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BIOLEACHING OF COPPER FROM BLACK SHALE ORE USING MESOPHILIC MIXED POPULATIONS IN AN AIR UP-LIFT BIOREACTOR

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Abstract

Bioleaching is an economical and cost-effective methodology, which has been widely used for the extraction of precious metals from mineral ores. Furthermore, it is an eco-friendly process when compared to conventional chemical leaching processes. The black shale ores contain base (e.g. copper and nickel), precious (principally silver) and PGM (platinum group metals) metals, but also high contents of organic matter that potentially handicap metal recovery by conventional techniques. The aim of the present investigation was to recover copper from black shale deposits using microbial leaching. These black shale deposits were collected from a mining industry in Poland. Bioleaching studies were carried out in a laboratory scale 5 liter Air Up-Lift bioreactor (AUBR).

A specific mixed consortium was identified on the basis of individual leaching performance of several microorganisms *(Leptospirillum ferrooxidans, Leptospirillum ferriphilum, Acidithiobacillus ferrooxidans, Acidithiobacillus thiooxidans, Acidithiobacillus caldus,* and *Sulfobacillus thermosulfidooxidans)* with a 2% solid-to-liquid phase ratio. Among these microorganisms, *L. ferrooxidans, L. ferriphilum, At. ferrooxidans* were identified as the potential candidates. Using the mixed microbial population, the bioleaching process was studied in a 5L custom-designed AUBR, equipped with automated pH, temperature and air flow rate controllers, under the following experimental conditions: 37^{o}C, 14 days of residence time, 10% (weight/volume) pulp density, aeration rate 150 liter per hour, and the pH was maintained between 1.8-2.0. Physico-chemical properties of black shale deposits were examined by SEM-EDAX and XRD analyses. The recovery efficiency for copper was calculated based on the analytical data obtained from ICP-OES. The bacterial growth was monitored using Epi-flourescence microscopy. Extra cellular polysaccharides (EPS) formed during the bioleaching process was characterized by ATR-FTIR spectroscopy. Results obtained from this work will be discussed.