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Optimizing Energy Production through Wastewater Treatment: The Utilization of a Mediator-Less, Single Celled Microbial Fuel Cell

Microbial fuel cells are of promising technology in the bio electrochemical field, but to produce sustainable amounts of energy, further experimentation on certain boundaries such as the type of inoculum need to be taken into consideration when constructing a viable fuel source. This study investigates the comparison of primary and secondary treated waste water in single-chambered microbial fuel cells. The effect of potassium ferricyanide, as a cathodic electron acceptor, was also tested to determine if there was a correlation between the chemical, the production of energy, and the treatment of water.

Four single-chambered microbial fuel cells were developed. Two of the containers contained 600 ml of either primary or secondary treated waste water depending on the fuel cell. Electrodes represented the anode and the cathode and consisted of carbon-cloth squares bounded by copper wire. Electrical parameters along with chemical oxygen demand (COD) tests were recorded to determine the performance of the fuel cells.

After conducting t-Tests (assuming unequal variance), the results revealed that there were no significant differences between the two waste waters and the comparison of which inoculum performed best with the permeation of potassium ferricyanide. Power production was significant with the addition of the chemical oxidant, creating a maximum power output of 400 mW. COD removal efficiencies were also significant, producing a maximum of 83% substrate removal. With further knowledge of the working parameters within a fuel cell, this product can soon become a green bioenergy technology; therefore, reducing dependence on fossil fuels and protecting the environment.