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Semi-pilot Biooxidation of Refractory Sulfide-Gold Ore Using Ferroplasma Acidophilum: D-(+)-Sucsore as a Booster and Columns Tests

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Abstract : It has been reported that the microorganism's attachment to the surfaces of ore samples is a key factor that influences the biooxidation in pretreatment for recovery of gold in sulfide-bearing ores. In this research, the implementation of D-(+)-Sucrose on the biooxidation of ore samples were studied in a semi-pilot experiment. The experiments were carried out in five separate jacketed columns (1 m height and 6 cm diameter) at a constant temperature of 37.5˚C and saturated humidity. The airflow rate and recycling solution flow rate were studied in the research and the optimum operating condition were reported. The ore sample (0.49 ppm gold grade) was obtained from the Hammond Reef mine site containing 15 wt.% of pyrite which included 98% of gold according to the results of micrograph images. The experiments were continued up to 100 days while air flow rates were chosen to be 0.5, 1, 1.5, 2, and 3 lit/min and the recycling solution (Containing 9K media and 0.4 wt.% D-(+)-Sucrose) flow rates were kept 5, 8, 15 ml/hr. The results indicated that the addition of D-(+)-Sucrose increased the bacterial activity due to the overproduction of extracellular polymeric substance (EPS) up to 95% and for the condition that the recycling solution and air flow rate were chosen to be 8 ml/hr and 2 lit/min, respectively, the maximum pyrite dissolution of 76% was obtained after 60 days. The results indicated that for the air flow rates of 0.5, 1, 1.5, 2, and 3 lit/min the ratio of daily pyrite dissolution per daily solution lost were found to be 0.025, 0.033, 0.031, 0.043, and 0.009 %-pyrite dissolution/ml-lost. The implementation of this microorganisms and the addition of D-(+)-Sucrose will enhance the efficiency of gold recovery through faster biooxidation process and leads to decrease in the time and energy of operation toward desired target; however, still other parameters including particle size distribution, agglomeration, aeration design, chemistry of recycling solution need to be controlled and monitored for reaching the optimum condition.

Keywords : column tests, biooxidation, gold recovery, Ferroplasma acidophilum, optimization
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