Adsorption of Reactive Blue 19 azo dye from Textile Wastewater by Fe_3O_4 magnetic nanoparticles: Kinetic and Equilibrium studies

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Untreated disposal of colored textile wastewater into environment imposes serious damages to aquatic life. Additionally, some dyes are toxic and mutagenic to human. Conventional biological wastewater treatment methods are not able to remove reactive dyes from colored wastewater, efficiently.

In this work, the adsorption of Reactive Blue 19 from colored textile wastewater using magnetic iron nanoparticles (Fe_3O_4) was investigated by batch adsorption experiments.

The effect of parameters such as pH (3-8), contact time (2-90 minutes), adsorbent dose (0.2-1 g/l) and adsorbate concentration (10-150 mg/l) on dye removal efficiency were studied. Moreover, kinetics and isotherms of adsorption were surveyed. Fe_3O_4 nanoparticles were prepared through coprecipitation method. The structure of the magnetic iron nanoparticles was characterized by scanning electron microscope (SEM) and Fourier transform infrared spectroscopy (FTIR). Based on the SEM image analysis, the average size of Fe_3O_4 Nanoparticle was found to range between 10 and 15 nm.

This study revealed that when the adsorbent dose and contact time increased and pH decreased, dye removal would be increased. In the optimal condition, Fe_3O_4 magnetic nanoparticles were able to remove dye as high as 96% in 60 minutes at adsorbent dose of 1 g/l and pH 3. Equilibrium studies revealed that the adsorption of dye onto adsorbent fits well with langmuir isotherm. The results showed that dye removal followed pseudo-second-order kinetic (R^2>0.99). According to the Dubinin-Radushkevich isotherm,