EXTRACTION OF PROTACTINIUM(V) WITH 2-THENOYLTRIFLUOROACETONE FROM STRONGLY ACIDIC SOLUTIONS

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The extraction of Pa(V) from strongly acidic solutions of mineral acids is carried out with benzene solution of thenoyltrifluoroacetone. To interpret the data obtained, two extraction mechanisms representing the descending and ascending parts of the extraction curves are suggested. At lower acidity, the formation of PaO(TTA)₃⁻·HTTA species predominates. In going to higher acidity, an ion-pair formation between anionic protactinium-inorganic complex species and H₂TTA⁺ cation is assumed.

Introduction

Solvent extraction of Pa(V) from strongly acidic solutions of mineral acids is of prime importance, since its ionic species is not liable to hydrolysis and hence be more easily extracted. Generally, data on solvent extraction of thenoyltrifluoroacetone complexes from strongly acidic media are very scarce and the extraction mechanism is still a matter of discussion. In case of Pa(V), the available data concern only the extraction with the aim of establishing separation methods.1 It is reported that, unexpected high extraction coefficients were obtained from strongly acidic solution of Pa(V).2 Limited data, however, are reported on the extraction mechanism to explain this anomaly.3-5 In the present investigation, the extraction of Pa(V) from high acid concentration of mineral acids is investigated, an extraction mechanism in the light of the data obtained is postulated and discussed.

Experimental

Materials

$^{233}\text{Pa}$ isotope was used as a tracer for Pa(V) and separated from irradiated thorium by diisopropylketone extraction from 8M HCl.6 Check on radiochemical purity of the separated $^{233}\text{Pa}$ isotope was carried out by using multichannel analyzer type
NORLAND ino Tech 5300. Certified thenoyltrifluoroacetone (HTTA), a product of Fisher Scientific Company was used without any treatment. Pure grade tetraphenylarsonium chloride, a product of Eastman Kodak was used for preparing 0.05M solution in chloroform. All other chemicals were of analytical grade, BDH products.

Procedure
Extraction experiments were carried out by batch equilibrium at room temperature (25 ±2 °C). In all cases, the aqueous phase containing the Pa-isotope was contacted with an equal volume of HTTA in benzene (5 ml each). The two phases were agitated in polyethylene ampules for 30 min using a rest hand action shaker. To determine the extraction coefficient (E), a sample (1 ml) from both phases was taken for γ-counting using well-type NaI(Tl) scintillation coupled with an EG&G ORTEC counting assembly.

Results and discussion
The extraction of Pa(V) from aqueous strong acid media (HClO₄, HCl, HNO₃) with HTTA solution in benzene was carried out. The data obtained show the variation of Pa(V) extraction coefficient (E) as a function of total acid concentration in the aqueous phase at constant organic phase content (Figs 1–3). Fig. 1 shows a decrease in E values with the increase in HClO₄ concentration passing through a flat minimum at 3–6M.

Fig. 1. Effect of HClO₄ concentration on the extraction of Pa(V) with HTTA