Gehan M Nabil et al., Chem Sci J 2016, 7:2(Suppl)
http://dx.doi.org/10.4172/2150-3494.C1.003

Protection and functionalization of magnetic iron oxide nanoparticles with phthalic acid for the efficient removal of Reactive Black 5 from aqueous solutions

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The objective of this work is the study of adsorption of the reactive dye RB5 by magnetic iron oxide nanoparticles (NPs) coated with phthalic acid prepared by co-precipitation method. This adsorbent was characterized by scanning electron microscope (SEM), transmission electron microscope (TEM), thermal gravimetric analysis (TGA) and fourier transform infrared (FT-IR) spectra. In batch adsorption procedure variables including the amount of adsorbent, initial dye concentration, contact time, pH and temperature had a great effect on the removal percentage of the dye. The application of magnetite nanoparticles loaded with phthalic acid as an adsorbent of RB5 removal has been successfully tested. The maximum removal percentage is 92% at pH=2, shaking time 20 min., adsorbent dose 25 mg per 10 mgL-1 initial dye concentration at 25°C. Different kinetic models: pseudo-first-order kinetic, pseudo-second-order kinetic, intraparticle and Elovich kinetic models were applied to examine the mechanism of adsorption. The data kinetically followed the pseudo-second-order kinetic model. Equilibrium adsorption capacities were determined by fitting experimental data to isotherm models: Langmuir, Freundlich, Dubinin-Radushkevich isotherm and Temkin models. Based on the calculated thermodynamic parameters ΔG, ΔH and ΔS, it was noticeable that the adsorption was a spontaneous and an endothermic process. The potential application of phthalic acid-loaded magnetite for the adsorptive removal of RB5 dye from real water samples was discussed.

Biography

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