CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY

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Project Number
S0807

Project Title
The Effect of Variable Microorganisms and pH on the Efficiency of a Microbial Fuel Cell

Abstract

Objectives/Goals
In light of depleting fossil fuels and their harm to the environment, there has been development in renewable sources of energy. The microbial fuel cell (MFC) is one such development; it is unique in that its only byproduct is water, and it uses microbes to generate energy. Our goal was to optimize this system's electrical output and stability, and to do so we tested MFCs with varying microorganisms and pH levels in the anode.

Methods/Materials
To determine the effect of these variables on the efficiency of microbial fuel cells, we built and tested 6 MFCs in six independent trials: using E. coli, S. cerevisiae, or I. galbana as the microorganisms, under pH conditions of 6, 6.5, or 7. Half of the cells had a cathode solution of H(2)O with dissolved oxygen, while the other half used H(2)O(2), in order to account for the limited amount of dissolved oxygen in the cathode half-cell of our trials. The cells were assembled accordingly and the electrical potential (voltage) was measured daily using a multimeter.

Results
Our results show that S. cerevisiae produced the most stable voltage, with the least day to day fluctuation as compared to the other trials. In terms of generating the highest voltage, all three microbes produced a similar range of voltages; however, there was a global trend based on pH level: as pH increases, voltage decreases, indicating that a more acidic anode solution results in a higher voltage

Conclusions/Discussion
This experiment shows that in terms of stability, the yeast fuel cells are the most stable, whereas achieving a high voltage output depends more on the environment the microorganisms are in, rather than the type of microorganism themselves. Therefore, in future studies of microbial fuel cells, it may be helpful to focus on altering the solutions in the anode half-cell, rather than the microbe, in order to optimize the efficiency of microbial fuel cells.

Summary Statement
An experiment manipulating the microbe type and the pH level to determine an optimal efficiency of a microbial fuel cell in terms of voltage output and stability.

Help Received
Physiology teacher, Ms. Alonzo, supervized us when we cultured our microorganisms.