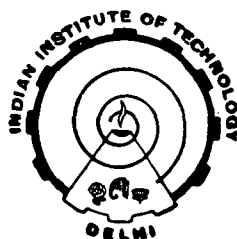


STUDIES ON EXTRACTION OF METALS WITH SOME NOVEL CHELATING EXTRACTANTS

by
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for the award of the degree of
DOCTOR OF PHILOSOPHY*



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APRIL, 1989

Dedicated To
My Parents

C E R T I F I C A T E

This is to certify that the thesis entitled "STUDIES ON EXTRACTION OF METALS WITH SOME NOVEL CHELATING EXTRACTANTS" by Jyothi Atluri is a record of original bonafide research carried out under our supervision and has not been submitted elsewhere for a degree.

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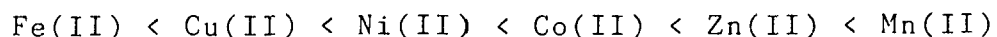
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(A. JYOTHI)

ABSTRACT

Two chelating ligands namely, 3-phenyl-4-acetyl-5-isoxazolone (HPAI) and 3-phenyl-4-benzoyl-5-isoxazolone (HPBI) containing a β -diketone moiety fused to the heterocyclic ring system have been prepared. They were characterized by elemental analysis, infrared and nuclear magnetic resonance spectroscopy and mass spectral studies. Extraction of some selected metals like manganese(II), iron(II), cobalt(II), nickel(II), copper(II), zinc(II), palladium(II), cadmium(II), lead(II), lanthanum(III), cerium(III), europium(III), thorium(IV) and uranium(VI) with HPAI, HPBI and LIX51 (a commercial fluorinated β -diketone from Henkel Corporation, U.S.A.) has been studied. Mechanism of extraction has been discussed on the basis of experimental evidence obtained. From the distribution data, $pH_{1/2}$ (pH at which 50% of the metal ion is extracted) and $\log K_{ex}$ (equilibrium constant in the two phase extraction system) values in all the systems wherever possible have been calculated. The order of extraction of metals with 0.01 M HPAI in methylisobutylketone (MIBK) as a function of $pH_{1/2}$ values is:

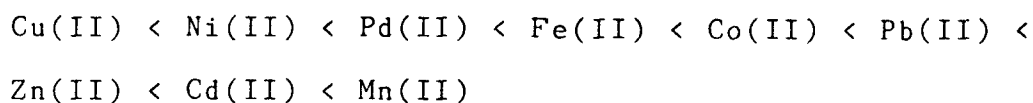


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and for lanthanides and actinides,



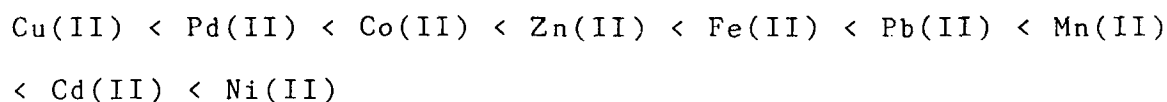
The trend in the order of extraction of metals with 0.01 M HPBI in chloroform as a function of $\text{pH}_{1/2}$ values is:



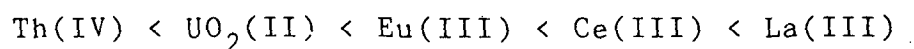
and for lanthanides and actinides,



Similarly, the order of extraction of metals with 5%(v/v) LIX51 extractant in MIBK as a function of $\text{pH}_{1/2}$ values is;



and for actinides and lanthanides,



The efficiency of these ligands for the extraction of metals studied here has been compared with that of other well known chelating ligands like thenoyltrifluoroacetone (HTTA) and 1-phenyl-3-methyl-4-benzoyl-5-pyrazolone (HPMBP). Quantitative separation of metals which are feasible using these extractants have been indicated. The extractants HPBI

and LIX51 have also been studied for possible applications in preconcentration and group extraction of metals.

Solid complexes of manganese(II), cobalt(II), nickel(II), copper(II), zinc(II), cadmium(II), lead(II), magnesium(II), lanthanum(III), cerium(III), yttrium(III), praseodymium(III), vanadyl(II), thorium(IV), zirconium(IV) and uranyl(II) with HPAI and HPBI have been synthesized. These complexes were characterized by using elemental analysis, IR, UV, visible, NMR and mass spectral studies. It has been shown that these compounds behave as bidentate ligands forming metal chelates through the carbonyl and hydroxyl group of the enolic form. Thermal stability of the complexes has been studied by obtaining thermograms (TGA). Thermogravimetric studies have indicated that the metal complexes decompose in steps on heating yielding metal oxide as the final product.

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