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Radiation Stability of Extraction Systems with Hydrophobic CyMe4-BTBP and CyMe4-BTPhen Extracting Compounds and Hydrophilic (SO3H)2-BTP, (SO3H)2-BTBP, and (SO3H)2-BTPhen Masking Agents

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Extraction properties and radiation stability of two systems with hydrophobic extractants (CyMe4-BTBP or CyMe4 BTPhen) and three systems with hydrophilic masking agents ((SO3H)2-BTP, (SO3H)2-BTBP or (SO3H)2 BTPhen) were studied throughout the GENIORS project.
The study of extraction systems containing CyMe4-BTBP or CyMe4-BTPhen dissolved in fluorinated BK-1 diluent revealed that the extraction properties of the BK 1-based solvents are promising. However, the radiation stability of those extracting compounds in the diluent BK-1 is insufficient for practical application. [1] Next, a study performed with another fluorinated diluent FS-13 revealed that this system shows much better stability than the system with BK-1. The behaviour of the CHALMEX system after irradiation by accelerated electrons at different temperatures was studied. The study of the irradiation of the solvent in the presence of nitric acid aqueous phase confirmed its earlier observed radioprotective efffect. A comparison of the theoretical values of distribution ratios after irradiation, calculated from the residual concentrations of the ligand, with their experimental values suggests that some of the CyMe4-BTBP degradation products or adducts of CyMe4-BTBP or TBP are probably able to extract the studied metals, too.
The i-SANEX extraction system with the masking tetrasulfonated BTPhen ligand ((SO3H)2-BTPhen) was tested for its behaviour under irradiation. The general trend observed was that up to 200/250 kGy the D values for Am(III) and Eu(III) remained similar, but for higher doses the values of distribution ratios changed dramatically. The trend in SFCm/Am values was similar to the trend of values of SFEu/Am. [2] Furthermore, characterization of (SO3H)2-BTP or (SO3H)2-BTBP irradiated at different temperatures was performed. After the irradiation of (SO3H)2-BTP-containing aqueous phase without contact with organic phase to high absorbed doses, the DAm and DEu exceed the values of blank –some degradation products/adducts formed probably act as efficient non-selective extractants of the mentioned metals. When the aqueous phase was in contact with organic phase during the irradiation, the system was more stable against radiolysis and DAm values increased more slowly. The system with (SO3H)2-BTBP behaved in a very similar way as the (SO3H)2-BTP one, however, it was much more radiation stable than the (SO3H)2-BTP system.

References:

[1] P. Distler, M. Mindová, J. Šebesta, B. Gruner, D. Bavol, R.J.M. Egberink, W. Verboom, V.A. Babain, J. John: Stability of Different BTBP and BTPhen Extracting or Masking Compounds against γ Radiation. ACS Omega. 2021, 40(6), p. 26416–26427.
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