

Coupling hydrometallurgy and electrochemistry for lithium recovery and compound production

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Abstract. Global CO₂ emissions reached 38.11 Gt CO₂ in 2025 (Statista, 2026). The transport sector contributes significantly to these emissions. Therefore, the ongoing energy transition in the European Union (EU) has increased pressure on the resources required for electric vehicle production, particularly critical raw materials used in batteries, such as lithium (Li) (Dong et al., 2026). To reduce the dependence of EU on external suppliers, efforts are being made to decentralize Li production and develop synergies with active industrial processes. In Portugal, it is envisaged the potential implementation of an industrial-scale Li refining facility based on a membrane electrolysis process, feeding LiCl and producing high-purity battery-grade Li compounds. The aim of this work was to produce LiCl from α -spodumene, an important Li-bearing mineral, using more sustainable hydrometallurgical processes. The produced LiCl via extractive metallurgy could then be used in electrolysis processes to maintain chlorine production, that is needed for several commercial applications. By replacing conventional NaCl with LiCl, the process also provides a precursor for other important Li compounds to the energy transition, such as Li₂CO₃ and LiOH. Therefore, hydrometallurgical routes were studied to maximize LiCl recovery from α -spodumene (Li = 3.2%) while minimizing reagent consumption and energy use. A maximum of 91% of Li was recovered, when conventional calcination and H₂SO₄ digestion was replaced by CaCl₂ roasting. This work highlights the potential of integrating hydrometallurgical processes with electrochemical routes to produce diverse Li compounds with lower environmental impacts.

Please consider above abstract for an oral session.

Acknowledgements. This work is a result of the Innovation Pact “NGS – New Generation Storage” (C644936001-00000045) by the “NGS” consortium, cofinanced by NextGeneration EU, through the Incentive System – “Agendas for Business Innovation”, within the Recovery and Resilience Plan (PRR).



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