



**CALIFORNIA STATE SCIENCE FAIR
2009 PROJECT SUMMARY**

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Project Title
Microbial Fuel Cell, Year Two: Comparing Ten Anode Electrode Materials' Average Power Density in an Air-Cathode Design

Abstract

Objectives/Goals
Last year my project was a broad investigation about the possibility of generating power with a simple microbial fuel cell. This year, I seek to determine which anode electrode material will produce the highest average power density using secondary (biological) treatment water, while keeping the single-chamber air-cathode microbial fuel cell configuration the same. I believe the Duocel Aluminum Foam Metal, 40 Pores Per Inch, 6-8 percent Density (Non-Compressed) anode electrode will produce the highest average power density reading over seven days. The hypothesis is based on literature that indicates Duocel Foam Metal Aluminum is a good conductor, does well in harsh environments, and provides good access for the bacteria to attach.

Methods/Materials
Designed and built ten identical single-chamber air-cathode microbial fuel cells. Telephoned suppliers and obtained free carbon, aluminum, and copper anode electrode materials; secondary (biological) treatment wastewater; and supplies. Built a homemade carbon fiber brush anode electrode and assembled the other nine anode electrode materials. Poured 1 Liter of secondary treatment water into ten air-cathode systems and sealed airtight. Connected the external circuit to a 1000 ohm resistor and a multi-meter. Recorded millivolt and milliamp readings three times daily for seven days.

Results
The anode electrode made from Aluminum Foam Metal, 40 PPI, 6-8 percent Density (Non-Compressed) had the highest average power density at 9.2367×10^{-2} mW/m² while processing secondary (biological) treatment water.

Conclusions/Discussion
The data does support my hypothesis that the Duocel Aluminum Foam Metal, 40 Pores Per Inch, 6-8 percent Density (Non-Compressed) anode electrode will produce the highest average power density reading. The medium density and non-compressed aluminum anode was a good conductor, biocompatible in the secondary treatment wastewater, and had enough surface area available for the bacteria to colonize. The data demonstrates that the type of anode electrode material is important when measuring the average power density in this homemade single-chamber air-cathode microbial fuel cell configuration.

Summary Statement
My project purpose is to present experimental data comparing the average power density of ten different anode electrode materials using secondary treatment water, in a homemade single-chamber air-cathode microbial fuel cell configuration.

Help Received
My parents drove me to purchase supplies and collect wastewater plant samples; my parents paid for all materials, lent me tools and the multi-meter; my parents answered questions about grammar and word choice, took pictures, and made sure I thought safety first.