Assessing Sustainable Waste Management at The Island School

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Introduction

Municipal solid waste (MSW) is best described as discarded household materials such as recyclables, food waste, and human waste. This waste is typically thrown out and sent to landfills once discarded. Landfills are harmful to the environment due to the contaminants that are released into the soil, air, and groundwater, as well as the organic material (biomass) that releases methane into the atmosphere. However, the Biogas team has challenged The Island School community to think about their waste and its impact on the environment and human health. Waste is a valuable resource and can be reused, recycled, composted, or converted. The waste hierarchy (Fig. 3) shows some of the ways that waste can be managed sustainably.

The research team transported 1,000 gallons of WVO from the Boneyard into the anaerobic digester. The initial WVO is tested for pH, free fatty acid content (FFA), and total dissolved solids (TDS) prior to the influent. After primary digestion, the WVO sits for 42-45 days which is the hydraulic retention time. The oil is then filtered for pH, volatile acids, alkalinity, TDS, temperature, and conductivity in the effluent. These tests were vital to assessing the health and functionality of the anaerobic digester.

Methods

Waste Audit

The waste audit was performed to determine the percentage of waste in Fig. 1 that was improperly sorted, as well as figuring out campus waste habits. All of the waste in Fig. 1 was categorized by type, weighed, and measured. It was sorted thoroughly in order to determine the types of waste that are produced most frequently.

Waste Knowledge Survey

The waste knowledge survey was sent out to the entire CES community as a way to get a better understanding of how informed the community is on solid waste management. The survey was sent out to The Island School community electronically through Google Forms. The survey provided insight into issues that need to be addressed when creating teaching modules (Fig. 11 & 12).

Discussion

The results from the waste audit and community survey indicate that source reduction needs to be the primary concern when educating the community. Based on the solid waste management hierarchy, source reduction is more preferred than anaerobic digestion. Although implementation and enforcement of source reduction is difficult, it is one of the strongest solutions to the global issue of waste management. The results from the waste audit and community survey indicate which solid waste streams need to be targeted when implementing source reduction on campus: plastics and scrap metals. The high rates of improperly sorted waste (15% on average) determined by the waste audit suggest that improvements to CES education around solid waste management are necessary. In our survey we found that 74.5% of people were concerned about the sanitary conditions and the environmental impact of solid waste pollution. This is further evidence that the community is not educated enough to understand the effects of solid waste pollution.

Next Steps

Anaerobic Digestion

Anaerobic digestion is an ideal solution to the abundance of waste vegetable oil (WVO) on The Island School campus. The establishment of the CES digester was a significant step toward sustainability and education around solid waste management. This initiative will allow the team to further reduce improper waste sorting which is a major concern for the research team. Through proper education and implementation, The Island School community will be able to reduce their carbon footprint and contribute to a healthier planet. The use of WVO as a renewable energy source will provide a unique opportunity for The Island School to demonstrate the potential of sustainable energy production on campus.

Updated Educational Strategies

Through the waste audit and community survey, it is clear that steps toward source reduction need to continue on campus. Education strategies such as classes or posters would be efficient when paired with the avaiable disengaging of single-use plastics. Additionally, as new employees, students, and visitors come to CES, this new educational curriculum could help mitigate the amount of improperly sorted waste.

Upcycled Resource Bins and Signs

Furthermore, in order to address the problem of improperly sorted waste on campus, new green bins were made to establish an efficient sorting system prior to the all campus recycling center. These bins will eliminate some human error and distraction.

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Literature Cited


Figure 1: The solid waste hierarchy depicts methods of waste management and the most to least preferred practices.

Figure 2: Schematic overview of anaerobic digestion.

Figure 3: An aerial of the Boneyard, the on campus dumping site. Outlined within the blue circles are the locations of the WVO collection.

Figure 4: The (Tingum Center) biofiltration recycling center where waste is sorted.

Figure 5: Anaerobic digester at Center for Sustainable Development.

Figure 6: Bioconductor conducting waste audit in Fig. 1.

Figure 7: Site assessment at Hatchet Bay Landfill.

Figure 8: A comparison of alkalinity and pH collected from the CSD anaerobic digester over the span of 40 days. The ideal pH range is indicated in the graph (6.5 – 7.5).

Figure 9: Off samples taken from different stages of AD: (Left) the influent, (Middle) the effluent from primary digestion, and (Right) the effluent from secondary digestion.

Figure 10: The results from the sorting of plastics #1 & #2 shows that food and beverage containers are used in abundance and need to be targeted when addressing solid waste management.

Figure 11: CESD community waste management hierarchy based on responses from the Waste Knowledge survey.

Figure 12: Current waste sorting signage in Fig. 1.

Figure 13: Upcycled plastic resource bins, previously used to store WVO, to be utilized as campus waste sorting bins.

Figure 14: Site assessment at Hatchet Bay Landfill.

Figure 15: Site assessment at Hatchet Bay Landfill.

Figure 16: Site assessment at Hatchet Bay Landfill.

Figure 17: Site assessment at Hatchet Bay Landfill.

Figure 18: Site assessment at Hatchet Bay Landfill.

Figure 19: Site assessment at Hatchet Bay Landfill.

Figure 20: Site assessment at Hatchet Bay Landfill.

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Figure 22: Site assessment at Hatchet Bay Landfill.

Figure 23: Site assessment at Hatchet Bay Landfill.