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Adsorption of Brilliant Green dye by polyaniline/silver nanocomposite: Kinetic, equilibrium, and thermodynamic studies

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Abstract

Polyaniline/silver nanocomposite (PANI/AgNPs) was synthesized by the chemical oxidative polymerization of aniline with ammonium peroxydisulphate in acidic medium sulfuric acid (1M). The surface of polyaniline is modified by silver nano particles. Samples were prepared at various molar ratios of silver nitrate to PANI ranging from 1 to 2.5. The emeraldine base was oxidized to pernigraniline, where the silver nitrate was reduced to metallic silver. The modified surface of PANI was confirmed by the scanning electron microscopy (SEM), Energy dispersive X- ray analysis (EDX), FT-IR and thermogravemetric analysis (TGA). The efficiency of polyaniline/silver nanoparticles for the adsorptive removal of Brilliant green (BG) from aqueous solutions, has been evaluated with respect to several experimental conditions. These conditions are contact time, initial BG concentration, temperature and nanocomposite dosage. The experimental data were analyzed by the Langmuir, Freundlich, and Tempkin isotherm models. The Langmuir isotherm fits the experimental data very well due to the homogeneous distribution of active sites onto PANI/AgNPs surface. The thermodynamic parameters such as Gibbs free energy, entropy and enthalpy changes of the ongoing adsorption process indicated the feasibility and endothermic nature of BG adsorption. The kinetics study revealed that adsorption of BG onto PANI/AgNPs follows the pseudo-second order kinetic model.

Keywords: Polyaniline/silver nanocomposite, Brilliant green, Adsorption, Dye removal, Kinetics

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