rotational Training Program on Biomass Energy Technologies

The Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE) conducted a two-week rotational On-the-Job Training Program on "Biomass Energy Technologies" for students from the National Power Training Institute (NPTI), Delhi, from 7$^{th}$ to 18$^{th}$ July 2025.

The program aimed to provide participants with practical exposure to diverse biomass conversion technologies, including biogas, bio-CNG, biochar, and biofuel production systems.

It featured laboratory demonstrations, expert lectures, and field visits, offering participants a comprehensive understanding of bioenergy applications within the Indian context.

## Visit to Punjab Agricultural University (PAU), Ludhiana

Dr. Vandit Vijay, Dr. Kunwar Pal, and Shri Vijay Bajala from SSS-NIBE visited the Punjab Agricultural University (PAU), Ludhiana on 16th July 2025 to discuss prospective awareness activities addressing the issue of stubble burning and to explore the feasibility of jointly organizing such outreach programs in Punjab.

During the visit, the team also interacted with scientists working in the area of biochar research to identify potential avenues for research collaboration and technology development. The discussions focused on the role of biochar in soil health improvement, carbon sequestration, and sustainable residue management.

## Industry Collaboration Meeting

Mr. Kiran, Managing Director, Kaashayap Energy Infrastructure Pvt. Ltd., visited the Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE) on 22nd July 2025 to explore potential areas of industry–research collaboration in the field of bioenergy.

During the visit, Mr. Kiran held detailed discussions with Dr. Sanjeev Mishra and Dr. A. Senthil Nagappan on topics related to biogas production, algal biomass utilization, and emerging bioenergy technologies. The deliberations focused on identifying feasible pathways for technology demonstration and scale-up in partnership with industry stakeholders.

The meeting underscored the institute's ongoing efforts to strengthen industry–institute linkages and promote translational research for sustainable bioenergy solutions aligned with national renewable energy goals.

## Expanding Biogas Portfolio with a New Plant in Haryana

The Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE) has further expanded its biogas outreach portfolio through the initiation of another biogas plant project in Hisar, Haryana. On 31st July 2025, the institute supplied the starter seed material to M/s Bransco for the commissioning of their Napier grass-based biogas plant.

## Independence Day Celebration

The 79th Independence Day was celebrated on 15th August, 2025 with enthusiasm in the institute. On this occasion, the Director General

of the Institute hoisted the flag. The flag hoisting was followed by tree plantation from DG, SSS-NIB. A brief cultural program was conducted by researchers, staff and their families.

79th Independence Day Celebration

## Invited Talk on Strategic Energy Security and Innovation

Dr. Vandit Vijay, Scientist at SSS-NIBE, delivered an invited talk during the Strategic Energy Security and Innovation Workshop jointly organized by the Punjab State Council for Science and Technology (PSCST), the U.S. Embassy, and IIT Ropar on 9th September 2025 at Chandigarh.

His presentation focused on the evolving role of bioenergy systems and renewable fuels in strengthening India's energy security framework and promoting innovation in the clean energy sector. The session provided a valuable platform for exchanging ideas with experts from academia, industry, and policy-making institutions on advancing sustainable energy technologies through collaborative R&D initiatives.

## Participation in the India Bioenergy & Tech Expo 2025

The DG, SSS-NIBE, along with Dr. Rawel Singh and two Research Fellows, participated in the 2nd Edition of the India Bioenergy & Tech Expo (IBET Expo 2025) held on 25th September 2025. The event, themed as an International Conference and Exhibition on Bioenergy and Technologies, was supported by the Ministry of New and Renewable Energy (MNRE), Ministry of Power, Ministry of Road Transport and Highways, and the Department of Science & Technology (DST), Government of India.

During the conference, the DG, SSS-NIBE, chaired a Cross-Panel Session on "Technical and Commercial Expectations & Performance Management," which brought together experts from government, academia, and industry to deliberate on strategies for advancing bioenergy deployment and performance benchmarking.

## DG, SSS-NIBE Speaks on Biological Green Hydrogen at National R&D Conference

The DG, SSS-NIBE, participated as a speaker in a roundtable discussion on "Biological Green Hydrogen Production" during the Green

Hydrogen R&D Conference held on 12th September 2025 at New Delhi.

The session brought together leading scientists, policy experts, and industry representatives to discuss advancements, challenges, and collaborative opportunities in the field of biological hydrogen generation and its integration into the national hydrogen economy framework.

The participation reaffirmed the institute's role as a knowledge partner and technology contributor in India's transition toward low-carbon and green energy solutions.

## ICRABR-2025: 5th International Conference on Recent Advances in Bio-energy Research

We're excited to announce the 5th International Conference on Recent Advances in Bio-energy Research (ICRABR-2025), organized by SSS-NIBE, taking place from 6th to 9th October, 2025. With a growing global focus on renewable energy, the conference will highlight cutting-edge research in biomass and bio-energy—including biohydrogen, biomethanation, bioethanol, biomass gasification, carbon materials, value added chemical and more. Building on the success of previous editions, ICRABR-2025 will bring together global experts to explore sustainable solutions for energy and environmental challenges. For more details please visit: www.icrabr.com

### Important Dates

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|---|---|
| Abstract Submission Opens: | 20/03/2025 |
| Abstract Submission Closes: | 15/08/2025 |
| Early Bird Registration Deadline: | 30/08/2025 |
| Intimation of Abstract acceptance: | 20/08/2025 |
| Final Registration Deadline: | 10/09/2025 |

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