Use of bifunctional compounds N, P for uranium purification from aqueous solutions of nitric acid
A. Artese, Sandrine Dourdain, Guilhem Arrachart, A. Leydier, S Pellet-Rostaing, N. Boubals, P. Guilbaud

To cite this version:

HAL Id: cea-02339123
https://hal-cea.archives-ouvertes.fr/cea-02339123
Submitted on 13 Dec 2019

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L’archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d’enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.
USE OF BIFUNCTIONAL COMPOUNDS N, P FOR URANIUM PURIFICATION FROM AQUEOUS SOLUTIONS OF NITRIC ACID

ARTESE Alexandre1,2, DOURDAIN Sandrine3, ARRACHARD Guilhem1, LEYDIER Antoine3, PELLET-ROSTAING Stéphane1, BOUBALS Nathalie2, GUILBAUD Philippe2

1- ICSM/LTSM
2- CEA/DEN/DMRC/SPDS/LILA
alexandre.artese@cea.fr

The refining plants of natural uranium concentrates rely on a solvent extraction process to produce uranium at the so-called "nuclear" purity. Extraction of uranium (from yellow cake) is performed thanks to an organic phase containing a specific extractant, further washed to recover pure uranium in a new aqueous phase. The conventional extractant is tri-n-butyl phosphate (or TBP). However, even though the TBP works pretty well at industrial scale, it is still of research interest to find optimized and highly efficient systems. Research has therefore been undertaken to find alternatives to TBP ([1], [2], [3], [4], [5]).

It turns out that most of the tested extractants have a moderate affinity for uranium (VI) with little or no selectivity for this element toward the other metallic species. A new series of N, P bifunctional ligands showed excellent properties in a nitric medium in terms of affinity for uranium extraction[6]. Based on the know-how of the LTSM team in the field of bifunctional ligands synthesis and study and of the CEA/DMRC teams in the data acquisition on major actinides [7], [8], the objective of this study is to explore and study the capacity of new molecular architectures for uranium extraction, and to understand their extraction mechanisms. It is now established that the mechanisms underlying the liquid-liquid extraction processes are based not only on the complexing properties of the extracting molecules [9], but also on their capacity to form supramolecular aggregates because of their amphiphilic nature. This study concentrates therefore on both molecular and supramolecular mechanisms to understand and master both chelation and self-assembly properties of these molecules in order to optimize extraction processes.

The molecular structures of the complexes are probed using different techniques such as infrared spectrometry. The extraction of cations, acid and water by the new bifunctional ligands are characterized by ICP, coulometry and potentiometry. The organization of the ligands in supramolecular aggregates is characterized by X-ray and neutrons scattering measurements. Critical aggregation concentrations are measured in detail by surface tensiometry to relate them to aggregation energies. All these molecular and supramolecular aspects of the system are related to its extraction properties.

[7] A. Leydier et al., Composés à fonctions oxyde de phosphine et amine, utiles comme ligands de l’uranium(VI), et leurs utilisations, notamment pour extraire l’uranium(VI) de solutions aqueuses d’acide sulfurique. FR 15 52886, 2015
[8] A. Leydier et al., Composés à fonctions oxyde de phosphine et amine, utiles comme ligands de l’uranium(VI), et leurs utilisations, notamment pour extraire l’uranium(VI) de solutions aqueuses d’acide sulfurique. FR 15 52888, 2015
Presenter information

Please select the thematic session of your abstract:

- [ ] 1. New combinations and applications of chemical systems
- [ ] 2. Toward intelligent chemical systems
- [ ] 3. Toward optimization of yields and processes
- [x] 4. Systems for separation and recycling

Within each session it will be appreciated that your talk covers at least one of the following item or combination thereof. Please indicate which is/are concerned:

- [x] A. Assessment-proof of concept of chemical systems
- [ ] B. Challenging theory by experiments and simulation
- [ ] C. Design-methods for optimization of systems

Type of communication:

- [x] Oral
- [x] Poster

Name: ARTESE

First name: Alexandre

E-mail: alexandre.artese@gmail.com

Institute / establishment: ICSM

Please complete the abstract and send it back in WORD format, before March the 15th 2018, by e-mail to: abstract@balard-conferences.fr