**PRESS RELEASE**

# IIT Hyderabad Researchers use corn husk to produce carbon electrode for high-voltage supercapacitors

## Their activated carbon electrode showed better energy density than conventional supercapacitors

**HYDERABAD, 29th July 2020:** Indian Institute of Technology Hyderabad Researchers have developed a simple and cost-effective method to derive 'activated carbon electrode' material from cornhusk for high-voltage supercapacitors. Their electrode showed better electrochemical performance (High energy density and high-power density) when compared with conventional supercapacitors.

This development is important for India, especially for States such as Uttar Pradesh and the combined Andhra Pradesh-Telangana States, which are the first and second largest producers of corn in the country respectively. They produce a large amount of cornhusk waste, much of which waste is currently burnt as its potential to be converted to valuable electrode material is not harnessed owing to lack of awareness, expertise sand technology.

This Research by IIT Hyderabad on affordable and efficient methods can enable this conversion, which would trigger the cascade of additional earning opportunity for the corn-farmer and provision of a sustainable energy source.

The research was led by Dr. Atul Suresh Deshpande, Associate Professor, Department of Materials Science and Metallurgical Engineering, IIT Hyderabad, in collaboration with Dr. T. N. Rao, Associate Director, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, along with their Research students, M. Usha Rani, and K. Nanaji (Project Scientist). Their Research paper detailing the synthesis procedure and the electrochemical performance of the material produced has been recently published in the reputed peer-reviewed *Journal of Power Sources*.

In the global sector, rapid advancements in adopting new technology and fast evolving green energy systems are trending in the supercapacitor's market. It is projected to share USD 720 million by 2025 market value, which is expected to grow at a CAGR of 12 per cent from 2020 to 2025.

Carbon based electrodes are playing a crucial role in the development of energy storage devices. Carbon based electrodes are typically derived from expensive, high purity precursors such as polymers, organic precursors, high purity gases using various methods. The production of carbon electrodes from biomass is a simpler straightforward process.

**In collaboration with ARCI (Hyderabad), the IIT Hyderabad team has developed activated carbon electrode using simple materials – Corn husk and KOH.**

**Explaining his research, Dr. Atul Suresh Deshpande,** Associate Professor, Department of Materials Science and Metallurgical Engineering, IIT Hyderabad, **said,** "*Activated carbon electrode material with porous sheet-like morphology has been prepared using corn husk through carbonization followed by KOH activation. Due to the low-cost precursors and simple processing method, this process of producing activated carbon can be easily adapted for large-scale commercial production*."

To obtain the high surface area activated carbon with porous sheet-like morphology from corn husk, the researchers added KOH as an activating agent. KOH helps in the formation of sheet-like morphology. The synergy of morphology and high specific surface area (1378 $m^2$ $g^{-1}$) improve the storage capacity of the activated carbon electrode material.

The storage capability of activated carbon sample tested by using high-operating voltage electrolyte (1M tetraethylammonium tetrafluoroborate ($TEABF_4$) in acetonitrile (AN)). This electrode showed better electrochemical performance (High energy density (20 Wh $kg^{-1}$) and high-power density (681 W $kg^{-1}$) at 1 A $g^{-1}$) than electrodes in conventional supercapacitors.

**Explaining further, Dr. T. N. Rao,** Associate Director, International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad, **added,** "*Activated carbon derived from natural sources is very promising electrode material for supercapacitors, and the well known Maxwell company*

*uses coconut derived activated carbon in their supercapacitors. The key scientific challenge in this research is pore size engineering of activated carbon with high surface area and suitable pore size that allows the electrolyte ions to adsorb into pores to maximum extent which inturn give high capacity. The group at IITH in collaboration with ARCI has succeeded in converting corn husk into high performing activated carbon for supercapacitor application. Corn husk being widely produced waste, it is also scalable from technology point as well."*

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**About IIT Hyderabad**

Indian Institute of Technology Hyderabad (IITH) is one of the six new Indian Institutes of Technology established by the Government of India in 2008. In a short span of around a decade, the institute built on an imposing 570-acre campus. It has been ranked among the top ten engineering institutes in India for five consecutive years in National Institute Ranking Framework (NIRF) released by the Ministry of Human Resource Development (MHRD), Government of India. The Institute was Ranked #8 in 'Engineering' category and Ranked #17 in 'Overall' category in NIRF Rankings 2020

The Institute was also ranked #10 in the first edition of Atal Ranking of Institutions on Innovation Achievements (ARIIA) introduced in 2019 by MHRD to systematically rank all major higher educational institutions and universities in India on indicators related to 'Innovation and Entrepreneurship Development' among students and faculties. IIT Hyderabad has been placed in 601-650 Ranking Band and secured 10th Position in India as per QS World University Rankings 2021. The Research Output of the Institute was ranked as 'Very High.' The Institute was also ranked among the 10 Best Institutes in India.

IIT Hyderabad has close to 211 full-time faculty, 2,869 students of whom 20 per cent are women, nearly 200 state-of-the-art laboratories and five research and entrepreneurship centers. The Institute has a strong research focus with more than Rs. 500 crore of sanctioned research funding while Ph.D. scholars account for about 30 per cent of total student strength. IITH students and faculty are at the forefront of innovation with more than 1,500 research publications and patent disclosures, 300 sponsored/consultancy projects and 50 industry collaborations. IITH has MoUs with 50 universities in the U.S., Japan, Australia, Taiwan and Europe. IITH has been pioneering change in pedagogy with fractal academic programs that atomizes course modules, encourage interdisciplinary learning spanning innovative technology, fundamental science, liberal arts and creative arts like photography, theatre and painting.

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