## Documents

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**Addressing preliminary challenges in upscaling the recovery of lithium from spent lithium ion batteries by the electrochemical method: a review**
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**Abstract**
The paramount importance of lithium (Li) nowadays and the mounting volume of untreated spent LIB have imposed pressure on innovators to tackle the near-term issue of Li resource depletion through recycling. The trajectory of research dedicated to recycling has skyrocketed in this decade, reflecting the global commitment to addressing the issues surrounding Li resources. Although metallurgical methods, such as pyro- and hydrometallurgy, are presently prevalent in Li recycling, they exhibit unsustainable operational characteristics including elevated temperatures, the utilization of substantial quantities of expensive chemicals, and the generation of emissions containing toxic gases such as Cl2, SO2, and NOx. Therefore, the alternative electrochemical method has gained growing attention, as it involves a more straightforward operation leveraging ion-selective features and employing water as the main reagent, which is seen as more environmentally benign. Despite this, intensive efforts are still required to advance the electrochemical method toward commercialisation. This review highlights the key points in the electrochemical method that demand attention, including the feasibility of a large-scale setup, consideration of the substantial volume of electrolyte consumption, the design of membranes with the desired features, a suitable layout of the membrane, and the absence of techno-economic assessments for the electrochemical method. The perspectives presented herein provide a crucial understanding of the challenges of advancing the technological readiness level of the electrochemical method. 

**Index Keywords**
Lithium-ion batteries, Recycling; Commercialisation, Electrochemical method, Elevated temperature, Environmentally benign, NO x, Operational characteristics, Resource depletion, Spent lithium-ion batteries, Toxic gas, Upscaling; Electrolytes

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