Electrodialytic Treatment of Secondary Batteries Cathodes

M.M. Cerrillo-Gonzalez, M. Villen-Guzman, J.M. Paz-Garcia*, C. Gomez-Lahoz, C. Vereda-Alonso, R. Garcia-Delgado and J.M. Rodriguez-Maroto

Department of Chemical Engineering, University of Malaga (Spain)
Facultad de Ciencias, Campus de Teatinos s/n. 29071, Málaga

juanma.paz@uma.es

The interest for reusing and recycling secondary batteries is increasing, driven by both economic and environmental reasons. Lithium-ion batteries are among the main energy storage devices more popular in portable electronic and there are being used more every year in the field of electric transportation. The growing demand for rechargeable batteries entails an increase in the attention paid to the recycling of spent batteries due to the toxicity of some of their essential components. Furthermore, some of these components, such as cobalt, natural graphite and phosphorus, are included in the list of critical raw materials for the European Union due to their strategic importance in the manufacturing industry. Therefore, the development of new technologies to selectively recover these key components should be addressed.

In this work, an electrodialytic method is applied to real battery wastes previously submitted to a pre-treatment process (Figure 1). We focused on the extraction of Co and Li from spent cathodes, in combination with acid-extraction and different oxidation/reduction environments. The optimization of some of the most relevant operating parameters, such as cell design, selection of enhancing agent and current density has been carried out according to the lithium-ion batteries waste characteristic. Results indicate that the electrodialytic method could be a useful technique for the selective extraction of Li and Co from spent batteries. Furthermore, the deposition of Co at the cathode surface may be optimized to separate the cations at the catholyte, for a direct reincorporation in the manufacturing chain.

Keywords: Electrodialytic, secondary batteries, cathodes.

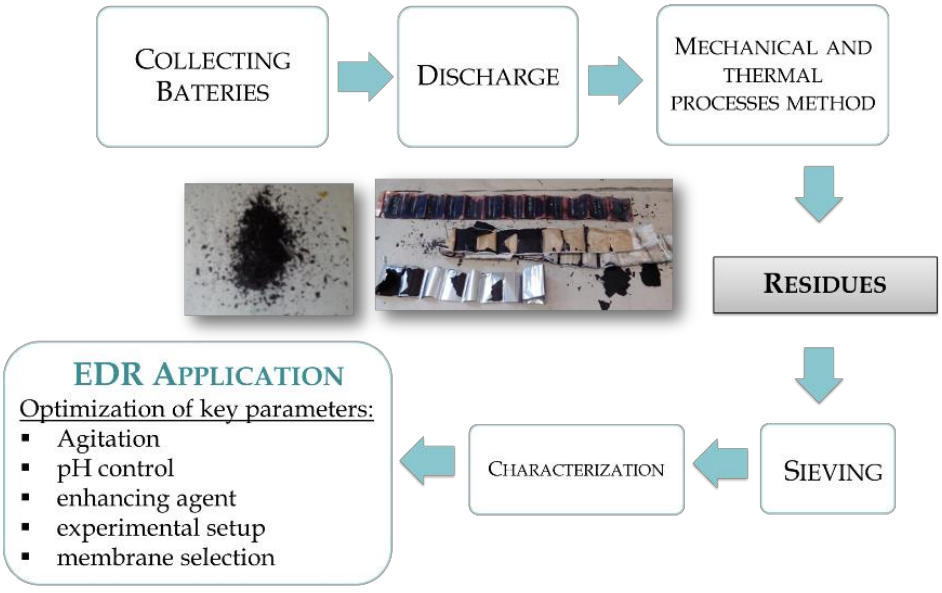

Figure 1. Proposal of a novel way for battery recycling.

Acknowledgements: This work has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 778045. Villen-Guzman acknowledges the funding from the University of Malaga for the postdoctoral fellowship PIT.UMA.A.3.2.2018.