Virtual

Seminar

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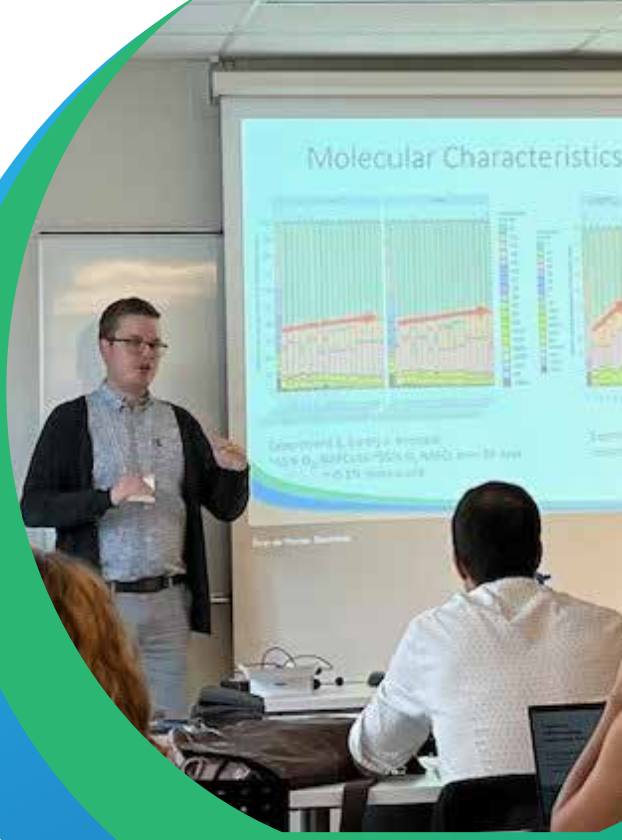
Environment and Climate Change Canada

12 pm MT, December 17, 2025

Naphthenic Acid Fraction Compounds from Oil Sands Process Affected Waters in Constructed Treatment Wetlands



ABSTRACT

Mining operations in the Athabasca Oil Sands region (AOSR) of Alberta, Canada have historically generated substantial volumes of toxic oil sands process-affected water (OSPW). The OSPW mixture is enormously complex, containing fine clays, elevated salt concentrations, and residual hydrocarbons. Despite this complexity, naphthenic acid fraction compounds (NAFCs) have been consistently associated with much of OSPW's toxicity, and these are therefore an important target for treatment in order to minimize adverse effects. This talk provides a meta-commentary on trends in NAFCs treatment outcomes as substantiated by high-resolution Orbitrap mass spectrometry. This talk draws from several separate, but related, pieces of collaborative work leveraging constructed wetland treatment systems (CWTSs) to ameliorate OSPW-derived NAFCs. Such work encompasses parameter optimizations for CWTSs examining the effects of different plants and temperature regimes, as well as empirical observations of degradation and corresponding decreases in OSPW toxicity from a 1 hectare engineered treatment wetland in the AOSR. Across systems, engineered systems consistently degrade NAFCs, as evidenced by decreasing concentrations & associated increases in oxidized and lower-#C formulae, coinciding with overall lower toxicity. Results of mesocosm-scale greenhouse studies provide justification for discussion of the relative importance of these parameters in determining the degradation behaviours and fate of NAFCs in treatment wetlands. In contrast, examination of pilot-scale results demonstrates both CWTS viability for treatment and providing examples of ongoing CWTS management challenges. This collection of results strongly indicates that CWTS strategies can successfully treat and detoxify OSPW.

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