ISGC 2022

N°591 / PC
TOPIC(s) : Waste and side streams valorization / Alternative solvents

Extraction and selective recovery of transition metals from acid mine drainage

AUTHORS

Helena PASSOS / CICECO, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO
Brayan CRUZ / CICECO, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO
Nicolas SCHAEFFER / CICECO, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO
Carla PATINHA / GEOBIOTEC, DEPARTMENT OF GEOSCIENCE, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO
Eduardo Ferreira da SILVA / GEOBIOTEC, DEPARTMENT OF GEOSCIENCE, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO
João A.P. COUTINHO / CICECO, UNIVERSITY OF AVEIRO, CAMPUS UNIVERSITÁRIO DE SANTIAGO, AVEIRO

PURPOSE OF THE ABSTRACT

The fast development of the electronic industry has led to an ever-increasing global demand in metals and has played an important role in nowadays metal scarcity. The development of processes that allow not only the environment detoxification but also the recycling of waste streams for the recovery of valuable metals, in line with the principles of a circular economy, becomes imperative. In this work, ionic-liquid-based aqueous biphasic systems (IL-based ABS) were used as a more benign alternative to conventional liquid-liquid extraction processes in transition metals (Zn, Cu, Co and Ni) selective and sequential recovery from acid mine drainage (AMD) waters.[1] Due to their ionic nature, the use of ILs allows metal extraction mechanisms that are not possible when conventional organic solvents are applied.[2] Thus, ABS composed of different ILs and Na2SO4 were evaluated and it was observed that ILs anion presents an important role in metal extraction, with thiocyanate anion (SCN) presenting a remarkable ability to extract Zn, Cu and Co from AMD through the formation of stable metal complexes. It was also shown that the use of NaSCN salt as an additive in IL-based ABS allows to reduce system cost and environmental impact but also to tune metal selectivity by the concentration of SCN anion added to the ABS. Furthermore, the formation of a hydrophobic salt composed of IL cations and metal-SCN complexes anions allowed the selective extraction and recovery of copper and zinc in a single step. These results permitted the development of a sustainable process for the selective and sequential recovery of 73.1 % of zinc (98.8 % pure) and 46.3 % of copper (87 % pure) present in pre-treated AMD, with no need of extra recovery steps and considering liquid phases recovery and recycling.

This work was developed within the scope of the project CICECO - Aveiro Institute of Materials, UIDB/50011/2020 and UIDP/50011/2020, financed by national funds through the Foundation for Science and Technology/MCTES. The field work and geochemical analysis were financed by the GeoBioTec Research Unit. This work is funded by national funds through FCT - Fundação para a Ciência e a Tecnologia, I.P., under the Scientific Employment Stimulus - Individual Call - CEECIND/00831/2017 - under the CEEC Individual 2017.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS

aqueous biphasic systems | recycling | selective separation | circular economy

BIBLIOGRAPHY

[1] H. Passos, B. Cruz, N. Schaeffer, C. Patinha, E.F. da Silva, J.A.P. Coutinho, ACS Sustainable Chem. Eng. 9 (2021) 3647-3657.

[2] N. Schaeffer, H. Passos, I. Billard, N. Papaiconomou, J.A.P. Coutinho, Crit. Rev. Environ. Sci. Technol. 48 (2018) 859-922.