Anaerobic Digester
"Converting food waste into to energy since 1859"

Sponsored by: Ryne Johnson, Center for Entrepreneurship

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PROJECT OVERVIEW

The purpose of this project was to reduce the amount of organic municipal solid waste destined for landfill and/or incineration.

PROJECT CONSTRAINTS

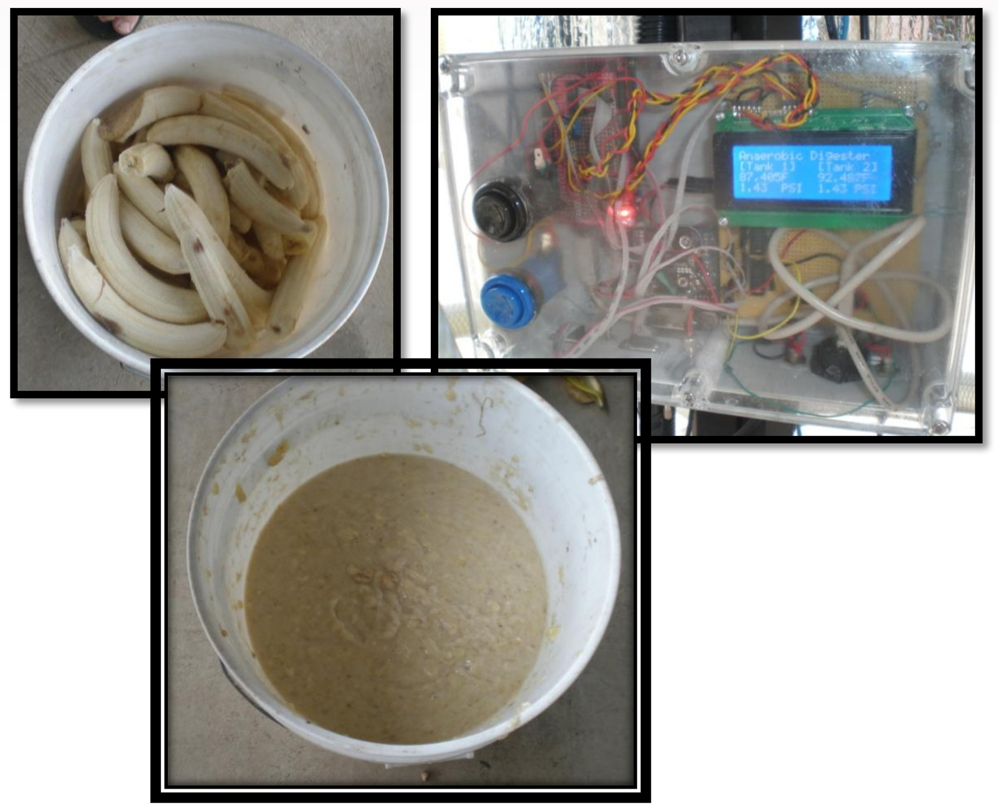
- The digester prototype must have a total material cost of less than $3000.00
- An organic load rate of 0.93 lb VS/day must be achieved
- The biogas yield must be in the range of 3.52-4.33 ft^3/lb VS
- The prototype must be able to fit in the back of a standard pickup truck bed

PROJECT OBJECTIVES

- Divert municipal solid waste from the landfill
- Reduce green house gas emissions at landfill sites
- Provide information and data on whether this technology is a valuable renewable energy source

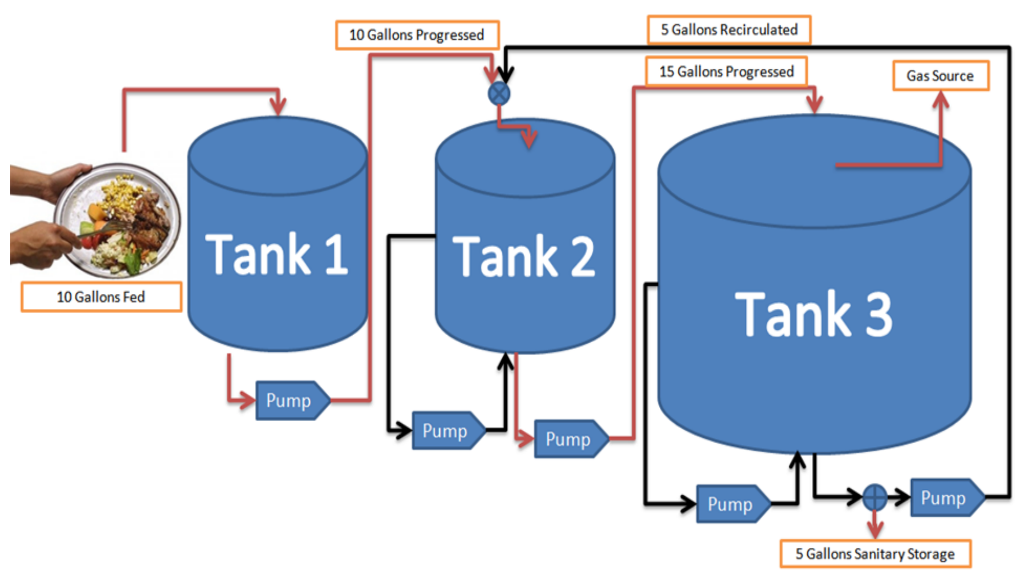
PROTOTYPE BENEFITS

- Reduction of waste going to landfill
- Offset of fossil fuel usage
- Increased efficiency from multiple stages
- Automated monitoring of system
- Ease of Assembly
- Only require 20 min/week for operation



HOW IT WORKS

The Anaerobic Digestion prototype utilizes three separate tanks to isolate key metabolic processes. The separation of processes allows for improved efficiencies and greater stability. The prototype will convert organic household waste into a methane rich biogas and compostable digestate solids. The biogas can be utilized to offset fossil fuel dependency



MICROBIAL CHEMISTRY

Anaerobic digestion occurs in a four-step process: hydrolysis, acidogenesis, acetogenesis, and methanogenesis. First large carbohydrates, fats and proteins are broken down into monomers. The monomers are then consumed to form acids, H_2 and CO_2. Lastly the methanogens consume the fatty acids, H_2 and CO_2 to produce methane gas.

a. Acetotrophic methanogenesis: $4\ CH_3COOH \rightarrow 4\ CO_2 + 4\ CH_4$
b. Hydrogenotrophic methanogenesis: $CO_2 + 4\ H_2 \rightarrow CH_4 + 2\ H_2O$
c. Methylotrophic methanogenesis: $4\ CH_3OH + 6\ H_2 \rightarrow 3\ CH_4 + 2\ H_2O$

PROJECT OUTLOOK

By use of an automated data collection system, maximum system efficiency can be determined giving the user a clear understanding of the system's performance. With the system running optimally, fossil fuel dependency can be reduced as well the amount of organic material destined for landfill of incineration.

TANK SELECTION

Plastic, full-drain tanks were used for their cost effectiveness and commercial availability. The full drain concept aides in ensuring all feed makes its way to the next stage.

PUMP SELECTION

Macerator pumps were selected to ensure reliable pumping of solid particles. These pumps feature an impeller, which acts as a grinder, reducing the particle size to a maximum of one-eighth of an inch. With four feet of suction capacity as well as 20 feet of head while pumping at 7.5 GPM this pump is capable of performing at the necessary specifications.