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Extraction of Ln/An from highly acidic solutions using cobalt bis(dicarbollide) functionalized with complexing CMPO group.

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Abstract

The nuclear fuel reprocessing isues an important problem in respect to handling of the family of actinides which represent the main source of radiotoxity during long-term storage. The separation of long lived radionuclides from liquid radioactive waste enables these hazardous elements to be either conditioned more safely in specific matrices, or destroyed by transmutation. Thus, elimination of minor actinides would lead to significant reduction of volume and radiotoxicity of the waste for the final storage and should consequently minimize the possible risks to biosphere. Several extraction concepts were proposed for separation of Ln and An from fission product mixture during last ten years.
In this paper, extraction of trivalent lanthanides and actinides using a compound based on covalent combination of cobalt bis(dicarbollide) (1-) anion (COSAN) and CMPO (N,N- dialkyl carbamoyl methyl diphenyl phosphine oxide) complexing group of the formula [8-Ph2P(O)-CH2C(O)N-t-C8H17-(CH2-CH2O)2-1',2'-C2B9H11)-3,3'-Co]- will be presented. This compound was selected for detailed tests from a broad panel of other derivatives (differing in the substitution at the CMPO function and its bonding to the COSAN cluster 1,2 due to very effective extraction of Ln(III) and An(III) from highly acidic solutions (3M HNO3), good solubility characteristics and an easy synthetic accessibility in a large scale. Extraction efficiency under different conditions (acidity, reagent concentration, macro amounts of metals, etc.), solubility in different solvents and chemical stability were tested to evaluate a possible technological use. The composition of extracted complex was studied. Extraction from fission product mixture revealed very effective separation from the majority of fission products with separation factor exceeding 1000. For some fission products, the presence of complexing agents was necessary.

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