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Tetracycline adsorption from aqueous solutions by a magnetic nanoadsorbent modified with ionic liquid

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ABSTRACT

Removal of tetracycline (TC) by the adsorption process was investigated by using iron oxide nanoparticles (Fe_3O_4 NP) modified with the trioctylmethylammonium thiosalicylate (TOMATS) ionic liquid (IL) (Fe_3O_4 NP@TOMATS IL) as a new magnetic nanoadsorbent. The adsorbent was characterized by field-emission scanning electron microscopy–energy-dispersive X-ray spectroscopy, Fourier-transform infrared, Brunauer–Emmett–Teller, and X-ray diffraction. Batch experiments were carried out to study the sorption kinetics, thermodynamics, and equilibrium isotherms of TC with Fe_3O_4 NP@TOMATS IL. The results showed that the maximum removal efficiency of TC in optimum conditions of pH (7), contact time (90 min), adsorbent dosage (0.2 mg L^{-1}), temperature (328 K), and initial concentration of TC (30 mg L^{-1}) was obtained 92% and 73% in the synthetic and real samples, respectively. Examination of the kinetics and adsorption isotherm equations demonstrated that the adsorption process followed the pseudo-second-order and the Freundlich isotherm. Also, the amount of equilibrium adsorption capacity is 36 mg g^{-1} in the real sample. Investigation of thermodynamic equations revealed that the adsorption by iron oxide nanoparticles modified with TOMATS IL was physically and spontaneously endothermic. The results obtained from the experiments also indicated that the synthesized nanocomposite has high reusability and recyclability after four periodic cycles.

Keywords: Tetracycline; Iron oxide nanoparticles; Ionic liquid; TOMATS

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