Lithium, cobalt and nickel dissolution from spent lithium – ion batteries

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ABSTRACT

Different leaching media have been used to evaluate the lithium, cobalt and nickel dissolution from the cathodic electrode of spent lithium ion batteries (LIBs). However, sulfuric acid is the only available acid for the industrial application. In addition, there is a problem that lithium ion batteries do not indicate their classification, harming an adequate recycling process. The environmental impact of these batteries, the implementation of laws that promote recycling and traceability and the paradigm shift from a linear to a circular economy, forces to find sustainable treatment alternatives for these secondary sources of metallic values. Therefore, it is proposed treat a mixture of different kind of LIBs ($LiCoO_2$ – $LiNi_{0.5}Mn_{1.5}O_4$) and use sulfuric acid as the leaching reagent for lithium, cobalt and nickel dissolution. The effects of metallurgical parameters such as sulfuric acid and hydrogen peroxide concentration were investigated. Thus, it will be possible to determine if it is feasible to treat different types of batteries under the same leaching conditions.

Lithium ion batteries were collected and dismantled manually, previous pretreatment to prevent the dangers of short – circuits and spontaneous combustion. The cathodic electrode material obtained was prepared by roasting at 700 °C by 2 h to remove organic components and subsequently classified into different size fractions. The leaching tests were carried out in stirred flasks at 80 °C, 150 rev/min and 90 minutes of leaching time. The results indicate that an increase of sulfuric acid concentration improves the lithium extraction, reaching recoveries of over 96% at 3 mol/L of H_2SO_4, however, cobalt and nickel dissolution present a different behavior reaching the maximum extraction at 2 mol/L of H_2SO_4. The addition of 20 %v/v hydrogen peroxide helps to improve the metals dissolution, reaching the best extraction values of 98.6 %, 70.6 % and 94.8 % for lithium, cobalt and nickel respectively.