Modelling the extraction of elements from secondary mining resources in electrodialytic systems

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Abstract

Mining residues from wolframite deposits have contents of tungsten (W), that is a transition metal commonly used for cemented carbide production, alloys and steels. The primary sources of W, ore bodies from scheelite and wolframite, have now a high supply-risk aligned to a high economic importance, being W included in the 2020 EU list as one of the 30 Critical Raw Materials [1]. In addition, arsenic (As) may be present in these residues, that is a harmful metalloid to the environment and public health. Since mining residues are deposited in open air impoundments is imperative to treat them to avoid potential risks for the surrounded ecosystems and to promote safe further reuses of this secondary resource. Therefore, sustainable strategies to recover W and to remove As from secondary resources are now becoming relevant. The electrodialytic (ED) treatment is commonly applied to remove inorganic and/or organic contaminants from liquid and solid matrices. When a low-level direct current is applied in a system with charged elements, through a pair of electrodes, the movement of contaminants is promoted. ED treatment was tested aiming the recovery of W and the removal of As from mining residues [2]. In this sense, a rejected fraction from the sludge circuit (that is directly pumped to the dam) from Panasqueira mine (Covilhã, Portugal) was used for the study. The results have shown promising achievements and, to support the study of the most feasible ED system, and improve the extraction of elements during the treatment, a modelling approach was performed. In this way, from the data obtained from the experimental work, W and As behaviors during the ED treatment were modelled in an aqueous

system, when pH was changed. This promoted the study of the mechanisms of W and As leaching, that are crucial to understand chemical phenomena in more complex ED systems (e.g. addition of enhancements, reactor multiple configurations, current variations).

References

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