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Procedure optimization for removal of 2,4-dichlorophenoxyacetic acid from water by surfactant-modified magnetic nanoparticles

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ABSTRACT

In this investigation, operation conditions of the separation procedure were optimized for efficient removal of 2,4-dichlorophenoxyacetic acid (2,4-D) from water by adsorption on the surface of Fe_3O_4 magnetic nanoparticles (MNPs) modified with cethyl trimethyl ammonium bromide (CTAB). In this order, Fe_3O_4 MNPs with the average size of about 60 nm were synthesized and characterized by scanning electron microscopy and infrared techniques. The surface of the nanoparticles was modified by coating with 3-(trimethoxysilyl)-1-porpanethiol and CTAB, respectively. Then, the modified MNPs were utilized to remove 2,4-D from the polluted water. The results of process optimization showed that at pH 9, temperature of 20°C, CTAB amount of 300 mg mL^{-1}, salt amount of 0.01 M and contact time of 30 min, maximum removal yield could be achieved. The study of the process kinetic showed that 2,4-D removal take places during a rapid sorption via a pseudo-second-order model. Thus, 2,4-D adsorption equilibrium data was fitted well, and the maximum monolayer capacity (q_{max}) was calculated as 4.9 mg g^{-1}.

Keywords: Fe_3O_4–TMSPT; Magnetic nanoparticles; CTAB coating; 2,4-dichlorophenoxyacetic acid; 2,4-D; Pollution removal

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