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EXTRACTION STUDIES ON SOME ELEMENTS AND ACIDS

FROM AQUEOUS MIXED MEDIA BY ORGANIC SOLVENTS

Thesis

Submitted by

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WORK

Dedicated to The LATE

Professor Dr. A. Haggag

Expressing our Feelings
of Sympathy and Compassion.



EXTRACTION STUDIES ON SOME ELEMENTS AND ACIDS
FROM AQUEOUS MIXED MEDIA BY ORGANIC SOLVENTS

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FORWARD

Solvent extraction is a well known technique in separation, purification and concentration of metal ions from trace as well as high level concentration. The technique is well applied in radioanalytical chemistry, fuel processing and reprocessing, purification and production of radioisotopes, as well as in the study of metal complexes and their stability constants. Tri-n-butyl phosphate, amines and bis(2-ethyl hexyl) phosphoric acid are among the most solvents used in this technique resembling neutral, anion and cation exchangers respectively.

Most of the research work published in the field of solvent extraction has applied the extraction of the metal salts from single acidic solutions. However, some work published by our laboratories involved the extraction from binary mixed acids-sulphuric and haloacids-for the purpose of separation. These reports did not give convenient picture about the reactions, complexes and mechanism appearing in the system. In some reports the complexes in 9M H_2SO_4 with 1M HCl (mixed acids) are mentioned as cationic species, while in others they are considered as chloride complexes neglecting the high stability constant of sulphate complexes.

The work in this thesis is aiming at introducing more details about the reactions taking place , complexes formed and the mechanism of extraction in the mixed acid systems. This study may lead to useful applications of the system studied in the field of nuclear and radiochemistry.

The complexes of Fe, Zn and In in the system are found as chloro-sulphate. This led us to separation of Fe, Zn, Co, Mn which is necessary before their determination due to the interference in their γ -energies. The reactions of UO_2^{2+} , SO_4^{2-} , HSO_4^- and Cl^- ions in the system and the anion exchange mechanism with amine showed that the extracted species is $(\text{LA}_2\text{H})_4 \text{UO}_2(\text{SO}_4)_3$. This study was extended to the neutral solvent tri-n-butyl phosphate (TBP) and the cation exchanger bis(di-ethyl hexyl) phosphoric acid. The effect of uranium concentration showed a great difference in complex formation. The high capacity of TBP for uranium in the system led to the study of thorium separation from uranium. ^{234}Th and ^{231}Th are obtained from the decay of ^{238}U and ^{235}U respectively, their separation is considered important to obtain thorium tracers that can be used in thorium chemistry and in some cases necessary for purification of

uranium from accumulated thorium and other elements.

The increase in production of uranium in industry has created a problem concerning natural water contamination. The described method for uranium determination in water is considered important, when the direct irradiation of uranium adsorbed on the resin is better than its analysis after elution.

Due to the importance of ^{99m}Tc , produced from the decay of radioactive ^{99}Mo in medical applications as clinical diagnosis, the development in the method of separation is important to obtain ^{99m}Tc of high purity. The study of separation showed that the method is simpler and the yield is higher and purer than that obtained by other methods.

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