Mitigation of Methane Emissions from Septic Systems

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Introduction

- Methane has been reported to be the 3rd largest contributing factor to the greenhouse effect. The global warming potential of methane is 21-23 times that of CO₂.
- It has also been reported that 1.2 billion kg of methane are produced annually in wastewater treatment processes. According to the EPA about 76% of wastewater sector methane emission come from onsite septic systems.
- Due to the difficulty of reducing overall production of wastewater, and the resulting methane, a solution is sought to mitigate methane emission through biological processes that will convert the methane into less harmful substances or provide advantageous byproducts.
- Methanotrophic bacteria can convert methane into CO₂, and utilizing these bacteria in septic tanks and onsite wastewater treatment systems has potential to lower the green house gas (GHG) emissions.

Methods

- Determine bacteria to add to bioreactor based on robustness, and rate of methane reduction.
- Design and construct a batch operated bench scale bioreactor.
  - Compost from Logan City amended with selected methanotroph
  - No gas exchange
- Analyze methane removal differences in reactor and control compost using gas chromatography
- Determine bacterial growth
- Construct a continuous flow bioreactor to simulate real conditions
  - Methane input
  - CO₂ outlet
  - Compost amended with selected methanotroph

Results

- Methylocystis hirsuta was found to grow best and is show below. It was originally cultured on Feb 15 using NMS media. Media was visibly turbid after about 1 month.
- Growth of the M. hirsuta was confirmed through microscopy and gram staining of the media as shown below.

Anticipated Methane Removal

Increased rates of methane removal with time indicate increased methanotrophic activity.

Anticipated Results and Future Work

- It is anticipated that that the bioreactor with compost amended with ideal methanotroph with have a lower level of CH₄ and higher levels of CO₂ when compared with control reactor.
- Examine possibility of the mitigation of CO₂ effluent from bioreactor through plant growth on the reactor.
- Analyzing naturally occurring methanotrophs in compost

The diagram depicts methane being pumped out of a septic tank, into a bioreactor amended with compost and methanotrophs. Methanotrophs convert methane into carbon dioxide which can be further utilized by plants growing on top of the reactor.

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References: