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Selective Removal of Zinc and Lead from Dirty Cu Concentrates By High Pressure Oxidation Leaching Followed By Amine Leaching

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Extended Abstract

Dirty Cu concentrate derived from complex sulfide ore is consist of high levels of impurities such as Zn and Pb alongside various sulfide minerals (e.g., chalcopyrite ($CuFeS_2$), sphalerite (ZnS), galena (PbS) and pyrite (FeS_2)) [1]. Additionally, it may contain anglesite ($PbSO_4$), which complicates the selective froth flotation of Cu minerals due to its high solubility [1]. This solubility leads to the dissolution of Pb^{2+}, which activates coexisting sulfide minerals such as ZnS, resulting in copper concentrates with elevated Zn and Pb impurity levels [2]. This study aims to selectively reduce Zn (<0.5%) and Pb (<0.5%) impurities in dirty copper concentrate using a two-step leaching process: (1) high-pressure oxidative leaching of Zn in an autoclave, followed by (2) selective amine leaching of Pb.

In the first step, the effects of leaching time, temperature, oxygen pressure, reagent type and its concentration were investigated to optimize selective Zn removal while minimizing Cu dissolution. When sulfuric acid was used as the leaching agent, about 98% of Zn was leached; however, 50-60% of Cu also dissolved under the following conditions: 1.0 mol/L sulfuric acid at 150 °C and 1.0 MPa oxygen gauge pressure for 60 min leaching time with a pulp density of 100 g/L and a stirring speed of 700 rpm. In contrast, using distilled water as the leaching solution resulted in selective Zn removal with a leaching efficiency exceeding 96%, while Cu dissolution was inhibited to approximately 10% under the following conditions: distilled water at 150 °C and 1.0 MPa oxygen gauge pressure for 120 min leaching time with a pulp density of 100 g/L and a stirring speed of 700 rpm. In the second step, Pb was selectively removed from the residue, achieving over 80% leaching efficiency under the following conditions: 0.5 mol/L diethylenetriamine (DETA), 25 °C, 15 minutes of leaching time, 100 g/L pulp density, and a shaking speed of 120 rpm. The leaching mechanisms were further elucidated through residue analysis and kinetic studies.

References

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