PREPARATION OF HIGH EFFICIENT ADSORBENTS AND DESIGN OF ADSORPTION BED FOR RECOVERY OF URANIUM FROM SEAWATER

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Summary

The recovery of uranium from seawater is studied with synthesized fibrous-amidoxime and calix[6]arene adsorbents. Commercial acryronitrile fibers are treated in a NH_2OH methanolic and then a NaOH aqueous solution. The intrinsic rate of adsorption of uranium becomes maximum at a certain reaction time for the NH_2OH treatment as well as the NaOH treatment and is in the range of 200-600 $mg.kg^{-1}$-dry $fiber.day^{-1}$ for the first adsorption run. The adsorption rate of optimized 6-denier fiber is about 250 $mg.kg^{-1}$-dry $fiber.day^{-1}$ after five repetitions of the adsorption and desorption cycle. The strength of the fiber is sufficient for packing in the adsorption unit.

A model of the adsorption unit packed with amidoxime fiber balls is proposed. The adsorption fiber is placed in small sperical shells of plastic net, and these fibrous balls are packed in a cage. The adsorption rate of fiber is correlated with fiber size, swelling ratio, liquid phase-side mass transfer and adsorption time. The cage is held in an ocean current, and seawater percolates through the packed bed and then permeates each ball. The adsorption yield of uranium at the outlet of the unit is calculated as a function of adsorption time. After the configuration and operational conditions of the adsorption unit are examined, the overall adsorption efficiency becomes higher than 0.5.

The rate of complex formation between calix[6]arene-p-hexasulfonate and uranyl ion is studied over a wide range of carbonate ion concentration. The complexation rate decreases with increasing carbonate ion concentration, and well correlated by means of the concentration of uranyl ions other than $UO_2(CO_3)_3^{4-}$.