OFFICIAL ABSTRACT and CERTIFICATION

The Creation and Optimization of a Plant Microbial Fuel Cell for Energy Generation with Brassica rapa

Samantha Chen and Emma Wang
Manhasset Seconday School, Manhasset, NY, USA

In 2017, 25% of the world's energy came from renewable sources, with 50% of the renewable energy coming from bioenergy. As the global consumption of energy is expected to increase by 28% by 2040, the demand for renewable and biological energy will increase as well. The purpose of this study was to create and optimize a Plant Microbial Fuel Cell (PMFC) using Brassica rapa, as a potential alternative source of energy. PMFCs were created in 13-ounce containers with graphite felt attached to titanium wire for electrodes. Square, circle, and octopus-shaped electrodes, distances of 3, 6, and 9 cm between the electrodes, inoculation of the anode with Escherichia coli k-12, the addition of Citrus sinensis, and connection of PMFCs in a series configuration were variables tested to optimize the PMFC. Data was collected over a 360-hour period for each trial, and the results showed a PMFC with circle electrodes inoculated with E. coli k-12, separated by 3cm, and with the addition of Citrus sinensis yielding the greatest average potential. Circle electrodes yield greater consistency in readings due to the more efficient surface area use, and inoculation with E. coli increases the electron output due to the bacteria's electrogenic properties. A distance of 3 cm increases efficiency by minimizing internal resistance, and addition of waste material increases the amount of organic material available for decomposition: this increases the number of free electrons in the system.

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