National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Extraction of microcrystalline cellulose from various wastepaper sources for environmental applications
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Venue	: BM Seminar Hall
Date and Time	: 19 Mar 2025 (04:30 PM)
Abstract	: This research examines the extraction of microcrystalline cellulose (MCC) from wastepaper, an economical and plentiful lignocellulosic biomass, for sustainable industrial uses. MCC is recognized for its non-toxicity, biodegradability, and mechanical properties, leading to its extensive application in food, pharmaceuticals, cosmetics, and polymer composites. This study examines the extraction of MCC from office paper, newspapers, and corrugated boxes via chemical treatments, analyzing their surface and compositional properties. Office paper-derived MCC (O-MCC) exhibited the highest yield (89.4±0.8%) and showed enhanced thermal stability relative to newspaper (N-MCC) and corrugated box (C-MCC) sources. Particle size analysis indicated that O-MCC exhibited the smallest median size at 47.87 μm, whereas N-MCC and C-MCC measured 85.5 μm and 83.9 μm, respectively. All MCCs displayed crystalline structures, affirming their appropriateness for industrial applications. The study investigates the development of eco-friendly supercapacitors utilizing MCC derived from various wastepaper sources. The supercapacitor derived from N-MCC exhibited a specific capacitance of 3.61×10^5 F/g and a current density of 6.14×10^5 J/m^3, indicating remarkable charge storage capacity. Electrochemical analysis demonstrated rapid charge-discharge rates and superior cycling stability, positioning these supercapacitors as suitable for flexible and transparent electronic devices. The study also aims in development of MCC-based aerogels for CO_2 adsorption. MCC based aerogels, characterized by their high surface area and porous structure, have the potential to function as effective, biodegradable adsorbents for carbon capture, thereby contributing to the resolution of environmental challenges. This study converts wastepaper into high-performance materials, thereby enhancing sustainable energy storage systems and fostering a circular economy, while underscoring the potential of MCC-based innovations for environmental applications.