10th ICARD IMWA 2015 | 10th International Conference on Acid Rock Drainage & IMWA Annual Conference

Heavy Metal Removal and Partitioning in Sulfate-Reducing Bioreactors Treating Mine Influenced Water

Benjamin Uster[1], Mark Milke[1], Aisling O'Sullivan[1], James Pope[2], Dave Trumm[2] and Jennifer Webster-Brown[3]

1. *Civil and Natural Resources Engineering, University of Canterbury, New Zealand*
2. *CRL Energy Ltd., New Zealand*
3. *Waterways Centre for Freshwater Management, University of Canterbury, New Zealand*

ABSTRACT

Four upward flow sulfate-reducing bioreactors (SRBRs) were tested in duplicate for two hydraulic retention times (HRT; 3 and 10 days) to treat mine influenced water (MIW) over a 10 month period. Locally available organic materials (bark, compost and bark mulch) as well as two alkalinity generating materials (limestone or waste mussels shells) were used as SRBR substrates. Following the flow-through treatment period, the spent substrate mixtures were analyzed using a combination of wet chemical and mineralogical analyses, including a sequential extraction procedure (SEP), X-ray diffraction, X-ray fluorescence and scanning electron microscopy equipped with X-ray energy dispersion spectrometer (SEM-EDS). Results from the SEP indicated that (1) Al, Fe, Cu and Ni are mostly retained in the residual, sulfide or organic-bound fractions, (2) Mn is mainly concentrated in the exchangeable and carbonate fractions, and (3) Zn and Cd are predominantly associated with the reducible, sulfide or organic bound fractions. While Mn partitioning was influenced by the HRT (a longer HRT resulted in more Mn associated with the carbonate fraction), all other metals seemed to behave independently from it. Furthermore, the HRT had an influence on the localization of the metals within the substrate, as the short HRT resulted in larger concentrations of Fe and Al in the top part of the reactors compared to the long HRT which resulted in similar concentrations for both the top and the bottom parts. SEM-EDS microanalyses identified Fe, Cu and Zn associated with sulfur. These combined analyses allowed us to assess metal removal mechanisms in SRBRs as well as potential metal mobility during management of spent substrates used in MIW passive treatment systems.

**There is no full article associated with this abstract.*