Mitigation of Methane Emissions from Septic Systems

Introduction

- Methane has been reported to be the 3rd largest contributing factor to the greenhouse effect.\(^1\) The global warming potential of methane is 21-23 times that of CO\(_2\).\(^2\)
- It has also been reported that 1.2 billion kg of methane are produced annually in wastewater treatment processes.\(^1\) 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 CO\(_2\), 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
  - CO\(_2\) 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

- Methane Concentration (mg/L)

Anticipated Results and Future Work

- It is anticipated that the bioreactor with compost amended with ideal methanotroph with have a lower level of CH\(_4\) and higher levels of CO\(_2\) when compared with control reactor.
- Examine possibility of the mitigation of CO\(_2\) effluent from bioreactor through plant growth on the reactor.
- Analyzing naturally occurring methanotrophs in compost

Study conducted with funding from the Utah Water Research Lab at Utah State University

References: