

Thesis Title	Bioleaching of low grade copper sulphide ores in the column
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Abstract

Adsorption of *Thiobacillus ferrooxidans* on low grade copper sulphide ore particles was studied in shake flask experiments at 30 °C and pH 2.8. The adsorption rate was found to be fast in comparison with the bioleaching rate. This result indicated that the bacterial adsorption was at equilibrium during the leaching process. The adsorption equilibrium data were correlated by the Langmuir equilibrium isotherm, which was used to predict the number of bacteria adsorbed on the ore particles.

Experiments in a batch reactor and a pilot-scale column system were carried out to study the effect of *T. ferrooxidans* on the solubilization rate of copper contained in ores. The column experiment was carried out for a period of 316 days. The experiment was set up by packing 25 kg of ores in a 110-cm high acrylic column. The leaching solution was fed through the column, collected in a reservoir, and then returned to the top of the column. Concentrations of bacteria and copper ion in the solution were analyzed. Ore samples, taken from different positions in the column, were analyzed for the number of bacteria adsorbed on the ore particles. The results were compared with the number of bacteria adsorbed on the ore particles calculated using Langmuir isotherm. It was found that the concentration of adsorbed bacteria measured was higher than that calculated using Langmuir isotherm. This could be the effect of the bacteria deposited on the ore samples. The deformation of ore particles from the original size was also observed. These results indicated that leaching solution might not truly flow throughout the column and

channeling flow occurred in the column. The measuring results of concentrations of bacteria adsorbed on the ore particles at different heights indicated that oxygen was not a limiting factor.

The rate of copper solubilization was related to the number of bacteria adsorbed on the ore particles. The result was compared with the initial rates of copper solubilization by bacteria in batch experiments. 5.8% (w/w) of copper was leached from the column during the first 120 days. The low number of adsorbed bacteria on the ore surfaces could cause this low leaching rate. To increase the concentration of bacteria in the column, 25 (mg/l) of bacteria were added to the total of reservoir. The leaching rate was found to be increased after the bacteria were added. Total of 11.6%(w/w) of copper was leached from the column after 316 days of the experiment. The specific rate of copper extraction (mg. Cu/mg Prot./min) in the column was found to be only about 2% of the specific rate of copper extraction in the batch experiments

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