Integrating MFC-MEC Technology into Farms for More Efficient Hydrogen and Food Production

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The integration of a microbial fuel cell-microbial electrolysis cell (MFC-MEC) generator into an aquaponics unit for more efficient hydrogen production has been tested. The goal of this project was to develop a system that utilized existing farmland in a minimally invasive manner to simultaneously grow crops, and produce hydrogen. To test the practicality of producing hydrogen on a large-scale using existing farmland, a revolutionary system was designed and tested on a smaller scale of ten liters. The average farm is 454 acres; this was considered large-scale. Through the combination of a modified MFC-MEC system, capable of producing small amounts of hydrogen, with modified aquaponics technology, it was shown that hydrogen can be produced in a practical and efficient manner on a large-scale. When the three technologies were combined using the unique system developed in this experiment, thirty-eight percent more hydrogen was produced with the same inputs. The system provided the extra benefits of putting out food, medicine, and oxygen while mitigating the overall carbon dioxide outputs typically associated with hydrogen production. Knowing the efficiency of modern hydrogen fuel cells (HFC's) is eighty percent, it was calculated that for every liter of this system, 0.42 wh of electricity to be produced. Implemented into forty-eight percent of farmland, enough hydrogen would be produced to meet forty percent of global energy needs. This increase in yield was accomplished through the provision of a systems inputs by another system's output. Overall, more beneficial outputs can be produced for similar inputs.

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