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Mining Problems in Africa

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Mining activities in Africa have significant environmental and health concern due to the improper disposal of mining waste. This waste contaminates soil, water and ecosystems posing a serious risk to biodiversity and local communities. To tackle these challenges, innovative waste management strategies are needed. In this study, heavy metals like copper, lead, and zinc from mining waste materials were bio-leach in a controlled bioreactors with *Bacillus subtilis* as metal binding bacteria. The pH, temperature, nutrient levels, and metal concentrations were determined by constant sampling. The measured concentration of heavy metals, was lead (Pb), copper (Cu), and zinc (Zn), with concentrations measured at 26.4 mg/kg, 8.55 mg/kg, and 91.79 mg/kg, respectively. The pH of the bioleaching system was adjusted and maintained at an acidic level (around pH 2) to create optimal conditions for the selected bioleaching microorganisms. The temperature was within 30°C to 50°C, ensuring that the temperature favored microbial activity with adequate oxygen supply was maintained throughout the experiment, supporting the microbial oxidation of metal sulfides. Over the course of the bioleaching process, regular sampling and analysis of the leachate indicated a substantial reduction in heavy metal concentrations. After 30 days of bioleaching, Pb concentrations decreased to 24.74 mg/kg, Cu concentrations decreased to 6.62 mg/kg, and Zn concentrations decreased to 86.88 mg/kg. Analysis of the solid residues revealed significant changes in mineralogy and chemical composition. X-ray diffraction (XRD) analysis showed the transformation of metal sulfides into less insoluble forms. In conclusion, the bioleaching experiment successfully reduced heavy metal concentrations in mining waste, making it a promising method for managing and remediating contaminated mining sites. This study suggests that further optimization and scale-up of this process could lead to environmentally friendly solutions for mining waste management.

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