

Comparison of Microwave-Assisted and Conventional Leaching for Extraction of Copper from Chalcopyrite Concentrate

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Abstract : Chalcopyrite (CuFeS_2) is the most common primary mineral used for the commercial production of copper. The low dissolution efficiency of chalcopyrite in sulfate media has prevented an efficient industrial leaching of this mineral in sulfate media. Ferric ions, bacteria, oxygen and other oxidants have been used as oxidizing agents in the leaching of chalcopyrite in sulfate and chloride media under atmospheric or pressure leaching conditions. Two leaching methods were studied to evaluate chalcopyrite (CuFeS_2) dissolution in acid media. First, the conventional oxidative acid leaching method was carried out using sulfuric acid (H_2SO_4) and potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) as oxidant at atmospheric pressure. Second, microwave-assisted acid leaching was performed using the microwave accelerated reaction system (MARS) for same reaction media. Parameters affecting the copper extraction such as leaching time, leaching temperature, concentration of H_2SO_4 and concentration of $\text{K}_2\text{Cr}_2\text{O}_7$ were investigated. The results of conventional acid leaching experiments were compared to the microwave leaching method. It was found that the copper extraction obtained under high temperature and high concentrations of oxidant with microwave leaching is higher than those obtained conventionally. 81% copper extraction was obtained by the conventional oxidative acid leaching method in 180 min, with the concentration of 0.3 mol/L $\text{K}_2\text{Cr}_2\text{O}_7$ in 0.5M H_2SO_4 at 50 °C, while 93.5% copper extraction was obtained in 60 min with microwave leaching method under same conditions.

Keywords : extraction, copper, microwave-assisted leaching, chalcopyrite, potassium dichromate

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