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Synthesis and characterization of Fe-Al-Ni ternary composite metal oxides as highly efficient adsorbent for fluoride removal from water

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ABSTRACT

The Fe-Al-Ni composite oxide was synthesized through a simple coprecipitation method. The adsorbent was characterized by using scanning electron microscopy, X-ray diffraction, Fourier transform infrared spectroscopy, zeta potential, and energy dispersive analysis of X-rays, and its defluoridation properties were investigated. Adsorption kinetics fitted well the pseudo-second-order model. The fluoride adsorption isotherm was well described by the Freundlich model. Moreover, when the initial fluoride concentration was 200 mg/L, the maximum adsorption capacity was calculated as 59.5 mg/g from the Langmuir model. It was found that the maximum removal rate was 93.6% at pH = 7, with an initial fluoride concentration of 10 mg/L. The co-existing anions indicate that chloride, sulfate, and nitrate don't have much effect on F^- adsorption, but phosphate and carbonate show a significant effect on F^- removal. It shows that the efficacy of the adsorbents still maintains high as being reused, indicating that the spent adsorbent is suitable for regeneration.

Keywords: Adsorption; Fluoride; Fe-Al-Ni composite oxide

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