



## BIOLEACHING OF MANGANESE IN TAILINGS FROM THE FIRST MAJESTIC SILVER CORP MINE "LA ENCANTADA"

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**Introduction.** "La Encantada" mine possess tailings from silver extraction. The tailings contain a silver concentration of 142 g/ton, however, this mineral contains manganese as pyrolusite (MnO<sub>2</sub>) also with a concentration of 3.78%. Pyrolusite acts as refractory ore and for silver extraction it is necessary a higher cyanide concentration in the cyanidation process, even when a high cyanide concentration process causes environmental pollution. Previously research on this topic has reported that bioleaching bacteria activity can solubilize manganese ore in manganese (II) from oxide of manganese (IV) <sup>(1)</sup>. The advantages in the use of microorganisms for bioleaching represent a low cost process, microorganisms act as a biocatalysts, and as a native bacteria, they are able to help leaching others refractory minerals. The aim of this work is remove the manganese content with help by native bacteria.

**Methodology.** Native bacteria inoculum from "La Encantada" mine was spread in 9K medium <sup>(2)</sup>, with the follow conditions: pH 2, 10% mineral density, 30°C and 160rpm. Manganese removal essays were carried out in 250ml flasks with baffled. The experiment variables were pH (2, 4 and 6) and mineral density (10, 20 and 30%). The response parameter was the manganese removal percentage quantified by inductively coupled plasma optical emission spectrometry (ICP-OES).

**Results.** Highest manganese removal, (91.26%) was obtained at 10% mineral density and pH 2 (**Table 1**). pH values in the range of 2 – 3.5 and an oxidation-reduction potential (ORP) range of 500 - 580mV were observed since day two. Intervals of pH in the range of 7 - 8.5 and a ORP value of 300mV were observed in the 20% mineral concentration experiment. Experiment with the 30% mineral density, showed pH range values of 7 - 8, and a ORP below 250mV. Bacterial growth is inhibited in high mineral concentration (20 and 30%) due to solids interference in the oxygen and carbon dioxide

transfer. In addition, the presence of mineral causes the decrease in bacterial population in suspension due bacterial adhesion to mineral particles <sup>(3)</sup>. The best manganese removal was observed in the experiments where ideal parameters for bacteria were reached: low pH (1.5-2.5) due to sulfuric acid generation, and ORP values above 400mV, due to the ferric ion generation, responsible for oxidation of mineral <sup>(4)</sup>.

**Table 1.** Manganese removal percentage after 15 days of bioleaching process at 10 % of pulp concentration and pH 2.

E0=sample before treatment, E1=sample after treatment.

Analyte	S	Fe	Co	Mg	Mn	Ca
Method	ICP14B	ICP14B	ICP14B	ICP14B	ICP14B	ICP14B
Detection	0.01	0.01	1	0.01	2	0.01
Units	%	%	ppm	%	Ppm	%
E0	0.23	12	1	0.28	10000	>15
E1	>5	>15	2	0.03	874	5.62

**Conclusions.** The best Mn removal was observed in experiment at pH 2. A negative effect in pulp concentration and manganese removal was observed since lower pulp densities are found to provide higher refractory ore removals.

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