

Optimizing the Microbial Fuel Cell as an Alternative Fossil Fuel Source

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This experiment sets out to determine the current output of a Microbial Fuel Cell (MFC) in varying salinities of soil. During the process of anaerobic respiration, protons and electrons are one of the constituents of the products of the reaction and as a result, this natural process allows for a fuel cell to be set up. It has been seen that modulated adjustments to the MFCs often result in a significant changes in the voltage output (Rabaey et al., 2007) as the addition of a biofilm to the electrodes resulted in a large increase in voltage.

The MFC tested is a soil-based MFC as the necessities for an MFC are naturally present in the soil. This experiment investigated how changes in the salinity of the soil would affect the current generated, since current accurately showed the bacterial activity through electron transfer. A Winogradsky column was used as the template for the MFCs as bacteria are autonomously segmented due to differing oxygenation levels. In the set up, a carbon source and sulfur, an inorganic electron mediator was added. The carbon substrate triggers the process of anaerobiosis and the sulfur acted as an electron donor for the reaction in the MFC. In each MFC, to confirm that the current was being supplied by the bacteria, two set-ups, including one control were prepared and tested individually and in the control set up. A reading of $0.5\mu\text{A}$ was seen in the set up containing soil, however, in the control, a reading of $0.2\mu\text{A}$ was observed. Hence, this indicates that the current in the set up is being generated by the bacteria present in the soil.

Although the MFC produces a minute amount of current, it can be utilized almost everywhere, as bacteria have been found in a variety of locations including non-arable land, and these 'wastelands' can be exploited for energy production. As such, it can be seen that if further research is done on MFCs, there is potential that one of the smallest living things on Earth will be able to supply energy to the human race for years to come.