Methanogenerate! A Methanogen-Methanotroph Carbon Recycler

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Global carbon dioxide emissions have become one of the most pressing concerns for the world, as the 2015 United Nations Climate Change Conference in Paris suggests; however, global reductions in carbon emissions could negatively impact the world economy, including developing nations where cheap energy is critical to ending extreme poverty. Energy production is especially important in Pennsylvania, where the hydraulic fracturing boom has stimulated the economy. Two microbiological processes used in conjunction, methanotrophy and methanogenesis, may be the key to reducing carbon emissions while maintaining energy usage by recycling carbon dioxide emissions. The objective of this experiment is to sustain long-term growth and proliferation of Methylococcus capsulatus, a methanotrophic organism, and Methanothermobacter thermautotrophicus on carbon dioxide alone in an anaerobic-aerobic bioreactor. The goal of this experiment is to develop a viable carbon dioxide recycler that simultaneously creates a microbiological carbon dioxide sink while possessing the capability for fuel production. After growing the two organisms in a bioreactor for 22 days, M. capsulatus proliferation occurred and M. capsulatus growth was sustained over growth time, with a final estimated biomass of over 9 milligrams (as determined by Total Suspended Solids data compared to an uninoculated nutrient broth control) and a gradual increase in total biomass over the growth period. The results of this experiment support the viability of this “methanogeneration” method of recycling carbon dioxide by combining the metabolic processes of methanotrophy and methanogenesis.

Awards Won:

Third Award of $1,000