Ain Shams University
Faculty of Sciences
Chemistry Department

"Retention of Some Radiocontaminants in Natural and Modified Clay Minerals from Radioactive Liquid Waste"

Thesis submitted
By

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Egyptian Atomic Energy Authority

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To
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Surface modification of ball clay minerals with gamma irradiation polymerization for removal of cerium and gadolinium ions from aqueous phase

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ABSTRACT

Surface modification of ball clay was produced by gamma irradiation of a mixture containing ball clay (BC), acrylic acid (AA), phosphoric acid (PA), and N,N`-methylenebisacrylamide (DAM) solution to produce a composite sorbent (BC-AA-PA). Both BC and BC-AA-PA composite were characterized using SEM, FT-IR, XRD, and XRF. Comparative evaluation of both materials for the sorption of gadolinium and cerium ions was explored. The outcomes exposed that the removal percentage enhanced from 38.2% to 91% and from 24.9% to 88% for gadolinium and cerium ions by BC and BC-AA-PA, respectively. The proposed sorption mechanism illustrated that the sorption occurs by an ion exchange process. Sorption kinetics, equilibrium isotherm, and desorption studies were conducted. The sorption obeyed the pseudo-second-order model and Langmuir isotherm model. The comparison of sorption capacity of BC-AA-PA with other sorbents in the literature indicated that BC-AA-PA has a much higher sorption capacity than many sorbents (1.085 and 0.907 mmol/g for Gd^{3+} and Ce^{3+}, respectively). Desorption of gadolinium and cerium ions from BC-AA-PA was investigated; the results certified that 0.1 M HNO_3 is the best eluent with a percentage of 99.99 and 92% for Ce^{3+} and Gd^{3+}, respectively, and the BC-AA-PA can be applied for further sorption processes. Hence, BC-AA-PA composite sorbent is recommended for the sorption of lanthanides from the liquid phase.

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Walaa Ragab Mohamed

Dedicated To
the Soul of My
“Dear Father”

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