Sediment Interfacial Interactions Controlling Nutrient and REDOX Flux within Experimental End Pit Lake Tailings

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The recovery of bitumen from Alberta Oil sands generates enormous volumes of oil sands process material (OSPM). After bitumen extraction, tailings are pumped into retention ponds, where the sand fraction settles, and most of the aqueous slurry (i.e. fines consisting of silts, clays and residual hydrocarbons) slowly densifies which is termed mature fine tailings (MFT). Long term Reclamation management strategies focus on the deposition of this material within large end pit lakes using a CT process. However questions still remain regarding the function of chemical and biological constituents within the MFT during maturation of developing end pit lake ecosystems. A number of processes can occur within the MFT that will affect both volume and water cap quality. This may include possible phsyico –chemical alteration of dissolved constituents within the MFT driven by reduction- oxidation reactions possibly controlling consolidation, water cap quality and microbial community structure.

In this study laboratory microcosms containing fresh MFT were used to investigate the chemical and biological controls affecting the REDOX chemistry of the MFT and establish the role of developing microbial communities within new MFT sediment upon aging. Changes in the principal chemical, physical and biological populations of the MFT will be assessed under aerobic and anaerobic conditions using a combination of microelectrode arrays and DNA profiling at the tailings water interface. The results presented will discuss some of the preliminary findings along with novel technique development to assess bench scale tailings characterization and their impact on sediment oxygen demand (SOD) for future end pit lake model behaviour. We also discuss how our laboratory based microcosm results can be validated under field conditions.