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The liquid-liquid extraction of minor actinides with CyMe$_4$-BTBP in selected diluents

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The CyMe$_4$-BTBP (6,6'-bis(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-1,2,4-benzotriazine-3-yl)-2,2'-bipyridine) has been demonstrated to be a prospective extractant for the liquid-liquid extraction of minor actinides. For industrial applications, its solubility in 1-octanol is low and the kinetics of extraction in this diluent is slow. Better performance has been demonstrated in cyclohexanone, however, the partial miscibility of this solvent with water makes its industrial use problematic. Therefore, the main purpose of this study was to find the most suitable diluent for the CyMe$_4$-BTBP. The separation of americium(III) from europium(III) was studied. This is in particular reference to the separation of minor actinides from the high-level liquid waste issuing from the reprocessing of spent nuclear fuel.

The results obtained using the diluents tested were compared with the data for cyclohexanone or 1-octanol as reference diluents. The principal diluents tested were alkylcyclohexanones. The parameters studied included the dependence of distribution ratios of americium(III) on the position of the alkyl group on the cyclohexanone ring, on the length of the alkyl substituent and on the number of alkyl groups in the ring. Extraction by the neat diluents (without CyMe$_4$-BTBP extractant) was also studied as well as the dependence of the distribution ratio on the concentration of nitric acid.

It has been shown that the alkylated cyclohexanones are promising diluents for the partitioning of minor actinides from lanthanides by CyMe$_4$-BTBP. In particular, 3-methylcyclohexanone was found to have the optimum properties compared with the other cyclohexanones.

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