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Name of the Scholar: Mohd Saquib Tanweer

Name of the Supervisor: Prof. Masood Alam

Name of the Department/Centre: Applied Sciences and Humanities, F/O- Engg & Tech.

Topic of Research: Studies of Sustainable Polymer Based Nanocomposites: Synthesis, Characterization and their Application

Findings

In the present thesis work, the development of sustainable polymer nanocomposite-based adsorbent and membrane are reported for the elimination of toxic organic dyes and heavy metal ions from wastewater solutions. The thesis includes seven chapters. The first chapter deals with Introduction which begins with a general introduction and discusses sources of water pollution, including point sources and non-point sources, water pollutants, and the health risks they pose to humans. The second chapter discusses Synthesis and Characterization. The scalability, large surface area, tunable surface chemistry, and functionalization of polymer based nanocomposite adsorbent and membrane have enhanced the scope of their potential application in the field of wastewater and other remediation. This thesis work covers the synthesis of sustainable polymer based adsorbents using the sol-gel technique, in-situ polymerization, hydrothermal techniques, and membrane developed by electrospinning technique, respectively. These as-synthesized polymer based nanocomposite materials were characterized with the help of FTIR, XRD, BET, SEM, TEM, zeta potential, TGA-DTA and EDAX spectroscopic techniques. In the case of Polyaniline based nanoadsorbent, the capturing of various organic dyes including Methyl orange (MO; q_{max}: 161.29 mg/g), brilliant green (BG; q_{max}: 136.98 mg/g), crystal violet (CV; q_{max}: 456.62 mg/g) has been successfully reported. On the other hand, Polyaniline based nanocomposites namely Zinc oxide/Moringa oleifera gum grafted L-methionine functionalized Polyaniline (ZM-g-Pani) has also been reported to successfully remove divalent metal ions including Cd^{2+}, Hg^{2+} and Pb^{2+} from wastewater. In addition, Poly vinyl alcohol based modified membranes were studied for Rhodamine B (RhB; q_{max}: 231.84 mg/g) from water.