Microbial Metabolism of Methylated Amines and Methanogenic Activity in Marcellus Shale, WV, USA

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ABSTRACT

Methylamine metabolism has recently been a subject of considerable attention as many authors have shown that methylated amines (choline (CHO), glycine betaine (GBT), and methylamines) are involved in biogenic methane production. This raises the question as to whether microbial methanogens could be engineered to improve the efficiency of natural gas recovery during shale gas development. My proposal seeks to outline the mechanism for alternate methane production through metabolism of substrates like choline, glycine betaine, and methylamines. I also intend to understand the applications of microbial methanogenic activities in relation to the enhanced recovery of shale gas. Deep subsurface pristine samples will be collected from the Marcellus Shale Energy and Environment Laboratory. The shale samples will be ground in to powder and organic solvents will be used to extract the dissolved organic matter (DOM). The shale-derived dissolved organic matter (DOM) will be combined with the various methylated amines as growth media for microbial enrichment. Enrichment experiments will be conducted in 120 mL serum vials filled with 50 ml of anaerobic growth media using the shale-derived DOM and 10 mmol methylamine per liter. The media will be made to approximate the salinity and alkalinity of the formation water produced from the drilled wells. After growth, the methane from the head space will be collected and analyzed isotopically with a Gas Chromatography isotope ratio-Mass Spectrometer. We hypothesize that methane concentrations will be higher in samples inoculated with methylated amines and that the concentration of methane will increase with amount of substrate.

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