Year II: Domestic Wastewater Clarification and Power Generation- Increasing the Conductivity of Permeated Electrodes in a Single-Celled Microbial Fuel Cell

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Enhancing the efficiency of single-celled microbial fuel cells (SCMFC) provides the opportunity for wastewater treatment plants to invest in biotechnology that will allow these facilities to become self-sustainable. SCMFCs comprise of a dualistic nature by producing electricity through the clarification of wastewater. In a SCMFC, the electrode compartments are a vital component of a stabilized fuel cell. This experiment examines the phenotypic potential between the cell's microbial community and the treatment of the electrodes. Nine SCMFCs were developed and later permeated with the chemical electron acceptors, potassium ferricyanide and manganese dioxide. Both are high reduction and oxidation compounds but ferricyanide releases a greater toxic concentration. Several tests were conducted to quantify the effects of specific electrode permeations and chemical catalyst's in SCMFCs. To determine treatment efficiency, fuel cell inoculum was measured for chemical oxygen demand, total phosphorus, and conductivity. To assess the fuel cells electrical production, research included measuring the voltage, resistance, and current daily. For this study, two statistical analyses were performed: repeated measures analysis of variance (ANOVA) and a three-factor ANOVA. Through the repeated measures results, there was an insignificant interaction between week*chemical*electrode. However, the highest electrical power production was achieved with the manganese fuel cells (2506.9mW). Developing an efficient combination of electrodes and catalyst compounds will allow SCMFCs to achieve high electron transfer. By decreasing the cost and the operational parameters of SCMFCs, this biotechnology will become a promising outlook for the future of wastewater treatment sustainability.

Awards Won:
Second Award of $2,000