**INTEGRATED APPROACH FOR THE TREATMENT OF LOW-GRADE LATERITE ORES**

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**ABSTRACT**

Nickel and cobalt are essential for lithium-ion batteries which power electric vehicles. Their demand in the European Union (EU), which is now met by imports from third countries, is going to increase dramatically in the near future. Thus, the exploitation and treatment of low-grade laterites ores in Europe is important for several industrial sectors [1-2]. In sevral cases, laterite ores may be also used for the extraction of rear earth elements (REEs) [3].

The present paper investigates the column leaching of two types of low-grade Greek laterite ores, namely saprolitic and limonitic, for the extraction of Ni and Co, as well as the valorization of the leaching residues for the production of alkali activated materials (AAMs). Leaching was carried out in two columns and the pregnant leach solution (PLS) obtained after the leaching of the saprolitic ore present in the first column was used for the leaching of the limonitic ore in the second column. This approach was used to minimize the acid consumption as well as to reduce the concentration of the non-desired elements in the PLS and improve process economics and the environmental footprint. The leaching agent was sulphuric acid 1.5-3.0 mol/L (M) while the addition of 20 g/L Na2SO3 to improve leaching efficiency was also investigated. The overall duration of the leachinhg tests in both columns was ~ 30 days. In the optimum conditions, over 70% of the entire Ni and Co were extracted, while the extraction of Fe was quite low (~ 8.5%). The extraction of Al, Mg, Ca and Mn was also monitored. The leaching residues were alkali activated using NaOH and Na2SiO3 and minor addition of metakaolin (MK) for the production of AAMs. X-ray fluorescence (XRF), X-ray diffraction (XRD), Fourier-transform infrared (FTIR) spectroscopy and Differential scanning calorimetry (DSC/TG) were used to characterize the ore, the leaching residues and the produced AAMs. The AAM specimens, obtained after 24 hours of curing and 7 days of ageing, exhibited compressive strength exceeding 40 MPa. The structural integrity of the AAMs was also investigated after heating in high temperatures or immersion in various solutions.

**KEYWORDS:** Greek laterite leaching, Alkali activated materials

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