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ORIGINAL ARTICLE

Adsorption of chromium (VI) and iron (III) ions onto acid-modified kaolinite: Isotherm, kinetics and thermodynamics studies

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Abstract The pollution of aquatic bodies by heavy metals effluent from many industrial activities is a significant environmental challenge affecting the ecosystem. Batch process was conducted to remove Cr (VI), and Fe (III) with hydrochloric acid modified clay (HMC) and acetic acid modified clay (AMC). The adsorbents morphology, chemical properties were measured by scanning electron microscope (SEM), X-ray fluorescence spectrometry (XRF), cation exchange capacity (CEC), X-ray diffraction (XRD) and Brunauer-Emmett-Teller (BET). The effects of time, adsorbent dose, temperature and pH of effluent on adsorption were studied. The acid activation increased the BET surface area from 84.223 m^2/g raw clay (RC) to 389.37 m^2/g (HMC) and 319.955 m^2/g (AMC), total pore volume increased to 0.2168 and 0.2285 cm^3/g, respectively. The CEC increased from 8.4 cmol/g to 22.30 cmol/g (HMC) and 20.73 cmol/g (AMC). The results of XRF, SEM and XRD studies show disintegration and a porous structure of the treated clay, and also changes in the intensity of the bands. The HMC had a maximum removal of Cr (VI), and Fe (III) of 79% and 90% at pH 7.0 and AMC recorded 60% and 57% at pH 6.0, respectively. The adsorption process equilibrium was attained at 50 and 90 min for HMC and AMC, respectively. Langmuir isotherms had the best fit. HMC and AMC adsorption capacity are, Cr (VI):18.15 mg/g and Fe (III):39.80 mg/g; Cr (VI): 10.42 mg/g and Fe (III):19.34 mg/g. The interaction of Cr (VI) and Fe (III) ions onto HMC/AMC was spontaneously endothermic. It agreed with the second-order equation. The maximum desorption efficiency recorded on HMC is 92.45 and 85.67% for Cr (VI) and Fe (III) and for

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