RECOVERY OF POTASSIUM FROM SPENT ALKALINE BATTERIES USING WATER

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Abstract

Potassium recovery from spent alkaline battery (SAB) black mass is rarely pursued as an independent process objective, despite its occurrence as highly soluble KCl phases thermodynamically distinct from the refractory MnO_2 and ZnO matrix. In this work, we propose a selective aqueous leaching process for potassium recovery from SAB black mass using water as the only leaching agent at ambient conditions. The phase selectivity basis for the process was confirmed by physicochemical characterization using XRF, XRD, SEM–EDX and ATR-FTIR. The optimization of leaching time and solid-to-liquid ratio was carried out using Response Surface Methodology (RSM) based on Central Composite Design (CCD), which resulted in optimum conditions of 60.75 min and 0.311 g mL^{-1} with a predicted potassium concentration of 11,024 mg/L. The potassium-rich leachate was then precipitated with NH_4Cl and crystallized with ethanol as antisolvent to yield high-purity KCl (K: 52.4 wt.%, Cl: 47.6 wt.%), which represents a clean and resource-efficient route for valorization of potassium from battery waste.

Keywords: Leaching, hydrometallurgy, Spent Alkaline Battery, water.