Synthesis and characterization of iron sulfide powders and its application for sorption of europium radionuclides

Karam Fatwhi Allan, Shiraz Labib*, Mohamed Holeil

Nuclear Chemistry Department, Hot Laboratories Center, Egyptian Atomic Energy Authority, P.O. Box 13759, Cairo, Egypt. Tel. +20 1114473191; email: karamallan@yahoo.com (K.F. Allan), Tel. +20 1005292059; email: dr_sh_labib@yahoo.com (S. Labib), Tel. +20 1117186420; email: holiel_m@yahoo.com (M. Holeil)

Received 6 July 2015; Accepted 13 September 2015

ABSTRACT

In this research, cubic iron sulfide powder was prepared for the sorption of $^{152 + 154}$Eu(III) from the aqueous solutions. The prepared sorbents were characterized by: X-ray diffraction analysis, differential thermal analysis, thermogravimetric analysis, Fourier transform infrared, scanning electron microscope and energy dispersive X-ray analysis. The sorption was performed as a function of pH, contact time, temperature, and metal ion concentrations in the batch experiments. The results demonstrated that the sorption was well described by the Langmuir adsorption isotherm with the maximum adsorption capacity of $(0.0203 \text{ mmol g}^{-1})$. The kinetic data indicated that the sorption fitted well with the pseudo-second-order kinetic model. The thermodynamic parameters implied that the sorption process was spontaneous and endothermic in nature.

Keywords: Cubic iron sulfide; Characterization; Sorption; $^{152 + 154}$Eu(III)