Abstract

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Selective recovery of metals from Maurliden (Sweden) mine water using novel biomineralization technologies

S. Hedrich and D.B. Johnson [1]

[1] *School of Biological Sciences, College of Natural Sciences, Bangor University, Deiniol Road, Bangor LL57 2UW, U.K, s.hedrich@bangor.ac.uk*

Abstract

Mine drainage waters are widely regarded as environmental pollutants, but they are also potential sources of valuable metals, such as copper, cobalt and zinc. Water draining the Maurliden mine (Sweden) is highly acidic (pH 2.3), and rich in zinc (~460 mg/L) and iron (~400 mg/L), and contains smaller concentrations (0.3 - 49 mg/L) of other transition metals and arsenic. We have developed novel techniques that promote the concurrent amelioration of acidic waste waters and the selective recovery of metals, and have applied these systems to synthetic Maurliden mine water in the laboratory. The two major metals present in Maurliden mine water were removed *via* controlled biomineralization: zinc as ZnS in a pH-controlled anaerobic sulfidogenic bioreactor, and iron as the mineral schwertmannite by microbial iron oxidation of the ferrous iron present followed by hydrolysis and precipitation of ferric iron at pH 3.2. A small proportion (~11%) of the schwertmannite produced was used to remove arsenic (by adsorption) as the initial step in the remediation process, and other chalcophilic metals (copper, cadmium and cobalt) were removed (as sulfides) in an "off-line" reactor. Results from this work have demonstrated that modular biomineralization units can be effective at processing complex mine waters and generating metal products that may be recycled.

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