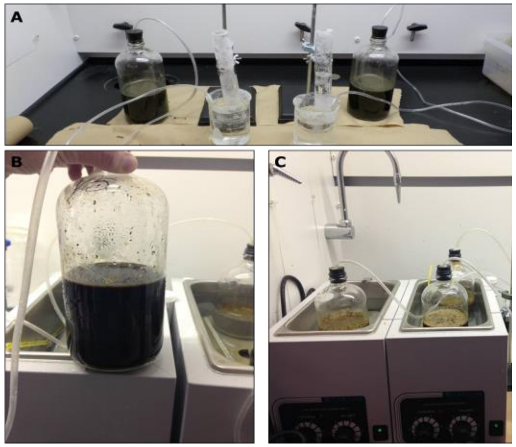


A) Preliminary batch of digestate., obtained from Michigan State University. 1L was grown into approximately 5L digestate to begin biochemical methane potential experimentation. This process began with two vials, and multiplied as bacteria colonies formed. B) Close-up view of preliminary batch digestion. C) Digestion vials were incubated at 90°C during experimental trials.

Possible uses for Digestion byproducts.

Anaerobic-Methane

Methane can be used for any number of things natural gas can already achieve. From heating, cooking, to even powering refrigerators.

Aerobic-Compost

Compost is vital to plant growth, and because of this its uses are numerous.
The compost could be used in local community farms or gardens, or sold to business and commercial agriculture as a high end plant nutrient.

Proposal

Use local commercial fisherman's fish waste to create an economical value for the community through methane production from Anaerobic Digestion, and compost through Aerobic Digestion. While simultaneously disposing of the organic waste.

What is Anaerobic Digestion?

Anaerobic digestion is a process that uses microorganisms in an oxygen less environment to breakdown biodegradable material (fish waste and food scraps) to produce a renewable methane biogas.

What is Aerobic Digestion?

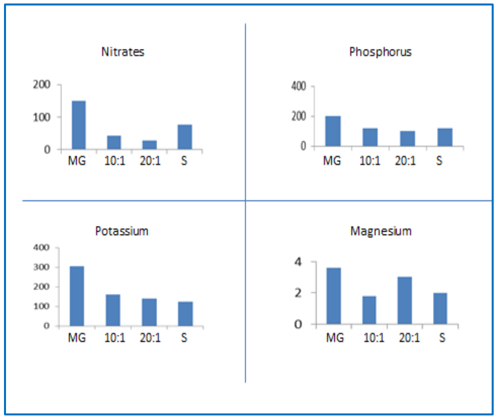
Aerobic Digestion is the breakdown of biodegradable materials using microorganisms in a normal oxygen environment. Eventually creating compost with proper aeration and watering.

How will this work?

Anaerobic Digestion- We combine food wastes of all sorts and the left over fish waste from cleaning to include everything left over organs, bones, heads, and even scales into an airtight tank. Microorganisms then break down the waste creating methane gas that is collected at the top of the tank, ran through a hose to the collection container where it is stored until ready to be used.

BAY MILLS COMMUNITY COLLEGE ANAEROBIC DIGESTOR

2015



Digestate as Fertilizer

After digestion a thick slurry of sludge, called digestate, can be used as fertilizer. To determine the viability of its use, we two different ratios of digestate with local soil and analyzed the compounds for soil nutrients. Above, you can see that Miracle Grow (MG) had highest levels of nitrates, phosphorus, potassium, and magnesium. In the case of nitrates, digestate did not add to the soil. However in the case of magnesium, the a ratio of 20:1 (20 grams soil to 1 gram digestate) carried more of the nutrient than did plain soil (S). No significant effects were observed between digestate mixtures and pure soil for phosphorus and potassium, The same can be said in the cases of nitrites and sulfates.

Aerobic Digestion of Fish Waste

Fish waste, food scraps and simple yard waste is added into a composter. Aerobic microorganisms break down the contents while proper agitation and moister levels of contents are maintained by watering it and spinning the composter. Resulting in nutrient rich compost.

Conclusions

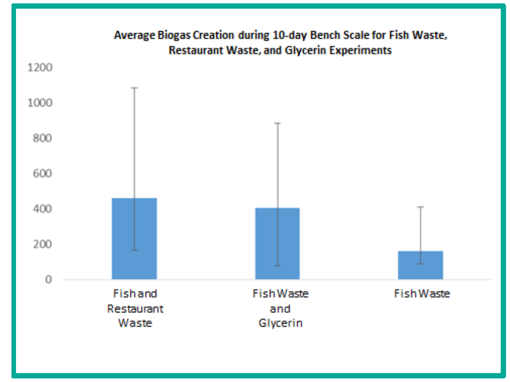
Bench-scale digestion and methanogenic cultivation techniques were established
Digestion of fish and restaurant waste, in all ratios, produced methane

2.5-times higher in digestion of 50% fish with 50% restaurant waste when compared to only fish waste ($p<0.001$)

Glycerin, biodiesel processing byproduct, is comparable to restaurant waste as additive to fish processing waste, and produces more biogas than fish processing waste alone

Two 55-gallon anaerobic digesters were compared. A more permanent version produced larger total volumes of biogas, which contained higher concentrations of methane. A more ‘user-friendly’ version, is more manageable for the average fisherman, but produces diminished volumes of biogas.

Anaerobic digestion was not feasible during winter months, when temperatures drop below -30˚F and frost levels are over a foot deep. Fortunately, local commercial fishing is also diminished at this time.



Glycerin, a byproduct of biodiesel production, was used as an additive to fish waste as replacement for restaurant waste. Averages of biogas from a combination of fish and restaurant waste were not significantly higher than that of a combination of fish waste and glycerin. Both of the combinations described above created significantly higher amounts of biogas, with concentrations of methane >1,000 ppm, than did fish waste alone ($p<0.001$).

Through the project we were able to create methane biogas from fish processing waste, material which otherwise has potential to cost local commercial fishermen money to dispose of, or increase eutrophication in areas near dumpsites. Methane, when captured properly, can be used similarly to propane to power generators or directly in altered propane fridges, stoves, grills, and more.

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