ANAEROBIC DIGESTION

LAB OVERVIEW

Level: Grades 9-16
Estimated Time to Completion: Two 180 Minute Sessions
Prior Knowledge: Background Provided

In this lab investigation, students will become familiar with anaerobic digestion of a waste stream.

Anaerobic digestion is a method similar to composting where the goal is to produce a stable product that can be utilized for many purposes such as fertilizer. Unlike composting, the gas produced during digestion contains a large portion of methane, which can be harnessed for energy needs. Characteristics of anaerobic digestion products include:

1. The gas component contains mostly methane (~60%) and carbon dioxide (~40%), with small amounts of hydrogen sulfide and water vapor.
2. About 2/3 of the nutrients from the source materials are maintained in a liquid component that can be used for fertilizer
3. If a solid separator is used, 1/3 of the nutrient value is removed with the solids and is a concentrated natural fertilizer

Upon completion, students will be able to:

- Test a variety of a waste streams (substrates) for biogas production capability
- Perform titrations to determine the amount of CO2 contained within a biogas sample
- Understand how pH affects the productivity of anaerobic bacteria
- Understand how multiple bacteria can living symbiotically within a system

MATERIALS REQUIRED

Lab Balance
pH Meter
Temperature Bath (~35-38 °C)
2 50ml Burets
2-4 150 to 250ml Erlenmeyer Flasks
2-3 60ml Vial with Caps and Rubber Stoppers
60ml Syringe with Needle and Open/Close Valves
Food Waste (sugar as control, spoiled fruit, etc…)
Anaerobic Seed Stock (obtained from a local city digester or dairy farm digester)
Nitrogen
.5M NaOH
.1M HCl
Phenolphthalein
Methyl Orange

NOTES TO INSTRUCTOR

- Instead of the digestion being performed in a sealed bottle, a high quality balloon is placed on the top and the gas produced is measured this way.
- Instead of flushing the bottle for 2 minutes with nitrogen, you could bubble through the solution, or not flush at all.
- The use of a gas chromatograph is optional depending on the resources available.