CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

36329

Project Title

Engineering Clean Energy: Measuring Energy Production of a Microbial Fuel Cell Using Waste Materials

Abstract

Objectives/Goals

The purpose of this experiment is to build mediator-less Microbial Fuel Cell (M.F.C.) and test fuel sources to determine which has the best potential for use in large scale application such as a dairy, food industry or wastewater treatment facility. Animal waste (manure), green waste, and distilled water as a control were tested as fuel sources in a 3,785 g capacity fuel cell. I hypothesized animal waste would produce the greatest amount of energy, for the longest period of time.

Methods/Materials

Three mediator-less M.F.C were built including an anode, cathode, salt bridge, and electrode. This phase required several redesigns, and took several weeks until a successful salt bridge was achieved. Plastic storage containers (3.785L) were used as the chambers. Carbon cloth and copper wire were used as the electrodes. A solution of water and agar, cording and a compression fitting were used as the salt bridge. An aquatic air pump was used to aerate the cathode. Manure was collected from a local dairy. Green waste was collected from a local food processing plant. Then, twice daily voltage readings were taken from each of the three fuel cells. Each trial consisted of 10 days.

Results

The results indicated that manure produced a stable electrical output. Electrical output was noted after the first day, and continued for the duration of the trials; concluding voltage output reached 243 mV, 488 mV, and 525 mV respectively for each trial. Green waste produced a varied electrical output and was not a stable source of energy production. The output varied dependent on the composition of the waste. In only one trial green waste produce a stable electrical output ranging from 13.8 mV to 498mV. Distilled water did not produce a stable electrical output for the duration of the trials.

Conclusions/Discussion

My hypothesis was proven partial correct. Manure produced the greatest amount of electricity for the longest period of time. While green waste produced an electrical output, it was inconsistent and unstable. To further this experiment, a modification of the electrode size was tested to see if a larger electrode would increase electrical output. The larger electrode was inconclusive when tested with the three fuel sources. Further testing is necessary. This fuel cell holds 3,785 g, transferring this design to a 2 ton tank capacity, using a larger electrode and manure as the fuel source could help to fuel a dairy

Summary Statement

Three mediator-less microbial fuel cells were built to harvest electricity produced from animal waste(manure), green waste(household/industry waste from food production plant), and distilled water to determine the best fuel source.

Help Received

My dad helped me using the drill, my mother/teacher helped to edit my written report and gave guidance for research information. Robert Sisneroz, Water treatment Supt. gave me a tour of The City of Hanford#s waste-water treatment facility, answered questions about the water treatment process. Jared Fragoso