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## Uranium(VI)/plutonium(IV) separation from mixed oxide spent nuclear fuels using a single monoamide extractant

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In the framework of plutonium multi-recycling, a new N,N-dialkylamide extractant for mixed oxide spent nuclear fuels reprocessing is proposed instead of TBP currently used in the PUREX process. This new solvent extraction process allows extraction and purification of uranium and plutonium towards the fission products in one single cycle without redox. Indeed, after uranium and plutonium extraction from concentrated nitric acid solution, plutonium is selectively back extracted by decreasing the acidity of the aqueous phase whereas, in the PUREX process, selective plutonium back-extraction is achieved by reducing the plutonium oxidation state, using reducing agent and nitrous scavengers.

Therefore, monoamide process is easier and safer to operate because plutonium is in a stable oxidation state through all the process. This new process will be more suitable for the recovery of plutonium from spent LWR MOX and then from FR MOX fuels in which Pu/U ratio will be higher than in current fuels.

Beforehand, batch experiments were performed to study the behaviour of water, nitric acid, uranium(VI), plutonium(IV) and some fission products towards their extraction by this monoamide to determine extraction isotherms. Experimental distribution data are described with a physicochemical model which is integrated into the CEA-Orano PAREX+ code. It was used to find the correct flowsheet to obtain uranium and plutonium at very high purity and to achieve considerable recovery efficiencies.

Then, four pilot tests, using mixer-settlers, were successfully performed with this extractant.

The first test was conducted with a surrogate feed representative of MOX fuels (Pu/U=10%) in alpha-shielded line (ATALANTE facility) to confirm the uranium/plutonium partition feasibility and compare experimental data with calculated values obtained with the PAREX+ code.

Afterwards, this flowsheet was applied to the treatment of actual high activity solutions in the CBP hot cell (ATALANTE facility).

Recovery ratios (99.6%), purity rate and decontamination factors ( $\sim 10^5$ ) were achieved in accordance with formal requirements.

These successful tests allow to pursue the development of this process and scaling up flowsheets for industrial purposes.