Use of Food Waste As a Natural Resource

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ABSTRACT

As a result of the increasing population of students at the Engineering and Science University Magnet School in New Haven (Fig. 1), food waste, as with many schools, is a major issue that is commonly overlooked (Fig. 2). Food waste is indeed a problem in the U.S., with 1/3 food produced going to the trash. To address this issue, I initially brainstormed a project that would utilize wasted food, in areas like school cafeterias, as a renewable resource. While brainstorming the construction of a machine that would process the food, I decided to investigate multiple existing food waste utilization processes to determine the best and most reasonable step to take in solving the issue for the school.

INTRODUCTION

There are 2,200 landfills in the United States (USDA, U.S. Food Waste Challenge). Food waste, once left in landfills, produces harmful methane emissions, which contribute to climate change as a greenhouse gas. The United States Department of Agriculture (USDA) Economic Resource Service estimated in 2010 that almost one-third of food at the consumer and retail level was wasted (USDA, U.S. Food Waste Challenge).

Current methods of food waste recycling include: biodiesel and other biofuels production, biomass, anaerobic digestion, and aerobic composting.

Figure 1. The Engineering and Science University Magnet School.

METHODS

The goal of this project is to address the common issue of food waste in schools by finding a process that food waste can go through based on the school's criteria. Repurposing food waste will decrease the emission of harmful gases produced by landfills, and will also provide a source of renewable energy or other resources.

Preparation

1. Research on possible processes for repurposing food waste (Table 1)
2. Inquiries with school officials at the Engineering and Science University Magnet School in New Haven (custodian, cafeteria chef, and secretary) on the following topics:
   - The process that the school's waste disposal goes through
   - The number of students who consume school meals daily
   - Whether or not left over oil is a resource for the school
3. Locate a process that would best suit my school's food waste
4. Contact businesses that would utilize food waste

Implementation

I plan to submit a letter to my school principal to propose a method of reducing food waste based on my research.

Figure 2. (a) Disposed food in the Engineering and Science University Magnet School. (b) Food waste.

RESULTS

Throughout my interviews, I discovered that my school did have a method of recycling bottles and cans for its waste disposal system. I learned that most students only consumed lunch meals, while less than half of students consumed the breakfast meals. From my observations, I found that many students did not complete their meals and mainly consumed the main meal and drinks and discarded side dishes such as fruits and vegetables (Fig. 2).

By further observation and analysis on factors such as my school's ability to fund methods of waste disposal and its access to facilities or machines that can receive the waste, I selected the aerobic composting process. Composting was proven to be most feasible due to its efficiency of producing a reusable product from it, affordability, and the availability of composting companies in the school's location that could potentially receive the waste and use it for local farming or gardening purposes (Table 1).

Reasons that other processes (anaerobic digestion, biodiesel, and other biofuels) were not selected include (Table 1):

- Lack of local facilities to process waste
- High expense
- Lack of particular food waste type needed for process (no cooking oil used in cafeterias)

CONCLUSION AND NEXT STEPS

Food waste is a concern for the New Haven School System, and particularly for the Engineering and Science University Magnet School (Fig. 1). After considering potential options for recycling food waste for energy or other resources, I found that composting may be a viable solution.

The next steps that I will take in completing this project are to contact composting facilities to determine their willingness to accept our school's food waste. If the companies are wiling to do so, and an alliance can be made, I will further address my school's principal on the issue and inquire about the possibility of utilizing the food waste in my school for such a purpose.

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Table 1. Results of research on food waste processes and their criteria.

Process	Inputs	Outputs	Mechanism	Size of System	Pros	Cons	References
Anaerobic Digestion	Organic waste, including fats, oils, and grease	Biogas (methane), compost	Biological process – microorganisms break down organic material with little or no oxygen	Power Plant Size	Lowers CO_2 emissions, kills pathogens, creates nutrient rich fertilizer	Expensive, space consuming, may chemically damage crops.	Biogen (n.d.); Connecticut Department of Energy and Environmental Protection (n.d.); United States Department of Energy (n.d.)
Composting (Aerobic Composting)	Raw organic materials	Humus, carbon dioxide, heat, water	Biological process – food waste broken down while exposed to ample amounts of oxygen	Depends on user's choice	Shorter processing time, destroys human/plant pathogens	Loss of nutrients, space consuming, expensive	Food and Agriculture Organization (n.d)
Biomass	Organic matter (organic waste, in this case)	Electricity	The waste is burned. Steam from burning is captured and used to turn a turbine and produce electricity.	Power Plant Size	Can provide electricity to industries and homes	Greenhouse gas emissions, space consuming	California Energy Commission (n.d.); Conserve Energy Future (n.d.); ReEnergy Holdings (n.d.)
Biodiesel	Cooking oil	Biodiesel	Fats are mixed with an alcohol and a catalyst, producing crude biodiesel and glycerin	Laboratory Size	Inexpensive, environmentally friendly, glycerine byproduct	Emits Nitrous oxide, space consuming, not an entirely dependable fuel	United States Department of Energy (2016)

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