

Comparison of the microbial communities of two bioreactors treating metal mine tailing seepage water with different efficiencies

Maryam Rezadehbashi

University of British Columbia, Canada

Abstract

In this study by using next generation sequencing techniques, we investigate the microbial community structures of two anaerobic bioreactors (S8 and S5) treating metal mine tailings seepage water containing elevated copper, molybdenum and sulphate concentrations in attempt to correlate the microbial communities with the bioreactors performances.

S5 is a horizontal plug flow pond, whereas S8 is an up flow/down flow. These bioreactors treat similar tailings seepage, use same carbon source and both received microbial inoculum from the same natural pond. S8 and S5 operate in different temperature, have different treatable volume and showed different metal removal efficiencies.

S5 has consistently achieved passive molybdenum, nitrogen and sulphate 90%, 41% and 16% respectively. Annual molybdenum and copper removals at S8 averaged 37% and 84% (more than S5) during 2008. The overall effect of S8 on water quality was similar to that of S5 – reliable molybdenum, nitrogen and sulphate removal, but with the significant added benefit of consistent copper removal.

The S8 bioreactor microbial community was made up mostly by methanogenic Euryarchaeota and extremophile Halobacteria. Differing from S8, S5 bioreactor was dominated by Proteobacteria, Bacteroidetes and Chloroflexi. Large portions of these populations were involved in oxidation-reduction of metals and degradation of complex organic compounds. Orders Desulfobacterales, Desulfuromonadales, Hydrogenophilales, Burkholderiales, Sphingomonadales and Rhodospirillales (Prevalent in S5) have members that are involved in bioremediation. In S8 bioreactor, members of these orders are still detectable although with lower frequency. The microbial community of S8 and S5 suggest a methanogenic/methanotrophic and sulphogenic environment for these two systems respectively.