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

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Scientists are currently pressed with the problems of conjuring up clean energy, clean drinking water, and waste management in a sustainable way so that we do not drink our planets resources dry. Instead of attacking these problems as separate ideas, through the incorporation of a Microbial Fuel Cell (MFC), they can be brought under a single roof and tackled as a single, more comprehensive challenge. MFCs work by using bacteria to metabolize the waste at the anode and they produce electrons and protons as by products. The electrons form a current and recombine at the cathode with oxygen and two protons to form water. However, the innate flaws in its design are holding the MFC back from large-scale implementation. The two-chamber MFC is inefficient due to high internal resistance and the single-chamber MFC has both 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. The design increased the power production of the system by a factor of 60%, which overshot the expected 10-20% increase in power production by a huge margin. By using the extent at which the design changes were set in place 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. 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.

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