BIORECOVERY OF SCANDIUM FROM BAUXITE RESIDUE

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The significant dependence on critical raw materials (CRM) and their supply risk is a growing concern for the European Union in recent years. Among the CRMs, rare-earth elements (REEs) are considered to be by far of the most uncertain supply. Bauxite Residue (BR) is an industrial by-product and its disposal constitutes a serious universal environmental problem (Wang et al., 2019). It contains a considerable amount of REEs, in particular Scandium (Sc), which represents more than 95% of the economic value of REEs in BR (Ochsenkuehn-Petropoulou et al, 2018). Its Sc extraction from BR has been investigated mostly by hydrometallurgical methods using different mineral acids such as nitric, hydrochloric, sulfuric acid under different leaching conditions (Ochsenkuehn-Petropoulou et al, 2018). Biotechnology, based on the understanding of living organisms and their interaction with different metals can be the eco-friendly option for their recovery (Kiskira et al., 2017).

This study focused on the development of a novel bioleaching process for the recovery of Sc from BR as an alternative approach to conventional acid leaching. All batch experiments were conducted using BR provided from Mytilineos S.A. The aim of this study was the investigation of a bioleaching procedure using a pure culture of fungus *Aspergillus niger* that produces high amount of organic acids, for Sc recovery from Greek BR and the optimization of the process by testing different parameters.

Bioleaching experiments were examined in batch cultures with the bauxite residue at various pulp densities (1, 5 and 10%, w/v), sucrose concentrations (40, 90 and 140 g/L) and bacterium suspension of 2, 4, and 6% w/w under one-step bioleaching conditions. The results were compared with previous studies in the same material using the chemotheotrophic bacterium *Acetobacter tropicalis* (42% scandium recovery) (Kiskira et al., 2021) and digested residue (anaerobic digestion waste) from a pilot-scale anaerobic digester (30% scandium recovery) (Michalopoulos et al., 2020). The recovery rate of Sc achieved in 15 days with the *Aspergillus niger* is comparable to that of conventional metallurgical processes.

The results indicate a synergistic effect of the different organic acids produced by the microorganisms. Optimisation of the bioleaching process is in progress, using different microbial cultures such as *Penicillium oxalicum* aiming to minimise the incubation time and maximise Sc recovery for up-scaling bioleaching for the Sc extraction from BR.

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