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Sustainable mining: effect of bio(surfactants) on microbial arsenic removal

Sustainable mining aims to reduce the negative effects of mining activities while ensuring that resources are available to future generations. A key aspect is the application of green technologies, such as bioleaching, which helps reduce the environmental impact of the mining industry.
The adsorption of surface-active compounds of both chemical and biological origin alters the surface properties of solid particles. Such phenomena can be used to enhance the extraction of valuable metals from the ore or control the release of metal and metalloids from the solid phase, preventing undesirable effects of bacterial activity in post-mining areas. This study aimed to investigate the physicochemical aspects of bacteria–mineral interactions that occur during the bioleaching of arsenic-bearing waste in the presence of surface-active compounds. The adsorption of biosurfactants and lipopolysaccharides on the mineral surface was demonstrated to alter its charge, influencing the process. The effect of bio-compounds was compared with chemical surfactants such as cetyltrimethylammonium bromide (CTAB) and sodium dodecyl sulfate (SDS). The highest bioextraction efficiency was observed in the presence of rhamnolipids, whereas the lowest efficiency was with adsorbed SDS. Electrokinetic studies revealed that under acidic conditions (pH 2.0 - 2.5), a strongly negative charge of solid particles with adsorbed rhamnolipid increases bacterial adhesion, leading to greater arsenic extraction. On the contrary, SDS adsorbed on a solid surface inhibits bioleaching, which can be used to prevent uncontrolled arsenic release into the environment.

References

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Primary author: PAWOWSKA, Agnieszka (Department of Process Engineering and Technology of Polymer and Carbon Materials, Wrocław University of Science and Technology)

Presenter: PAWOWSKA, Agnieszka (Department of Process Engineering and Technology of Polymer and Carbon Materials, Wrocław University of Science and Technology)

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