Total Microbial Profiling… Because Sometimes Bacteria Just Aren't Enough.

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Various types of microorganisms have been identified as important in the bioremediation of chemically contaminated sites. These include bacteria, fungi, archaea and, depending on the substrate (soils, sediment or water), even algae and protozoa.

In natural environments, these microbial groups usually occur in complex multi-species communities (consortia), usually bound to surfaces (biofilms). Recent research indicates that bioremediation may occur by multiple species working together to degrade a contaminant. When transferred to a laboratory for standard microbiological culturing, most of the microbial species present in a site go undetected (e.g., <10% of soil bacteria grow under laboratory conditions). If microbial enumeration by standard techniques is used for determining remediation potential, estimates of biotreatability potential of the site will be inaccurate. In addition, the culturing of a single species in controlled laboratory conditions, often fail to provide a realistic assessment of the diversity and biodegradation potential of the microbial populations on a giving site.

These limitations can be overcome by using molecular techniques such as DNA profiling. This technique analyzes the DNA from all members of the microbial population regardless of their ability to grow in the lab. The DNA profile is generated by separating the DNA fragments from individual members of the microbial population based on differences in their sequence. However, often DNA analysis is focused on one particular microbial group, mostly bacteria, which still limits an accurate analysis. We are expanding our profiling capabilities to include archaea, fungi, and algae, enabling the total microbial profiling of a given site.

We are applying these techniques to oil sands tailing ponds as a way of understanding the microbial ecology and bioremediation potential of these sites. We have found complex communities of bacteria and archaea. This long-term research project will also examine the presence of fungi and algae.

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Pernilla Stenroos a Research Scientist at HydroQual Laboratories Ltd as well as an Alberta Ingenuity r&D Industry Associate. The goal of her project is to develop a DNA-based method to characterize the microbial population structure and function of biofilms in end pit lakes for reclamation of oil sands tailings. The view is to develop a method for application to biofilms in general for the remediation of contaminated sites.

Pernilla Stenroos graduated with a Master of Science degree in Cellular Biology from Åbo Akademi University, Finland in 2008. Her thesis elucidated the relationship between a transcription factor and a single-stranded, non-coding RNA molecule called microRNA. As an undergraduate Ms. Stenroos did an internship at the University of Calgary, studying susceptibility of biofilms and planktonic cells to metal ions.