

Liquid-Liquid Extraction of Uranium (VI) from Aqueous Solution Using 1-Hydroxyalkylidene-1,1-Diphosphonic Acids

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Abstract : The extraction of uranium(VI) from aqueous solutions has been investigated using 1-hydroxyhexadecylidene-1,1-diphosphonic acid (HHDPA) and 1-hydroxydodecylidene-1,1-diphosphonic acid (HDDPA), which were synthesized and characterized by elemental analysis and by FT-IR, ¹H NMR, ³¹P NMR spectroscopy. In this paper, we propose a tentative assignment for the shifts of those two ligands and their specific complexes with uranium(VI). We carried out the extraction of uranium(VI) by HHDPA and HDDPA from [carbon tetrachloride + 2-octanol (v/v: 90%/10%)] solutions. Various factors such as contact time, pH, organic/aqueous phase ratio and extractant concentration were considered. The optimum conditions obtained were: contact time = 20 min, organic/aqueous phase ratio = 1, pH value = 3.0 and extractant concentration = 0.3M. The extraction yields are more significant in the case of the HHDPA which is equipped with a hydrocarbon chain, longer than that of the HDDPA. Logarithmic plots of the uranium(VI) distribution ratio vs. pHeq and the extractant concentration showed that the ratio of extractant to extracted uranium(VI) (ligand/metal) is 2:1. The formula of the complex of uranium(VI) with the HHDPA and the HDDPA is UO₂(H₃L)₂ (HHDPA and HDDPA are denoted as H₄L). A spectroscopic analysis has showed that coordination of uranium(VI) takes place via oxygen atoms.

Keywords : liquid-liquid extraction, uranium(VI), 1-hydroxyalkylidene-1,1-diphosphonic acids, HHDPA, HDDPA, aqueous solution

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