CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34423

Project Title

MFCs Reloaded: A Novel Bio-Augmented Design to Enhance MFC Efficiency

Abstract

Objectives/Goals

My objective was to see if a bio-augmented design would increase the efficiency, as well as power production, of a Microbial Fuel Cell. Moreover, I aimed to analyze the extent at which it would optimize the power production, if optimization was achieved at all. I established a goal of increasing power production by 10-15%.

Methods/Materials

I came to discover that there were innate flaws in MFC design that were holding it back from realizing the potential of such a revolutionary technology and set out to change the design itself. The two-chamber MFC is highly inefficient due to its high internal resistance and the single-chamber MFC has both a low lifespan and is not cost-efficient. The same way by which researchers were inspired by nature in the pursuit for artificial photosynthesis, I used nature#s model to successfully design a more efficient MFC to reduce internal resistance, increase longevity, and increase the surface area to volume ratio of the system. I used PVC piping and PVC compression fitting to construct the system and was able to control the price to be $15-$18 USD.

Results

The design modifications increased the power production of the system by a factor of 60% in comparison to the baseline power produced. By using the extent at which the design changes were applied as a function of power production, as well as a matrix of meticulous controls, I was able to conclusively determine that it was indeed the modifications in design, and not any adverse affect that lead to an increase in power production.

Conclusions/Discussion

The 60% increase in power production overshot the expected 10-20% increase in power production by a huge margin. The next step would be determining and overcoming obstacles regarding scaling up the idea before implementation can begin in developing nations and integrated into developed nations.

Summary Statement

I was able to engineer a more efficient MFC design that yielded 60% more power production while simultaneously reducing its cost.

Help Received

Sister helped with the board; teachers helped streamline the design process with feedback; father helped with practical applications and outreach