Gold leaching from copper concentrate using alternative lixiviants

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ABSTRACT

Copper concentrate from an active mine is received for direct gold leaching study. The main copper sulphide mineral is mainly chalcopyrite and small amount of chalcocite. The particle size of the concentrate is analysed to be P80 30 µm by particle size analyser. Gold recovery from cyanidation is 18%, 32%, and 32% using 1,000 ppm, 3,000 ppm, and 5,000 ppm NaCN, respectively from 24 hours bottle roll leaching test while maintaining the initial cyanide concentration. The gold extractions using thiourea system in a specially synthesized solution show 82% and 92% in 60 g/L thiourea and 90 g/L thiourea, respectively. Direct gold extraction from the chalcopyrite concentrate can be implemented prior to smelting process resulting in increased revenues better than precious metal credits from the smelters. The other advantage is to make cleaner copper concentrate if it contains higher arsenic. The preliminary tests show that the arsenic dissolution is high enough during the gold leaching to decrease the arsenic content in the leached residue with majority of copper sulphides remained in the solid form.

The copper concentrates are also leached by POX (Pressure Oxidation) in different conditions. The resulting residues are leached by cyanidation and other alternative lixiviants including thiourea, thiosulfate, and amino acids. Cyanidation gold recovery is performed using 100, 250, and 500 ppm NaCN. The gold recovery is gradually increased with increasing cyanide concentration. Cyanide consumptions are from 0.29 kg/t to 2.55 kg/t while lime consumption varies from 65.6 kg/t to 197.4 kg/t which is well expected from the POX residues. Three thiosulfate salts (Na-, (NH4)-, and Ca-) are used to investigate the gold leaching with sodium hydroxide, ammonium hydroxide, and calcium hydroxide as pH control reagent.

Keywords: gold; pressure oxidation; cyanide; thiosulfate