National Institute of Technology Rourkela

Defence Seminar

Seminar Title	: Functionalized g-C3N4 quantum dots based fluorescent sensors for detection of toxic metal ions
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Venue	: Chemistry Seminar Room, Hybrid mode (https://meet.google.com/uvy-axdi-dnk)
Date and Time	: 19 Nov 2024 (11 AM)
Abstract	: Toxic metal ions like mercury, lead, and cadmium pose significant health risks, spurring ongoing research into sensitive and selective detection methods. Metal-free graphitic carbon nitride quantum dots (g-C_3N_4 QDs) have emerged as promising fluorescence sensors, offering strong photoluminescence, stability, and resistance to photobleaching. In this doctoral research, we have focused on developing functionalized g-C_3N_4 QDs by using heteroatom doping or surface functionalization for target metal ion sensing. We have successfully synthesized various functionalized g-C_3N_4 QDs, namely Silver nanoparticles embedded sulfur-doped gCN quantum dots (Ag-S-gCN QDs), L-Glutathione (GSH) modified graphitic carbon nitride quantum dots (GSH@g-C_3N_4 QDs), and L-Cysteine (L-Cys) functionalized boron doped gC_3N_4 QDs (L-Cys/B-gC_3N_4 QDs) for detection of Hg^{2+}, Pb^{2+}, and Cd^{2+} ions, respectively. The synthesized materials were comprehensively characterized to understand their structural, morphological, and optical properties. The stability of each probe was also investigated to determine its resistance to photobleaching and high ionic strength. The fluorescence properties of the materials were then exploited for fluorescence sensing of toxic metal ions in water, from which we assessed the sensitivity of the probes. Further, the selectivity and interference tests were conducted to account for the selectivity of the sensor system. A detailed mechanistic study using a lifetime decay experiment was carried out to understand the interaction between the probe and analyte. Ultimately, the sensor system was applied in environmental monitoring by testing real water samples to detect the targeted toxic metal ions.