

OA 1 - Removal of Long-Lived Minor Actinides by Means of Solvent Extraction with Lipophilic Chemically Modified Chitosan

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Post treatment of HLLW (High Level Liquid Wastes) generated after the reprocessing of spent nuclear fuel is a fatal problem for atomic energy which should be solved in our generation. The selective removal of long-lived minor actinides (MA) such as americium and curium from HLLW is the key for resolving this difficult problem. Since the removal of MA directly from HLLW is very difficult because these are coexisting together with large amount of trivalent lanthanides with chemical similarity, two step separation is proposed at present; i.e. 1) separation of actinides together with lanthanides from other elements existing in HLLW such as strontium, cerium, zirconium and so on followed by 2) selective separation of MA from lanthanides. For the step 1), solvent extraction with N, N'-substituted malonamide (in France) or N, N, N', N'-tetraoctyl-3-oxapentane-1, 5-diamide (TODGA, in Japan) followed by stripping with dilute nitric acid solution is proposed and is now being nearly successfully established. However, the step 2 is far from solution. So far, selective solvent extraction of MA from the raffinate from the step 1) using various types of reagents such as dialkyldithio- phosphinic acid (Cyanex 301) and 2, 6-di (5, 6-dipropyl-1, 2, 4-triazin-3-yl) pyridine (DPTP) have been tested for this purpose. Although these reagents exhibited high selectivity, they are suffered from chemical unstability.

In the present work, lipophilic chitosan containing functional groups of dithiocarbamate (DTC-lipophilic chitosan) was prepared and tested for the selective solvent extraction of MA from large excess of lanthanides in dilute nitric acid solution. This reagent was found to be soluble not only in chloroform and toluene but also in kerosene, which is very favorable for practical purposes.

Although solid chitosan gel chemically modified with functional groups of dithiocarbamate prepared according to the conventional method had exhibited no selectivity to MA over lanthanides, DTC-lipophilic chitosan exhibited high selectivity to americium over europium; i.e. the separation factor of Am/Eu was as high as 1227 in the extraction at pH=4. In addition, it exhibited the same separation factor at the second solvent extraction test carried out one week after the first test, suggesting that it is chemically stable at least for one week contraly to Cyanex 301 and DPTP.