

Unveiling the Opportunities of Rare Earths Recovery from Phosphate Byproducts and Waste Streams

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Abstract

The development of today's industries is fundamentally based on the supply of critical metal resources such as rare earth elements (REEs). This latter is considered as the engine of various technologies including permanent magnets, electric vehicles, lightning materials etc. The performance of these elements is mainly based on their outstanding chemical, physical and mechanical properties, which makes them irreplaceable in these applications. As an alternative resources, REEs could be recovered from phosphate rock and its derivative products and waste streams in the fertilizer industry. Throughout the production of phosphoric acid, REEs are fractioned between phosphogypsum and phosphoric acid. The concentration and purification of this latter generates huge amounts of sludges containing elevated concentrations of REEs in the range of 0.3 and 0.4 wt.% REEs (Fig. 1). In this regard, several processes were developed for the leaching and extraction of these elements from phosphoric sludge. The adopted strategies include the production of mixed concentrates of REEs and the manufacture of other high-added value products in the framework of circular economy.

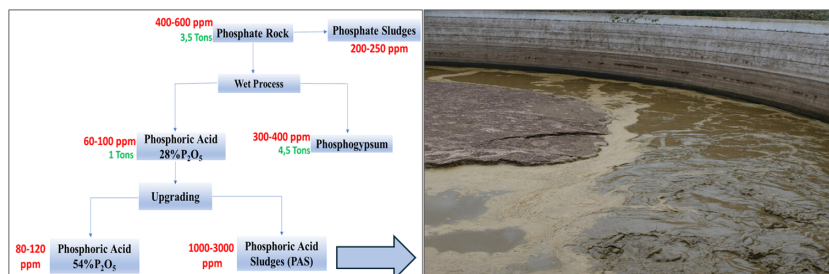


Fig. 1. Distribution of REEs in the value chain of phosphate rock.

References

- [1] **J. Ait Brahim**, A. Merroune, H. Mazouz, R. Beniazza, *Recovery of rare earth elements and sulfuric acid solution from phosphate byproducts via hydrofluoric acid conversion*, *Journal of Industrial and Engineering Chemistry*, 127 (2023), 2023, 446-453, <https://doi.org/10.1016/j.jiec.2023.07.028>
- [2] A. Merroune, **J. Ait Brahim**, Achiou, B., Kada, C., Mazouz, H., Beniazza, R., 2024, *Closed-loop purification process of industrial phosphoric acid: Selective recovery of heavy metals and rare earth elements via solvent extraction*, *Desalination*, 580, 117515, <https://doi.org/10.1016/j.desal.2024.117515>
- [3] **J. Ait Brahim**, A. Merroune, R. Boulif, E.M. Mounir, R. Beniazza, *Efficient leaching process of rare earth, alkali, and alkaline earth metals from phosphogypsum based on methanesulfonic acid (MSA) as green & eco-friendly lixiviant*, *RSC Adv.* 12 (2022) 30639–30649. <https://doi.org/10.1039/D2RA04124C>.