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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

Black shale (BS) deposits found in Europe (Kupferschiefer type) contain base (e.g., copper and aluminium) and precious (e.g., gold and silver) metals and also PGE (platinum group elements), but also high contents of organic matter that potentially impede with metal recovery by conventional techniques. The aim of the present investigation was to recover copper (Cu) from BS using microbial leaching. BS deposits were collected from a mining site in Lubin, Poland which consisted of 14 ± 2 mg/g of Al, 13 ± 2 mg/g of Cu, 10 ± 1 mg/g of Fe and relatively significant amounts of Mn and Zn. Several chemolithotrophic bacteria *(Leptospirillum ferrooxidans, Leptospirillum ferriphilum, Acidithiobacillus ferrooxidans, Acidithiobacillus thiooxidans,* and *Sulfobacillus thermosulfidooxidans)* were evaluated for their ability to extract Cu selectively from BS with a 2% pulp density. Among these bacteria, the iron oxidizing *L. ferrooxidans, L. ferriphilum, At. ferrooxidans* were identified as the potential candidates, and their Cu extraction efficiencies were 62% ± 3%, 55% ± 3%, 25% ± 2%, respectively. Using a mixed population of these microorganisms, the bioleaching process was performed at different pulp densities of BS and their corresponding Cu leaching efficiency was evaluated. Following the batch experiments, the bioleaching process was scaled-up to a 5 liter laboratory scale custom-designed Air Up-lift Bioreactor (AUBR). The Cu extraction could be increased to > 70% at a higher pulp density (10% wt/v) under the experimental conditions set at pH 2.0 and 37°C with the aeration rate of 150 liter per hour for 15 days of continuous bioleaching operation.

Key words: acidophiles; air up-lift bioreactor (AUBR); bioleaching; black shale; mixed consortia

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