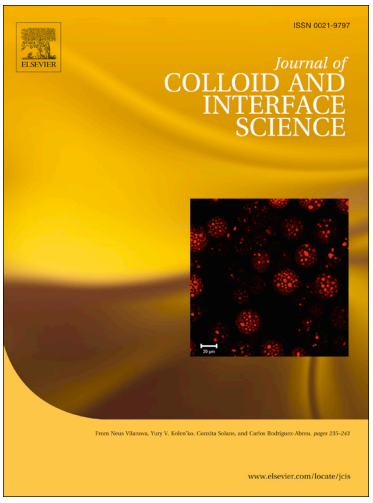

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Bismuth Oxide Decorated Graphene Oxide Nanocomposites synthesized via Sonochemical Assisted Hydrothermal Method for Adsorption of Cationic Organic Dyes

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Abstract

Bismuth oxide decorated graphene oxide (Bi_2O_3@GO) nanocomposites were successfully synthesized by sonochemical method followed by hydrothermal treatment. The structural, morphology/microstructure and functional groups were investigated through X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), Transmission Electron Microscopy (TEM) and Fourier Transform Infrared (FTIR) spectroscopy, respectively. In the FESEM and TEM studies, well dispersed Bi_2O_3 nanoparticles of size 3-5 nm were found uniformly distributed throughout the surface and edges of GO sheets. The HRTEM measurements on the Bi_2O_3 nanoparticle decorated graphene oxide shows imaged lattice spacing of 3.2 Å corresponding to (111) plane of Bi_2O_3 which confirms the successful synthesis of bismuth oxide decorated graphene oxide (Bi_2O_3@GO) nanocomposite. The synthesized nanocomposite was employed for adsorption and removal of cationic organic dyes like RhBfrom industrial wastewater. The effect of various parameters, viz., contact time, temperature, pH and amount of adsorbent on the adsorption capability as well as dye removal capacity of the adsorbent was studied in detail. Under optimized conditions, like, contact time (65 min), amount of adsorbent (5 mg), temperature (35°) and pH (4), the adsorption capacity of GO and Bi_2O_3@GO were recorded and the percentage of removal was found to be 64% and 80.7% for GO and Bi_2O_3@GO, respectively. The Bi_2O_3@GO nanocomposite shows higher adsorption capacity (320 mg/g) as compare to only GO (224mg/g). The adsorption isotherm follows both the Temkin as well as Langmuir isotherm having heat of sorption 65.88 with Langmuir constant of 13.13 corresponding to the complete monolayer coverage of 387.44 mg/g. The adsorption kinetics also follow, both pseudo first order and intraparticle diffusion model with adsorption capacity of 84.91 mg/g and intra particle diffusion rate constant of 10.53 mg/gmin$^{1/2}$ for Bi_2O_3@GO nanocomposites. Our results suggest that the prepared Bi_2O_3@GO nanocomposites possess potential application as high-performance renewable adsorbent for removal of toxic dyes from wastewater.

Key Words: Bi_2O_3@GO Nanocomposites; Rhodamine B (RhB); Adsorption and Removal of Toxic Dyes; Adsorption isotherm; Adsorption kinetics; Adsorption capacity.