National Institute of Technology Rourkela

Progress Seminar

Seminar Title	: Remediation of micro-nanoplastics from water resources with zeolite Y and its functional composite derived from aluminosilicate industrial wastes
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Venue	: Department Library, Department of Chemical Engineering
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Abstract	: Micro-nanoplastics (M/NPs) generally originate from minute polymeric particles generated from abiotic and biotic stress over time, as well as the gradual decomposition of conventional plastics these particles disseminate throughout the ecosystem via oceanic wind currents. Their eradication is emerging as a formidable environmental challenge due to their nonbiodegradable characteristics and extensive dispersion, particularly in aquatic environments. M/NPs diminutive sizes enable them to traverse numerous filtering systems, complicating their removal from water, for instance. There are serious long-term health hazards associated with micro- and nanoplastics, which have been found in numerous human tissues. These microplastics predominantly accumulate in aquatic environments due to negligent usage and inadequate disposal methods, and once reduced to micro or nano sizes, they become very challenging to eliminate from water sources. This study aims for the remediation of M/NPs from water by the zeolite Y synthesized from aluminosilicate industrial waste through the adsorption method. Zeolite Y composites, integrated with appropriate functional components, are also synthesized for comparative analysis and to enhance efficacy and recovery rates. Zeolite Y serves as an excellent porous adsorbent material for the adsorption of M/NPs due to the negative charge of MPs. The single-use plastic waste products such as High-density Polyethylene (HDPE), Low-density Polyethylene (LDPE), Polypropylene (PP), Polystyrene (PS), and Polyethylene terephthalate (PET) were utilized for preparing M/NPs and zeolite Y was prepared from the coal fly ash, both through a sono-assisted method. The removal efficiency was found 94.95% at 2ppm concentration of microplastics and an adsorbent dosage of 10mg. The experimental data from the adsorption study were well fitted with the pseudo-second order kinetic model with an R2 value of 0.99. XRD, FESEM, EDX, Raman and FTIR proved that the synthesized material is zeolite Y with polycrystalline, tetrahedral morphology, with required functional groups, elemental composition and has a Si/Al ratio more than 1.5. Surface area is determined to be 525.862 m^2/g by BET and the lattice pattern and porous structure was identified by HR TEM.