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EXAMINATION OF THE USE OF AMMONIUM ACETATE AS LIXIVIANT IN RECOVERY OF ZINC FROM WASTE BATTERIES AND KINETIC ANALYSIS

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Abstract

This study is focused on the dissolution kinetics of zinc oxide in ammonium acetate solutions to recover the zinc from alkaline and zinc-carbon spent battery powders. This study represents a first step for further studies in which actual waste powder is to be used. Therefore, the experiments were performed by using pure zinc oxide powder to evaluate the dissolution behavior of zinc. The effects of ammonium acetate concentration, reaction temperature, stirring speed and solid to liquid ratio on the dissolution of zinc oxide were examined, and a kinetic analysis was performed by using the heterogeneous and homogeneous reaction models. It was determined that the dissolution rate increased with increasing ammonium acetate concentration and reaction temperature, and with decreasing solid to liquid ratio. It was found that zinc oxide was dissolved approximately 99.5 % under the experimental conditions at 1 M, 40°C, 400 rpm, 1/250 g/mL, and 15 min. The kinetic analysis results showed that the dissolution rate fit to the first-order pseudo-homogeneous reaction model. The activation energy of the dissolution process was calculated to be 43.83 kJ/mol. According to the results of this study, ammonium acetate can be used as an effective leach reagent to extract the zinc from spent battery powder.

Key words: battery, dissolution, kinetics, zinc

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