National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Green Synthesis of Carbon Quantum Dots and Investigations of Their Physical Properties for Various Applications
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Venue	: MC 126, Physics Department Seminar Room
Date and Time	: 10 Jul 2024 (11.00AM)
Abstract	: Carbon quantum dots (CQDs), a new class of carbon nanomaterials with a particle size of less than 10 nm, have received increasing attention among researchers because of their significant advantages in terms of low toxicity, excellent biocompatibility, low cytotoxicity, excitation wavelength dependent photoluminescence (PL) behavior, excellent water solubility, and physicochemical properties. Due to their outstanding properties, they have great potential applications in the fields of optoelectronics, bio-imaging, drug delivery, biosensing, catalysis, energy storage, etc. The physical and chemical properties, along with the quantum yields of CQDs, depend on the methods of preparation using various carbon precursors. Most of the traditional approaches to synthesizing CQDs involve toxic chemical reagents or organic solvents as precursors, which is against the core principles of environment-friendly sustainable development. It is desirable that the method should be remarkably green, sustainable, eco-friendly, and effective in terms of technological and economic perspectives. In this research work, we propose a green, simple, eco-friendly, and low-cost approach for the synthesis of CQDs utilizing various natural biowaste as carbon precursors without using any surface passivating agents and investigate their physical and chemical properties. The synthesized CQDs were characterized by using various techniques such as UV-Vis absorption spectroscopy, fluorescence spectroscopy, FTIR, XRD, Raman spectroscopy, zeta potential measurements, XPS, and TEM. The synthesized CQDs possess unique physicochemical and photophysical properties, including strong fluorescence emission properties, excellent photostability, broad excitation spectra, excitation-dependent fluorescence emission properties, good bio-compatibility, zero toxicity, and excellent water solubility. Furthermore, the CQDs synthesized using various natural green biowaste precursors through sustainable methods have shown promising potential for applications in diverse fields, including heavy metal ion sensing, supercapacitors, anticorrosion coatings, antifungal agents, and rice plant growth enhancement. This research underscores the potential of green synthesis routes to produce CQDs with desirable properties for various technological and environmental applications, paving the way for sustainable nanotechnology advancements.