Production of HCl and LiOH from Lithium-ion Batteries Leaching Solution by Electrodialysis

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Recycling lithium-ion batteries (LIBs) have been developed based on metallurgical techniques, which typically treat the battery wastes with mechanical and thermal pre-treatment to facilitate the metals dissolution via acid leaching. After extraction, metals are traditionally separated by precipitation. Although selective precipitation is efficient to recover some of the valuable metals from LIBs wastes, such as Cobalt, Manganese and Nickel, it requires a high reagent consumption. Moreover, the recovery of lithium by precipitation is limited due to the high solubility of lithium hydroxide.

In this work, electrodialysis is proposed to produce HCl and LiOH from a LIBs leaching solution after metals precipitation. The experimental setup is described in Figure 1, which consists of an electrodialytic cell with four compartments divided by two cation exchange membranes (CEM) and one anion exchange membrane (AEM) arranged alternatively between the anode and cathode. The cell configuration results in the generation of an acidic and alkaline stream on both compartment sides of the feed compartment, which was allocated in the third compartment between the AEM and 2nd CEM. The application of an electrical current between the electrodes promotes the mobilization, on one hand of anions from the feed compartment through the AEM to the acid compartment, and on the other hand, of cations through the CEM to the alkaline channel. Both, acidic and alkaline compartment, were electrically balanced by H^+ and OH^- generated by water oxidation (anode) and reduction (cathode).

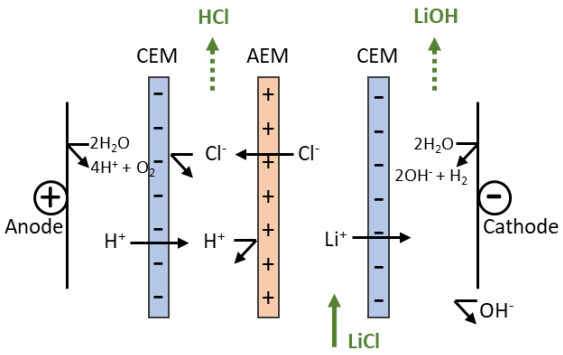

Figure 1: Experimental setup scheme

Experiments were carried out using a feed solution composed of lithium (0.8M) and chloride ions (0.8M) with an initial pH of 7. That solution simulated the final solution once metals from LIBs were extracted using HCl (explain the presence of Cl^- in the solution) and separated by precipitation (except Li^+). Different parameters such as current density, compartment size and initial feed concentration were studied. Results indicate that the electrodialytic method could be a useful technique not only for concentrate LiOH, but also to generate HCl and LiOH stream that can be reuse for the extraction and precipitation steps, respectively, in the LIBs recycling process.

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