

Use of natural Tunisian clays for defluoridation of industrial wastewater

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Received 1 August 2016; Accepted 25 May 2017

ABSTRACT

The aluminum fluoride manufacturing generates large amounts of wastewaters containing fluoride (AFMW). The aim of this study was to investigate the removal of fluoride from AFMW using natural Tunisian clay as an adsorbent. X-ray fluorescence analysis showed that SiO₂ (30.7%) and CaO (26.3%) were the major constituents of clay. Batch experiments were performed to study the influence of initial fluoride concentration (525–2003 mg/L), adsorbent dose (0.5–5 g/L) and initial pH (2 to 11). Kinetic tests showed that fluoride sorption to natural clay reached equilibrium after around 2 h. An optimal value of pH 2 was observed. The experimental data showed the data could be fit to Langmuir and Freundlich isotherm. Pseudo-second-order rate and an intra-particle kinetic model fit well the adsorption kinetic data. It was found that intraparticle diffusion contributes to the rate of removal of fluoride. Fourier transform infrared analysis and X-ray diffraction patterns of the adsorbent before and after adsorption indicated that fluoride ions were chemisorbed by this adsorbent. Results from this study demonstrated potential use of Tunisian clay in defluoridation of AFMW.

Keywords: Natural clay; Aluminum fluoride manufacturing; Batch experiment; Defluoridation; Adsorption; Isotherms

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Presented at the EDS conference on Desalination for the Environment: Clean Water and Energy, Rome, Italy, 22-26 May 2016