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Adsorption and kinetic studies of cesium ions from aqueous solution by functionalized silica

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ABSTRACT

In this work, functionalized silica (F-silica) was synthesized by condensation reaction of 2-hydroxyacetophenone-3-thiosemicarbazone with diazotized silica and evaluated for removal of cesium ion from aqueous solution. The synthesized compound was characterized using Fourier transform-infrared spectroscopy. The batch experiments were carried out in a range of initial cesium concentration from 500 to 2,500 μg/L using F-silica in the solution. The effect of initial cesium concentration and contact time on process kinetics and equilibrium were also studied. Nonradioactive cesium chloride was used as a surrogate of the radioactive cesium. The experimental data were analyzed using equilibrium isotherm Freundlich and Langmuir models. The adsorption data were well described by Freundlich model. Pseudo-first-order and pseudo-second-order kinetic models were used to analyze the adsorption-rate data. The pseudo-second-order model was found to correlate best with the kinetic data. The results showed that F-silica can adsorb Cs(I) with high efficiency by chemisorption and physiosorption mechanisms.

Keywords: Adsorption isotherm; Adsorption kinetics; Cesium metal ion; Functionalized silica; Radioactive nuclides

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