A Clean and Highly Efficient Leaching–Electrodeposition Lead Recovery Route in HClO₄ Solution

Xuan Zhang, Yanzhi Sun, Junqing Pan^{*}

State Key Laboratory of Chemical Resource Engineering, Beijing University of Chemical Technology, Beijing 100029, China

^{*}E-mail: jqpan@mail.buct.edu.cn

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To address a series of problems in the hydrometallurgical process of lead recovery, such as high energy consumption (810-930 kWh ton⁻¹), low efficiency and electrolyte pollution, we invented a novel, highly efficient and clean route for recovering high purity metallic lead via a leaching-electrodeposition process in a HClO₄ solution. First, the desulfurated spent lead paste and lead plate-grids from spent lead–acid batteries were dissolved in the HClO₄ solution to generate a HClO₄–Pb(ClO₄)₂ solution, denoted as the leaching process. An electrolysis process was then conducted in this solution to obtain metallic lead with HClO₄ regenerated for reuse in the next batch, denoted as the electrodeposition process. For the leaching process, the concentration of HClO₄, leaching temperature and leaching time were systematically investigated to achieve the highest leaching rate. For the electrodeposition process, the influences of Pb²⁺ concentration and HClO₄ concentration, temperature, current density, and additives on the electrode position process were studied in detail and optimized. The results show that the invented route has a lead leaching rate of above 98.5%, an electrolytic energy consumption of only 500 kWh tonne_{Pb}⁻¹, and a purity for the electrodeposited lead product of up to 99.9991%.

Keywords: Spent lead–acid battery; Leaching process; Electrodeposition; HClO₄

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