

Extraction behavior of lanthanide with phosphine type extractant as phosphorus donor ligand

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Solvent extraction of lanthanide using phosphine type extractant such as Triphenylphosphine, Bis(diphenylphosphino)methane, Bis(diphenylphosphino)ethane and Bis(di-2-thienylphosphino)ethane was investigated for development of selective separation of minor actinide and lanthanide. Dipicrylamine as hydrophobic anion was used with phosphine type extractant in order to enhance the distribution ratio of lanthanide.

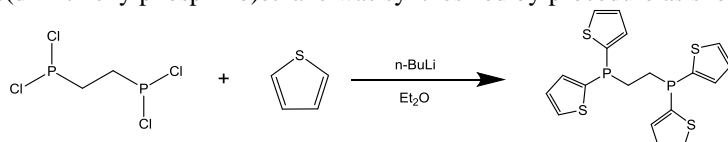
I. INTRODUCTION

Separation and transmutation of long-lived radionuclides is one of the most important issues on waste management of high level waste which arose from reprocessing process of spent nuclear fuel. Especially, separation of minor actinide, Americium and Curium, is important because minor actinide is α -emitting and long half-life radionuclide. Selective separation of minor actinide from lanthanide was investigated and developed in past decades.¹ Solvent extraction is one of the major methods for selective separation of minor actinide from lanthanides. Previously, sulfur donor and nitrogen donor extractant, so called soft donor extractant, indicated high selectivity for Americium.

Present study focused on phosphorus donor ligand and solvent extraction of lanthanide by phosphine type ligands such as Triphenylphosphine (TPP), Bis(diphenylphosphino)methane(DPPM), and Bis(diphenylphosphino)ethane (DPPE) was investigated. In order to research the effect of substituent on phosphine type extractant, Bis(di-2-thienylphosphino)ethane (DTPE) was synthesized and used for extraction.

II. EXPERIMENTAL

Bis(di-2-thienylphosphino)ethane was synthesized by procedure as shown in Scheme 1.



Scheme 1

Solvent extraction of lanthanide was carried out as follow procedure. The aqueous phase was acetic buffer solution containing lanthanide. The organic phase was 1,2-dichloroethane solution with phosphine type ligands, such as TPP, DPPM, DPPE and DTPE. In order to enhance the distribution ratio of lanthanide, hydrophobic anion, dipicrylamine and so on was used as counter anion.

III. RESULTS AND DISCUSSION

Compared with extraction ability of phenyl substituent type phosphine, the distribution ratio of Eu was the order of DPPM > DPPE > TPP. The distribution ratio of Eu by chelate type phosphine, DPPM and DPPE, was higher than that of monodentate type phosphine, TPP.

Figure 1 shows the extraction pattern of lanthanide by DPPM and DPPE. In the case of DPPM, lighter lanthanide was selectively extracted. On the other hand, heavier lanthanide was more extracted by DPPE. In the same experimental condition, the D value of Eu by DTPE was higher than that of DPPE. This tendency was agreement with the tendency of monodentate phosphine. Substituent on phosphine type extractant affected the extractability of lanthanide.

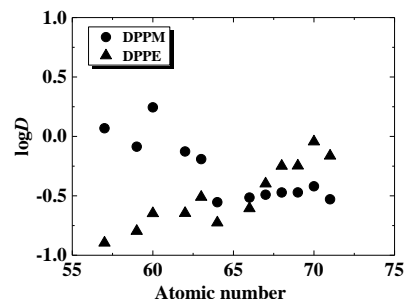


Fig.1. Extraction pattern of lanthanide by DPPM and DPPE.

REFERENCES

1. C. Hill, *Ion Exchange and Solvent Extraction A Series of Advances*, **19**, 2009, 119.