Advanced (bio)hydrometallurgical methods for the optimized extraction and beneficiation of Rare Earth Elements from Ion Adsorption Clays

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Extended Abstract

Their physicochemical properties make Rare Earth Elements (REE) essential ingredients of renewable energy appliances such as wind-energy generators and electric vehicles. Whilst recycling only covers about 1 % of today's REE demand, the extraction from Chinese Ion Adsorption Clays (IAC) is still the main source of these critical raw materials (European Commission, 2014).

The significant impacts on environmental receptors such as surface and groundwaters, soils and sediments deriving from conventional extraction techniques of REE from IAC (e.g. Alfonso et al., 2012, Yang et al., 2013), emphasize the need for environmentally sustainable methods for the extraction and processing of these elements. Furthermore, about 200 comparable REE-rich deposits exist worldwide in regions such as Madagascar, Laos, Suriname and Brazil that so far have been little exploited for their REE content. Thus, any alternative and optimized mining technology for the REE extraction from IAC will bear on the resource efficiency and environmental sustainability in China and beyond.

The main objective of our project (Fig.1) is consequently to develop mining and processing methods for on-site leaching and (bio)hydrometallurgical extraction of REE from IAC.

In detail, we aim to:

- i) enhance sediment permeability of IAC by **geotechnical conditioning** using cryotechnology to promote a more efficient and environmentally sustainable leaching process,
- ii) optimize currently employed hydrometallurgical processes (e.g. in terms of reactant consumption) and **develop new (bio)hydrometallurgical processes** (e.g. based on lixiviants such as organic acids, complexing agents and chelators) in order to selectively leach and recover REE,
- iii) develop **sorption processes based on bio-materials** such as algae and yeast to sequester and separate REE from solutions and
- iv) study and optimize processes of the REE extraction and recovery (e.g. on different yeasts) by **numerical process simulation** based on **experimentally derived thermodynamic data** in order to evaluate and improve the newly developed methods.

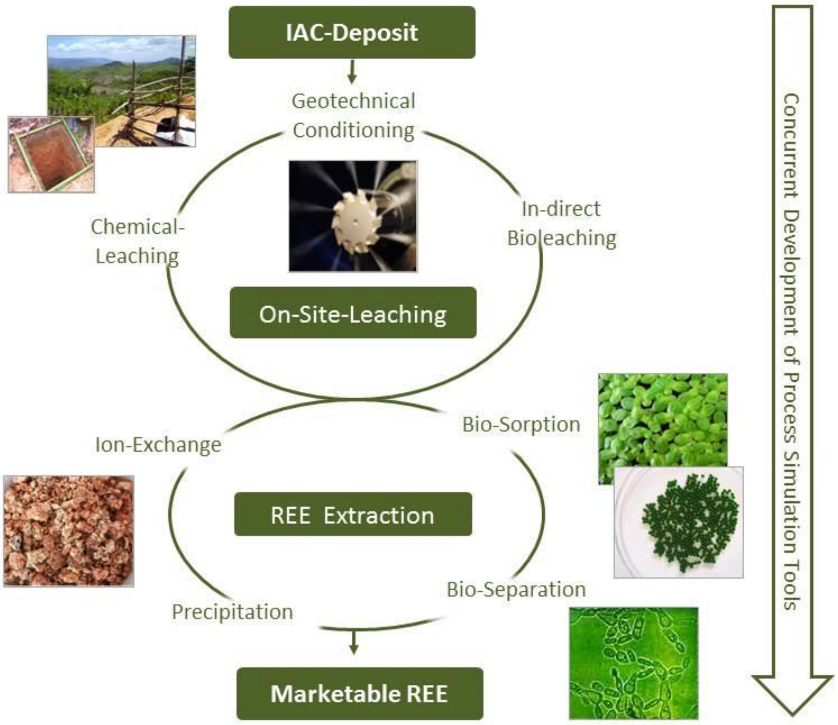

Figure 1 *Proposed process steps for the extraction of REE from Ion Adsorption Clays*

Key words: environmental impact, on-site leaching, biomining, modeling, geotechnical extraction

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