Combining bioleaching and liquid-liquid separation for metals recovery from low-grade matrices

José G.P. Santos[1], Joana Lourenço[2], Sónia Mendo[2], João A.P. Coutinho[1], Tânia Caetano[2], Helena Passos[3,4,*]

[1]CICECO - Aveiro Institute of Materials, Department of Chemistry, University of Aveiro, 3810-193 Aveiro, Portugal

[2]CESAM and Department of Biology, University of Aveiro, 3810-193 Aveiro, Portugal

[3]LSRE-LCM – Laboratory of Separation and Reaction Engineering – Laboratory of Catalysis and Materials, Faculty of Engineering, University of Porto, Porto, Portugal

[4]ALiCE – Associate Laboratory in Chemical Engineering, Faculty of Engineering, University of Porto, Porto, Portugal

**hpassos@fe.up.pt*

The EU has set a goal to become climate neutral by 2050. To achieve this, renewable energy must become the main energy source. Copper is a critical material for clean energy technologies, and its demand is expected to double by 2035. This presents a significant challenge to achieving climate goals, as there may be a supply gap if alternative sources and viable options for Cu recovery are not explored.

Bioleaching, the natural ability of microorganisms to catalyze the oxidative dissolution of metals, is considered cost-effective, eco-friendly, and adaptable for both large and small-scale applications. The applicability of bioleaching to treat low-grade matrices was previously demonstrated.[1] However, the low concentration and variability of metals present in pregnant liquor solution (PLS) obtained in the bioleaching process limit metals recovery by conventional processes.

Liquid-liquid extraction (LLE) processes using ionic liquids (ILs) have shown promising results on the separation and recovery of metals from high to low concentrated solutions.[2,3] The versatile and tunable nature of these solvents have greatly expanded the field of metal processing. This study aims to develop a sustainable and economically feasible process that combines bioleaching with LLE based on alternative solvents to selectively recover Cu and other valuable metals from low-grade matrices. Preliminary results on the optimization of incinerated bottom ashes bioleaching by *Pseudomonas* spp. and metals separation by the mixture of obtained PLS with different ILs will be presented.

Acknowledgements

This work was further supported by national funds through FCT/MCTES (PIDDAC): LSRE-LCM, UIDB/50020/2020 (DOI: 10.54499/UIDB/50020/2020) and UIDP/50020/2020 (DOI: 10.54499/UIDP/50020/2020); ALiCE, LA/P/0045/2020 (DOI: 10.54499/LA/P/0045/2020); CICECO-Aveiro Institute of Materials, UIDB/50011/2020, UIDP/50011/2020 & LA/P/0006/2020; CESAM, UIDP/50017/2020, UIDB/50017/2020 & LA/P/0094/2020. This work was also financially supported by national funds through FCT – Fundação para a Ciência e a Tecnologia, I.P., within the scope of the project PlatILPlus (2022.04478.PTDC, DOI: 10.54499/2022.04478.PTDC). JL was funded by national funds (OE), through FCT—Fundação para a Ciência e a Tecnologia, I.P., in the scope of the framework contract foreseen in the numbers 4, 5 and 6 of the article 23, of the Decree- Law 57/2016, of August 29, changed by Law 57/2017, of July 19 (https://doi.org/10.54499/DL57/2016/CP1482/CT0116). TC was funded by national funds (OE) through FCT in the scope of the framework contract (CEECIND/01463/2017; 10.54499/CEECIND/01463/2017/CP1459/CT0013).

References

[1]T.H. Nguyen, S. Won, M.-G. Ha, D.D. Nguyen, H.Y. Kang, *Chemosphere*, 2021, **282**, 131108.

[2]N. Schaeffer, M. Gras, H. Passos, V. Mogilireddy, C.M.N. Mendonça, E. Pereira, E. Chainet, I. Billard, J.A.P. Coutinho, N. Papaiconomou, *ACS Sustain Chem Eng*, 2019, **7**, 1769–1777.

[3]H. Passos, B. Cruz, N. Schaeffer, C. Patinha, E.F. Da Silva, J.A.P. Coutinho, *ACS Sustain Chem Eng*, 2021, **9**, 3647–3657.