Ion Exchange Characteristics of Poly-acrylamide and Poly-acrylonitrile Based Ce (IV) Phosphate for Removal and Separation of Some Radionuclides from Waste Solutions

A thesis Submitted By

Sayed Sayed Metwally

M.Sc. (Chemistry)

Atomic Energy Authority

To

Chemistry Department, Faculty of Science,

Ain Shams University

For

The Degree of Doctor of philosophy in Chemistry (Ph.D.)

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ABSTRACT

Ion exchange is one of the most common and effective treatment methods for radioactive liquid waste. It's technique is well developed and has been employed for many years in both the nuclear industry and in other industries. In this thesis poly-acrylamide and poly-acrylonitrile based Ce(IV) phosphate were prepared and characterized by using advanced analytical techniques. The prepared materials were used as a composite ion exchangers for removal and separation of cesium, cobalt and europium ions from radioactive waste solution. Effect of pH of the medium on the removal of aforementioned ions was investigated. The kinetic sorption was studied and the data were analysed by different kinetic models which revealed that the mechanism of the sorption process is mainly controlled by pseudo-second-order reaction, and particle diffusion might be involved in the sorption process. The values of diffusion coefficient of the three metal ions were calculated and suggested that chemisorption was the predominant sorption mechanism. Several isotherm models were applied for the sorption, and thermodynamic parameters were determined. The positive values of enthalpy change, ΔH, for the three metal ions confirmed the endothermic nature of the sorption process. Breakthrough data were determined in a fixed bed column at room temperature (298 ^{o}K). The effect of various process parameters like bed depth, flow rate and initial metal ion concentration on the breakthrough curves were studied. The results indicated that the prepared materials can be used as an efficient ion exchange materials for the removal of cesium, cobalt and europium ions from radioactive waste solutions.

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[3] Results and Discussion

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