Feasibility study of using bio-reductant for extraction of valuable metals from spent LIBs

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Abstract

The increasing use of lithium-ion batteries (LIBs) in consumer electronics and electric vehicles has resulted in a growing volume of spent batteries which highlights the efficient and sustainable recycling methods. This feasibility study explores the potential of using bio-reductants for the extraction of valuable metals, such as lithium, cobalt, and nickel, from spent LIBs. Various reagents, including organic and inorganic acids with or without bio-reductants, were evaluated for their effectiveness in reducing metal ions in leach solutions obtained from processed LIBs. Preliminary results indicate that the high antioxidant activity and phenolic content of green reductants are responsible for leaching valuable metals from black mass and can facilitate their extraction from spent LIBs. Parameters such as pH, temperature, bio-reductant concentration, and reaction time were optimized to maximize metal recovery rates. Results showed that at a pulp density of 20 g/L, bio-reductant concentration of 30% (V/V), temperature of 70°C, and a leaching time of 2 hours, maximum metal dissolution was obtained. This research demonstrates the potential of bio-reduction as a greener approach for the extraction of valuable metals from waste LIBs. However, further research into the optimization and scaling up of bio-reductant-based recycling technologies is needed to fully realize this potential.