Recycling Lithium-Rich Wastes: Perspectives from Mine Waste Rock and Li-Rich Enamels and Lithium Aluminosilicate Glass (LAS) Industrial Non-Compliant Materials

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Lithium is classified as a critical raw material under the European Critical Materials Act. Demand of lithium minerals necessary for the green energy transition and for electric cars battery production is expected to increase about eight times in the next future due to the EU plan to dismiss fossil-fuel vehicles by 2035.

Reserves of Li are limited with prediction of Li shortages. To meet the increased demand alternative sources are needed. Recycling is focused on batteries and cell manufacturing scraps, while other Li rich materials as mine or industrial wastes have received limited attention. For example, glass and ceramics are the second-largest sector for global lithium use (18%) after batteries.

From this perspective, the ARTU and LiCylce projects provide an opportunity to reflect on the possibility of defining a laboratory-scale lithium extraction process from mining and industrial wastes for industrial scale-up. Preliminary characterization of non-compliant industrial enamels and LAS (lithium aluminosilicate glass) from a Tuscany-based company (Colorobbia) showed Li tenors (up to 14400 mg/kg for enamels, 48690 mg/kg for LAS) comparable to the main mined mineral spodumene; additionally, mine wastes from the extraction of rhyolite and eurite, and kaolin from mines based in Tuscany contained up to 182 mg/kg and 3041 mg/kg, respectively.

The feasibility of extracting lithium from waste is part of the projects. In addition, the projects will encourage reflection on the storage of a critical mass of lithium to be usable at industrial scale, including the development of specific protocols for the possible use of mine excavated volumes to store Li-rich wastes.

This contribute wants to open a discussion for the future development of innovative methods for the recovery of lithium from industrial and mine wastes, to find new advanced recycling strategies, to promote circular wastes management and to promote alternative environmentally safe and sustainable extraction processes.