Usage of magnetic nanoparticles coated with 3-(trimethoxysilyl)-1-propanethiol for removal of methylene blue from a textile mill wastewater

Pantea Sadat Movaseghi a,*, Mohammad Hossein Mashhadizadeh a, Siavash Salek Soltani b

aFaculty of Chemistry, Kharazmi (Tarbiat Modarres) University, Tehran, Iran, Tel. +98 2122693275; email: p.movaseghi@gmail.com (P.S. Movaseghi)

bSchool of Chemistry, University College of Science, University of Tehran, Tehran, Iran

Received 22 November 2016; Accepted 17 July 2017

A B S T R A C T

The aim of this work was to apply iron oxide magnetic nanoparticles coated with 3-(trimethoxysilyl)-1-propanethiol, for adsorption of the cationic dye, methylene blue (MB), from aqueous solutions prior to determination with UV–Vis spectrophotometry. To approach this purpose, iron oxide magnetic nanoparticles (IOMNPs) were synthesized via co-precipitation method and characterized by Fourier transform infrared spectroscopy (FT-IR) and scanning electron microscopy. The effective parameters such as pH, time, adsorbent amount, type and volume of the desorption solvent, ionic strength of the solution and the sample volume were optimized. Figures of merit such as detection limit, relative standard deviation (RSD) and linearity range were calculated as 0.24 mg L⁻¹, 6.8% and 0.32–16 mg L⁻¹, respectively. Kinetic studies proved that adsorption process obeys pseudo-second-order model, also the adsorption isotherm was best fitted to Freundlich model with maximum adsorption capacity of 27.78 mg/g. Eventually, the method was successfully used for removing MB from a textile mill wastewater with recoveries ranging from 60% to 102%.

Keywords: Dyes; Iron oxide magnetic nanoparticles; Methylene blue; Wastewater; 3-(Trimethoxysilyl)-1-propanethiol

* Corresponding author.