



Eggshell modified with alum as low-cost sorbent for the removal of fluoride from aquatic environments: isotherm and kinetic studies

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Received 28 May 2018; Accepted 10 December 2018

ABSTRACT

The present study was conducted to investigate the performance of eggshells modified with alum for fluoride removal from aquatic solution and determine the isotherm and kinetic isotherms. This study was conducted on the batch mode and some effective parameters on the adsorption rate such as contact time, pH, adsorbent dose and adsorbate concentration were evaluated. The characteristic of the modified adsorbent was determined via X-ray diffraction (XRD) and scanning electron microscopy (SEM). The results of XRD showed the peaks for modified eggshell powder with alum, which illustrated the presence of the alumina on the adsorbent. SEM images disclosed that the particles in the raw eggshells are broken down into small pieces with sharp-sided. In addition, the batch experiments showed that the residual concentration of fluoride has decreased as time increases. Also, the removal efficiency has decreased as pH increases toward alkaline phase. It is observed that increase in the adsorbent dosage subsequently decreases the residual concentration level of fluoride. The results of the experimental data showed that Dubinin–Radushkevich isotherm and pseudo-second-order model (high R^2) gave much better fit with data. According to the results, eggshell adsorbent modified with alum has been recommended for fluoride removal from aqueous solution.

Keywords: Adsorption; Eggshell; Alum; Fluoride removal; Isotherm and kinetic

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