Optimization of Microbial Fuel Cell Technology to Maximize Power and Nitrate Removal

McDonald, Alexandra (School: Yorktown High School)

The unsustainability and environmental pollution caused by primary energy sources along with issues on the purification of wastewater act as a major impetus for research into alternative bio-renewable technologies. Microbial Fuel Cells (MFC) are bio-electrochemical devices that are able to reduce the cost of the purification process while simultaneously generating renewable energy that is good for the environment. MFC's harness the power of respiring microbes to generate electric energy and remove pollutants directly from organic matter present naturally in the environment. Electrons generated at the anode from the oxidation-reduction reactions are used to reduce nitrates at the cathode and produce electrons. Four different types of fuel cells were constructed using household materials and the power production along with the nitrate removal was measured and compared. The results show that the double chamber MFC was most efficient, most likely caused by the separation of the two chambers using a proton exchange membrane. Future experimentation could focus on scalability to fully explore the potential of MFCs functioning as mobile waste-processing units. Fuel Cells can dramatically lower energy bills which can be beneficial to lower class families and places with low access to electricity. There has also been raised interest in incorporating Microbial Fuel Cells to provide longer-lasting power for implantable medical devices (IMDs). We have only scratched the surface on the limitless possibilities of MFC technology. These revolutionary fuel cells have the potential to reshape how wastewater is treated through energy production and biodegradation.

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