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Adsorption behavior of fluoride ion on trimetal-oxide adsorbent

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ABSTRACT

The suitability of trimetal-oxide (a refractory waste material) as a possible adsorbent has been studied for the removal of fluoride ion from the aqueous solution. Batchwise experiments have been conducted for following the adsorption behavior. The effect of various variables such as shaking time, hydronium ion concentration, initial fluoride concentration, and adsorbent dose were studied. Freundlich, Langmuir, Dubinin–Radushkevich, and Temkin isotherms were applied to calculate the adsorption behavior of fluoride and were found to be in good agreement with the experimental data, and the mechanism was of chemisorption. The kinetics of the adsorption phenomenon was also studied using Lagergren pseudo-first-order, pseudo-second-order and intra-particle diffusion models, and the results showed that the process of the adsorption of fluoride follows pseudo-first-order as well as pseudo-second -order kinetic models. The adsorbent has shown high defluoridation efficiency of 78% between pH 6.0 and 7.0. The trimetal-oxide was characterized by WD-XRF and XRD techniques before adsorption, and the most dominant components were found to be Al_2O_3, CaO, and MgO with diaspore, calcite, and dolomite being the major mineral phases.

Keywords: Fluoride; Thar Desert; Adsorption; Intra-particle diffusion; Chemisorption

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