National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Potential of Jamun Pulp as Natural Coagulant for Effective Removal of Surfactant in Wastewater
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Venue	: BM Department Seminar Room
Date and Time	: 24 Dec 2024 (11.00 AM)
Abstract	: Surfactants are emerging contaminants commonly found in greywater systems, including wastewater from showers and washing machines. These chemical compounds are widely used in laundry detergents and soaps for washing. Their presence in wastewater raises concerns regarding environmental impact and human health. Due to their surface-active properties, surfactants can affect water quality, disrupt natural ecosystems, and potentially bioaccumulate organisms. Therefore, it becomes crucial to implement effective treatment methods to remove surfactants in wastewater before their release into the environment. The present study tested the coagulation ability of Jamun pulp (JP) powder for surfactant removal from simulated wastewater. The experiment was performed in a six-paddle jar test apparatus, and the operational conditions were pH 8, coagulant dose 3 g/L, fast mixing with 140 RPM, slow mixing with 40 RPM, and 1 h settling time. The turbidity and surfactant removal efficiency was 77.08% and 68.25%, respectively. Various analyses were conducted to characterize the natural coagulant. X-ray Diffraction (XRD) was used to examine the crystalline structure, and the observed diffractogram peaks between 15 to 40 degrees indicated the presence of proteins, lipids, and carbohydrates. Total carbohydrate and protein content analysis revealed concentrations of 600 µg/g and 97.14 µg/g in JP, highlighting the presence of the bioactive compounds. Scanning Electron Microscopy (SEM) revealed a distribution of forty irregularly sized structures on the coagulant's surface. At the same time, Energy Dispersive X-ray (EDX) analysis showed that JP primarily consists of carbonaceous materials (60.5%) along with trace amounts of inorganic elements, including calcium (Ca), potassium (K), sulfur (S), magnesium (Mg), and sodium (Na). Zeta potential measurements determined the surface charge at different pH levels. Results showed a zeta potential of -5.17 mV for JP and 3.48 mV for the surfactant at pH 6, -13.5 mV for JP, and 2.94 mV for the surfactant at pH 8, and -6.8 mV for JP and -11.2 mV for the surfactant at pH 10. Using Fourier Transform Infrared Spectroscopy (FTIR), the study confirmed the presence of functional groups in the coagulant, identifying free hydroxyl groups (3600–2800 cm^{-1}), stretching bonds related to alkanes and carboxylic acids (2926 cm^{-1}), C-O stretching vibrations associated with alkanes or carboxylic acids (2353 cm^{-1}), polymeric compounds like proteins, polysaccharides, and esters (1600–959 cm^{-1}), COO– symmetric stretching (1438 cm^{-1}), and halogen compounds such as C-Cl (500–730 cm^{-1}). The current study demonstrates that JP powder is an excellent coagulant for wastewater treatment due to its notable cost-effectiveness and environmental benefits. This natural coagulant showcases the immense potential for the efficient and effective removal of surfactant from wastewater, significantly contributing to preserving and restoring the precious environment. ALL ARE CORDIALLY INVITED