Biodegradation Potential of Groundwater Contaminants by Acidophilic Methanotrophs

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Background/Objectives. Acidophilic methanotrophs are a unique group of methane-oxidizing bacteria capable of expressing methane monooxygenase (MMO) to oxidize methane under low pH environments (pH < 5.5). Interestingly, many of these acidophilic methanotrophs are also facultative, i.e.,they are capable of growing on more than C_1 compounds. However, their ability to degrade groundwater contaminants in acidic aquifers has not been understood. This study investigated the potential of acidophilic methanotrophs to degrade concerned groundwater contaminants under acidic conditions

Approach/Activities. *Methylocella tundrae* and *Methylocystis bryophila* are used as model strains in this study. *Methylocella tundrae* possess only soluble MMO (sMMO) while *Methylocystis bryophila* can express both particulate MMO (pMMO) and sMMO. The growth curves with methane, and none C1 carbons like acetate and propane were determined. The effects of growth substrates on the expression of MMO type were also investigated. Resting cell degradation tests were conducted to determine their degradation potential for trichloetheylene (TCE), cis-1,2-dichloetheylene (cis-1,2-DCE) and 1,2,3-trichloropropane (TCP) and 1,4-dioxane.

Results/Lessons Learned. Our preliminary results show that *Methylocella tundrae* can grow on methane and acetate, with a faster grow rate when using acetate as carbon source. *Methylocystis bryophila* can grow on methane and propane, with methane is preferred carbon sources. *Methylocystis bryophila* grew faster when supplied with low concentration of cupper. These strains can survive at lower pH, with the optimal pH is 5.5. Positive results of naphthalene assay suggested that *Methylocella tundrae* can constitutively express sMMO when grown with acetate. The acetate-grown *Methylocella tundrae* can degrade TCE, cis-1,2-DCE, TCP. Interestingly, *Methylocystis bryophila* can grow on propane and express sMMO in the absence of cupper and the propane-grown cells can degrade TCE. Ongoing research effort is to confirm the degradation of 1,4-dioxane by *Methylocystis bryophila*. Our findings will be valuable to facilitate future development of enhanced biodegradation of groundwater contaminants in acidic environments where multi-carbon compounds occur.