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A new hydrometallurgical process involving mechanochemical conversion with reagent

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In this study, a new application of nickel improvement is proposed involving mechanochemical conversion with a reagent (R-MC) followed by an acid leaching (AL) process. It was developed based on the synergistic effects of high-energy milling and different chemical reagents which have a positive effect on extractive metallurgical leaching processes. The combination of R-MC as a pretreatment of AL aimed to overcome the disadvantages of traditional metallurgical processes used for nickel recovery, such as high temperature, high acid concentration, high cost and material requirements. For the statistical design of experiments combined with regression techniques, response surface methodology (RSM) involving central composite design (CCD) was applied to optimize the key factors that affect processes conditions in both R-MC and AL for high-efficiency nickel recovery. The optimum processes conditions of both R-MC and AL were determined for high-efficiency nickel recovery process by designing the experiment and performing a statistical analysis on the experimental data. The large determination coefficients (R_2>95%) for each process indicated that CCD is a suitable design for both mechanochemical process with reagent and acid leaching. The FTIR, XRD and SEM analyses results support each other in that the application of mechanochemical processes has positive effects on valuable metal recovery in extractive metallurgy. In addition, the experimental data obtained from leaching experiments was evaluated according to shrinking core model equations to determine the advantages of mechanochemical processes on leaching kinetics. The leaching control step was identified as both chemically and diffusion-controlled by the shrinking core kinetic model. Thus, this study provided a new and more economical method in which mechanochemical pretreatments with reagents were combined with acid leaching. The positive effect of mechanochemical processes on leaching with reagents was defined by their high nickel efficiency (Ni(%)>95%) at lower acid concentrations (0.5 M<Co<1.5 M) and shorter leaching times (30 minutes).

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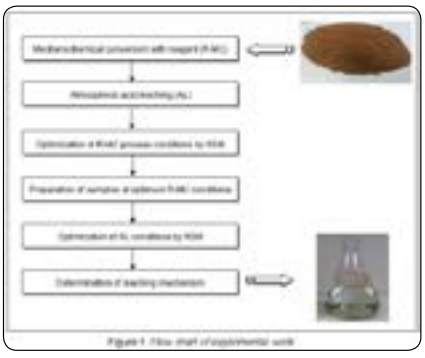

1. Çetintaş S and Bingöl D (2016) Response surface methodology approach to leaching of nickel laterite and evaluation of different analytical techniques used for the analysis of leached solutions. Analytical Methods 8:3075–3087.
2. Georgiou D and Papangelakis V G (1998) Sulphuric acid pressure leaching of a limonitic laterite: Chemistry and kinetics. Hydrometallurgy 49:23–46.
3. Gao J, Yan Z, Liu J, Zhang M and Guo M (2014) A novel hydrometallurgical approach to recover valuable metals from laterite ore. Hydrometallurgy 150:161–166.
4. Li X, Zhang Y, Pan L and Wei Y (2013) Effect of mechanical activation on dissolution kinetics of neutral leach residue of zinc calcine in sulphuric acid. Transactions of the Nonferrous Metals Society of China 23:1512–1519.
5. Montgomery D C (2008) Design and analysis of experiments, seventh ed., John Wiley & Sons Ltd., New York. ISBN-10: 8126528370.

Biography

Seda Çetintaş graduated in 2011 from Department of Chemistry at Faculty of Science and Arts in Anadolu University. She received MD in 2014 and then started PhD in Chemistry from Kocaeli University. Her primary specialization was applications on recovery of metal values from ores and removal of impurities. Her secondary specialization was applications on statistical design of experiments. She is interested in applying these topics to several content areas in analytical chemistry, including separation, purification and enrichment. During PhD, she works in a research project on nickel recovery from lateritic ore.

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