NEW COMPOSITION TO SELECTIVELY EXTRACT LANTHANIDES AND ACTINIDES

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ABSTRACT

The Institute of Organic Synthesis and the Institute of Water and Environmental Sciences, belonging to the University of Alicante, have jointly developed an extractant mixture formed by the combination of a process ionic liquid (TSIL) and an ionic liquid (IL) that allows the selective and efficient extraction of metals of the f series of the periodic table (lanthanides and actinides) with respect to other metals of the s, p and/or d series. This technology is characterised by the fact that the extractant mixture can be reused in new extraction cycles without losing effectiveness, which represents a great advance in sustainability and environmental protection.

This novel formulation can be applied industrially in areas such as mining, nuclear chemistry, nuclear medicine and nuclear waste treatment.

Companies interested in acquiring this technology for commercial exploitation through patent licensing agreements are being sought.

ADVANTAGES AND INNOVATIVE ASPECTS

ADVANTAGES OF THE TECHNOLOGY

This novel extraction procedure has the following advantages:

1) It allows the **selective extraction of inner transition metals (f-block)** from metals belonging to the s-, d- and/or p-blocks of the periodic table in a very efficient way.

2) The extractant mixture is **recyclable**: once the extraction procedure has been completed, the complexed metal(s) can be fully recovered and the extractant mixture can be used in new extraction cycles.

3) The extractant mixture has a low affinity for the metals of the s-, d- and p- series of the periodic table, so that the metals of these series are extracted with a low or zero percentage.

4) The recovery rate of the extractant mixture is at least 95%, so it is possible to reuse it in **new extraction cycles** once the extracted metals have been released.

5) The extraction process is **environmentally friendly**.

6) The procedure is carried out under **mild reaction conditions** (temperature between 0°C-25°C and atmospheric pressure).

7) Both the **TSIL compound** and the **CYPHOS NTf_2** solvent are **commercially available** (or can be easily prepared by simple ion exchange).

8) The procedure is **feasible on an industrial scale** and can be adapted and implemented to the needs of the company.

In summary, the new extractant mixture is a revolutionary technology that **significantly improves on current methods for the extraction of inner transition metals** (lanthanides and actinides) **in complex matrices**.

INNOVATIVE ASPECTS OF THE TECHNOLOGY

The present extractant mixture [TSIL + CYPHOS NTf_2] has several innovative aspects that differentiate it from other similar technologies on the market. In general, it is not common to combine TSIL compounds with ionic liquids.

Firstly, this novel chemical composition allows the **selective and efficient extraction of the inner transition metals of the f-series (lanthanides and actinides)** from other metals of the s-, d- and/or p-series of the periodic table. In this sense, the main interaction of the inner transition metals with TSIL, which acts as a selective chelator, takes place via the 1,3-dicarbonyl site.

Moreover, once the extracted metals have been separated, the **original extractant mixture is recovered with a yield of more than 95%**, which allows it to be **recycled** and subsequently used in new extraction cycles, making it a **sustainable and environmentally friendly procedure** (there is no other extraction system of these characteristics on the market that is recyclable).

MARKET APPLICATIONS

This novel composition is able to selectively extract the inner transition metals from the other metals of the periodic table at pH=6.

The main **application sectors** of this novel technology are:

- Mining.
- Nuclear chemistry.
- Nuclear medicine.
- Nuclear waste treatment.
- Scientific research.

This technology solves the problem of the selective separation of the chemical elements belonging to the rare earths (lanthanides and actinides), some of which are used as fuels in nuclear power plants.

The selective separation of these metals (f-block) from the rest of the metals listed in the periodic table is crucial both in the process of **extracting the starting minerals** and in the treatment of **nuclear waste products**.

Its application in different industrial sectors can have a positive impact on the **environment** and can contribute to improving **energy sustainability** worldwide.

COLLABORATION SOUGHT

Companies interested in acquiring this technology for **commercial exploitation** through **patent licensing agreements** are sought.

Company profile sought:

- Mining.
- Chemical industry.
- Nuclear industry.
- Nuclear medicine.
- Nuclear waste treatment.