



सत्यमेव जयते

नवीन और  
नवीकरणीय ऊर्जा मंत्रालय  
MINISTRY OF  
NEW AND  
RENEWABLE ENERGY

**SARDAR SWARAN SINGH**

**NATIONAL INSTITUTE OF BIO-ENERGY**

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



Quarterly Newsletter

**Bio-ऊर्जा**

October 2024

Issue 8

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



*The eighth issue of SSS-NIBE's quarterly newsletter is scheduled for release as we complete the second quarter of the financial year 2024–25.*

*We were fortunate to hold the 40<sup>th</sup> Governing Council and 6<sup>th</sup> Annual General Meeting at the premises of SSS NIBE, where Secretary, MNRE physically conducted the meeting and appreciated the R&D progress at the institute. He also visited the labs and held one-to-one interaction with Scientists and Researchers.*

*This quarter witnessed conducting a training program, which was exclusively tailor-made for the executive of NTPC. The two-day training program provided the participants hands-on training on the biomass testing methodology and protocols that could be adopted for testing of biomass samples for co-firing in their thermal power plant. The other event was successfully conducting of a one-day seminar on opportunities and challenges in biomass supply chain management. The seminar had pan-India participants representing policy making bodies, R&D institutions, academia and industry.*

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

## Research and Innovation

### **Bamboo's use in the form of activated carbon for hydrogen storage**

By Dr Amlan Das

In an inhouse R&D works recently taken up by Electrochemical Process Division, Bamboo ( grass family), a fast growing biomass was taken up for activated carbon and value added by products development. The increasing global demand for energy, driven by essential factors such as population growth and urbanization, spotlights the urgent need for sustainable energy solutions. Among these, hydrogen stands out as a particularly promising alternative energy carrier, distinguished by its zero-carbon emission profile, and presenting a compelling response to the challenge of sustainable energy generation. This urgency to explore sustainable energy sources underlines the significance of enhancing hydrogen storage solutions, a critical step toward realizing a viable hydrogen economy. Activated carbons (ACs) are at the forefront of this quest,

attributed to their exceptional specific surface area, micropore volume, and their role in improving the activated carbon density for optimized hydrogen storage. In the realm of activated carbon sources, bamboo-based ACs emerge as a key player due to their environmental friendliness, cost-effectiveness, and superior adsorption characteristics. The exploration of bamboo's potential unleashes new avenues for producing activated carbon with ideal porosity and surface area, critical factors in powder activated carbon and carbon porosity that directly influence chemical adsorption dynamics. Unveiling the role of biochar as a catalyst support for converting methane-rich biogas into hydrogen in a sustainable way.



The production of activated carbon (AC) from bamboo involves a structured process

that ensures the transformation of bamboo into a highly porous material suitable for hydrogen storage. Initially, bamboo materials undergo preparation, which includes cleaning and cutting into suitable sizes.



Following preparation, pyrolysis is conducted, which involves heating the bamboo in the absence of oxygen to break it down into char. The charred bamboo then undergoes carbonization at high temperatures, which further enhances its carbon content. The activation step follows, where the carbonized bamboo is exposed to activating agents. This stage is crucial as it develops the porosity and surface area of the AC. We can utilise steam or carbon dioxide to activate the bamboo char. Alternatively, we can treat bamboo char with chemicals such as zinc chloride or phosphoric acid. This method is characterized by lower temperatures and

shorter activation times. The activated carbon is cleaned thoroughly and dried for characterizations.

## Optimization of Mixed Agroresidue Pellets for Enhanced Fuel Quality and Economic Feasibility

By Sh. Gajera Binubhai Bhautik

This article addresses a critical issue faced in northern India, where farm fires due to the burning of agricultural residues, particularly rice straw, has been causing severe environmental pollution. This study aims to provide a solution by optimizing biomass pellet compositions using rice straw, mustard straw, and sawdust to enhance their fuel quality for co-firing in thermal power plants. Given the increasing demand for clean energy and the Indian government's mandate to utilize paddy straw in power generation, this research becomes highly relevant in promoting sustainable biomass usage.

The uniqueness of the study lies in its integrated approach combining Response Surface Methodology (RSM) and Artificial Neural Networks (ANN) with a Multi-Objective Genetic Algorithm (MOGA) to

optimize biomass blends. This approach allowed the researchers to effectively balance various parameters such as calorific value, ash, nitrogen, and sulfur content in the biomass pellets. This is the first time report as per our knowledge to effectively use multiple parameters targeting efficiency and pollution aspects. The methodology ensures that the optimal blend has a high energy output with minimal emissions, making it suitable for large-scale industrial applications.

The study identified an optimal biomass pellet blend of 74-76% rice straw, 14-16% mustard straw, and 10% sawdust, significantly improving fuel quality by maximizing heating value and minimizing ash, nitrogen, and sulfur content.

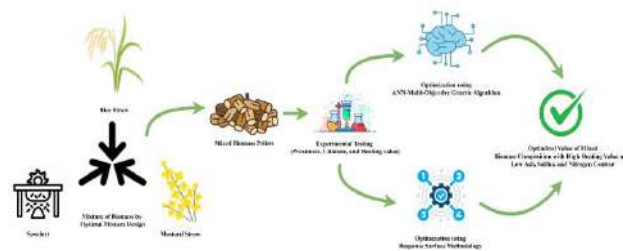


Figure 1. A general overview of the study to determine an optimal blend of biomass adhering to low emission and high calorific value.

Chloride and sulfur levels in the optimized blend were determined to be 4189 mg/kg and 2716 mg/kg, respectively, as determined by combustion ion chromatography. A techno-economic analysis revealed that a 100% agro-residue-based power plant would have a highest generation cost of Rs. 10.71 per unit, with co-firing 5% biomass in thermal plants proving competitive in the matters of cost-effectiveness.

## News and Events

### **Workshop on Biomass sampling and characterization**

SSS-NIBE hosted a two-day National Workshop titled “Specialized Hands-on Training and Workshop on Agro-biomass Sampling and Characterization Techniques

for Thermal Power Plant Applications” on July 4-5, 2024, specifically for NTPC officials. The workshop was inaugurated by Dr. G. Sridhar, DG, SSS-NIBE, along with Chief Guest Shri Satish Upadhyay, Director of SAMARTH Mission, and Guest of Honour

Shri V. Chandrasekharan, GM, NTPC. The event began with a prayer to Maa Saraswati.



Workshop on Biomass sampling

### **Guest Lecture**

Prof. Aravind Purushothaman Vellayani from the University of Groningen visited SSS-NIBE on July 21-22, 2024. During his visit, he delivered an insightful talk on "Biohydrogen and Solid Oxide Fuel Cells," which highlighted the potential of these technologies in advancing bioenergy solutions. Following the presentation, engaging discussions were held to explore collaborative research opportunities in bioenergy, focusing on innovative applications and technologies. Additionally, the possibility of launching new academic

programs in India in partnership with the University of Groningen was explored, aimed at enhancing knowledge and skills in this crucial field.



Guest Lecture by Prof. Aravind P Vellayani

### **Independence Day Celebration**

The 78th Independence Day was celebrated with great enthusiasm at SSS-NIBE on August 15, 2024. The DG, SSS-NIBE hoisted the national flag, marking the occasion with a sense of pride and unity. Following the flag hoisting, the DG, led a tree plantation initiative, symbolizing a commitment to environmental sustainability and growth. The celebration included a brief cultural program featuring performances by researchers, staff, and their families, showcasing the vibrant spirit of the institute.

## **National Seminar on Biomass Supply Chain Management**

On September 5, 2024, SSS NIBE hosted a National Seminar titled "Biomass Supply Chain Management: Challenges, Opportunities, and Developments" at the MGSIPA Complex in Chandigarh. The event was inaugurated by Dr. G. Sridhar, DG, SSS-NIBE, in presence of prominent guests including Chief Guest Shri Satish Upadhyay, Mission Director of SAMARTH, Guest-of-Honour Er. Pritpal Singh, Executive Director of PSCST, and Shri Anirudh Tewari (IAS), Director General of MGSIPA.



National Seminar on Biomass Supply Chain Management

The seminar aimed to foster collaboration among government officials, industry leaders, entrepreneurs, policymakers, and researchers, providing a platform to share insights, experiences, and best practices in biomass

supply chain management. Participants engaged in discussions about the current challenges and emerging opportunities in the sector, highlighting the importance of sustainable practices and innovation in biomass utilization.

## **International Conference on Bioenergy**

Dr. Rawel Singh, Scientist-D, SSS-NIBE, delivered an insightful presentation on "Emerging Biomaterials & Biochemicals" during the International Conference on Bioenergy: Unleashing Bioenergy Potential in India, which took place from September 2-4, 2024, at Yashobhoomi, Dwarka, New Delhi. His session highlighted innovative developments in biomaterials and biochemicals, emphasizing their role in advancing sustainable bioenergy solutions in India. The conference brought together experts, researchers, and industry leaders to explore the vast potential of bioenergy, fostering collaboration and knowledge sharing to drive progress in the sector.

## **International Day of Clean Air for Blue Skies**

On September 9, 2024, a state-level function

to celebrate the “International Day of Clean Air for Blue Skies” was organized by the Punjab Pollution Control Board at IK Gujral Punjab Technical University in Kapurthala. Dr. G. Sridhar, DG, SSS-NIBE, attended the event as a Guest of Honor, where he delivered a special talk addressing the importance of clean air and sustainable practices. Following his address, Dr. Sridhar engaged in fruitful discussions with senior officials from IKG PTU and the Punjab Pollution Control Board, focusing on collaborative efforts to enhance air quality and promote environmental sustainability in the region.

### **Visit to Lambra Kangri Cooperative Society**

On September 12, 2024, Dr. G. Sridhar, DG, SSS-NIBE, along with Dr. Sachin Kumar, Dr. Kunwar Pal, and Dr. Vandit Vijay, visited the Lambra Kangri Society in Hoshiarpur district. The society has been actively engaged in several initiatives focused on decentralized energy generation, particularly through biogas, as well as wastewater treatment and agricultural practices.

During the visit, the society’s secretary showcased their successful biogas plant,

which has been operational for several years, demonstrating effective cooperative-based management. The plant not only provides a reliable source of biogas but also produces organic manure for agricultural use. The delegation discussed potential future collaborations aimed at field-based research activities, exploring opportunities to further enhance the society's initiatives and contribute to sustainable development in the region.

### **Hindi Pakhwada**

In celebration of Hindi Fortnight, the institute organized a series of competitions, which saw enthusiastic participation from employees. These events highlighted the importance of promoting Hindi language and culture within the institution. Additionally, on September 17, 2024, the institute hosted a Hindi Kavi Sammelan, featuring esteemed poets Mr. Rajesh Chetan and Dr. Rasik Gupta, both recognized for their contributions to poetry on national and international platforms. The event provided a vibrant atmosphere for the exchange of poetic expressions, further enriching the cultural experience of the



participants and fostering a love for the Hindi language.



Hindi Kavi Sammelan

### **40<sup>th</sup> GC and AGM meeting**

The 40th Governing Council and 6th AGM meeting took place on September 26, 2024, at 12:30 PM, chaired by Sh. Bhupinder S. Bhalla, Secretary MNRE. The meeting was held in the Committee Meeting Room at SSS-NIBE in hybrid mode. In the afternoon, the Secretary MNRE led a tree sapling plantation event.



40<sup>th</sup> GC and AGM meeting

### **Swachhta Pakhwada**

Swachhta Pakhwadas were celebrated at the Institute with great enthusiasm and active participation from staff and research fellows. The event was organized in compliance with the national Swachh Bharat Abhiyan initiative, emphasizing the importance of cleanliness, hygiene, and sanitation. Various activities were conducted throughout the week, including a Swachhta Campaign, Swachhata Samvad, a slogan writing competition, and the Swachh Bharat Oath. These initiatives fostered a sense of community and commitment to maintaining a clean environment.



Swachhta Pakhwada

### **Visit to NTPC**

From September 29 to October 1, 2024, a team consisting of Dr. Kunwar Pal (Scientist-C), Dr. Tapas Kumar Patra (Scientist-C), and

Research fellows visited the NTPC power plants in Jhajjar, Haryana, and Dadri, Uttar Pradesh. The purpose of the visit was to observe the existing modalities for biomass sampling, handling, and characterization at these power stations.

This visit built on discussions held during a hands-on training program organized by SSS

NIBE in July 2024 for NTPC personnel. The team aimed to gain practical insights and enhance their understanding of the processes involved in biomass management at the power plants, facilitating improved collaboration and knowledge sharing in future initiatives.



\*\*\*\*\*For suggestion please contact at [sss.nibe@nibe.res.in](mailto:sss.nibe@nibe.res.in)\*\*\*\*\*

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