EXTRACTION OF URANIUM WITH CROWN ETHER CARBOXYLIC ACIDS FOR NEUTRON ACTIVATION ANALYSIS

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Uranium in aqueous solution can be extracted by sym-dibenzo-16-crown-5-oxy-acetic acid and its modified analogue 2-/sym-dibenzo-16-crown-5-oxy/-hexanoic acid into chloroform in the pH range 5.5-6.0. The extraction method combined with neutron activation analysis provides a sensitive method for the determination of uranium in natural waters.

INTRODUCTION

Macrocyclic polyethers have attracted enormous attention recently from analytical chemists because of their unique properties of strong and selective binding of metal ions\(^1,2\). The binding is determined primarily by the compatibility of the size of the macrocyclic ring and the radius of the cations involved. However, complexation of neutral crown ethers with metal cations generally requires the presence of large lipophilic counter anions in order to transport the complex efficiently from aqueous phase into organic phase. To overcome this problem, a negatively charged functional group may be added to crown ethers.
for efficient transport of metal ions. The crown ethers with pendant carboxylic acid groups have been found effective and selective for lanthanide extraction. One of the advantages of this chelation system is that many matrix species in natural waters, including the alkali metals and the halogens, can be simultaneously removed during extraction. This is particularly significant for trace metal determination by neutron activation analysis because sodium and bromine are two of the major interfering elements present in many natural water systems. This report describes the applications of sym-dibenzo-16-crown-5-oxyacetic acid and 2-/sym-dibenzo-16-crown-5-oxy/hexanoic acid to the extraction of uranium from aqueous solution for quantitation by neutron activation analysis.

EXPERIMENTAL

Sym-dibenzo-16-crown-5-oxyacetic acid [I] and 2-/sym-dibenzo-16-crown-5-oxy/hexanoic acid [II] [Fig. 1] were prepared in our laboratory according to the procedures described in the literature. All other chemicals used in the experiments were Baker analyzed reagents. Uranium standards were prepared by dissolving $\text{U}_3\text{O}_8$ [NBS Reference Material 950a] in $\text{HNO}_3$ and diluting to proper concentrations with 0.1M $\text{HNO}_3$. Synthetic seawater was prepared according to a formula given in the literature. Deionized water was prepared by passing distilled water through an ion exchange column [Barnstead Ultrapure Water Purification Cartridge] and a 0.2 µm filter assembly [Pall Corp., Ultipor DFA]. All containers used in sampling and experiments were acid washed, rinsed with deionized water, and dried in a class 100 clean hood.