Geophysical Research Abstracts,
Vol. 10, EGU2008-A-08515, 2008
SRef-ID: 1607-7962/gra/EGU2008-A-08515
EGU General Assembly 2008

Possibilities and Conditions for the Production of re-usable Bio-Precipitates from Waste Streams

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Waste streams from the mining and metallurgical industries can contain significant metal concentrations that threaten the environment. Various technologies exist that successfully remove these metals to acceptable levels. However, closing the metal resource cycles may become increasingly important in the near future as world economies grow with leaps. Therefore, the focus of technological developments is broadening from mere removal to obtaining metal products fit for re-use in an environmentally friendly way. Consequently, not only kinetics and recovery, but also product purity, stability and morphology become important aspects to consider. Hence, an understanding of the interplay between chemical, physical and biological factors is needed, as this influences the properties of bio-precipitated materials. Therefore, research is initiated within the Dept. of Environmental Technology to systematically study the impact of changing (geo)chemical parameters on the biological controls in bio-precipitation processes and on the resulting product properties. Our present aims are to investigate if bio-precipitation with microbes can yield products with an increased purity compared to chemically derived products and whether the crystallinity and size distribution in processes now yielding amorphous and small particles can be improved. Since variation of solution parameters may be limited compared to chemical precipitation processes, due to bacterial growth optima, bio-precipitation also offers its own challenges. A systematic approach to study the bio-precipitation of metal products, such as metal sulfides (e.g. NiS and ZnS) and elemental metalloids (Se^{o}), generated in anaerobic reactors by bio-reduction of metal sulfate streams, is presented.

These cases can be regarded as examples of indirect and direct bio precipitation, respectively.