Proposal

Title – Bioremediation of Hexanoic Acid and Phenanthrene in Oil Sands Tailings by the Microbial Consortium BioTiger™

Program of Study – Chemistry

Presentation Type – PowerPoint

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Category – Basic

Abstract: Oil sands are deposits of sand, clay, water and bitumen, and their processing produces wastewater that is toxic to wildlife and ecosystems. A major challenge of the oil extraction process is the varying compositions of the oil sands, especially the bitumen composition. Additionally, there are environmental toxicity concerns with byproducts of the oil sands industry, such as tailings ponds, runoff from the tailings ponds, and wastewater from the facilities, known as oil sands process-affected water (OSPW). The oil extraction process produces large volumes of slurry wastes contaminated with various byproducts, including naphthenic acids (NAs) and polycyclic, or polynuclear, aromatic hydrocarbons (PAHs) that are toxic to aquatic life and can readily enter into local watersheds. Polycyclic aromatic hydrocarbons and naphthenic acids are the most potent and environmentally recalcitrant compounds found in process-affected water and tailings from the oil sands industry. Both classes of compounds are structurally and toxicologically diverse. Microbial bioremediation of PAHs and NAs is an environmentally favorable strategy, since bioremediation can render harmful materials innocuous. In this work, BioTiger™ (BT), a twelve bacteria consortium isolated from a

Polish oil refinery's waste lagoon, and some of BT's individual components cometabolically biodegraded the NA hexanoic acid and the PAH phenanthrene. BioTiger™ also biodegraded both HA and Ph when present in a mixture simultaneously and biodegraded HA in the presence of phenanthrene and tailings. Hexanamide was produced during cometabolism of the NA hexanoic acid. Three of the twelve BT components generated biosurfactant(s) (BS) with the bacterial adhesion to hydrocarbons (BATH) assay, seven with the methylene blue active substances (MBAS) assay, and nine with a hemolysis assay. The BioTiger™ consortium produced biosurfactant(s) when tested against all three of the aforementioned assays. In this work, it was demonstrated that BioTiger™ cometabolically biodegraded the recalcitrant polycyclic aromatic hydrocarbon phenanthrene and the naphthenic acid hexanoic acid in various combinations. It was also shown that some of the BT components and the consortium produced biosurfactant(s).