An Optimal, Low-Cost Microbial Consortium for Oxidation of Biodegradable Waste in a Waste Based Microbial Fuel Cell

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The United States generates 230 million tons of landfill waste annually and around 20% is biodegradable waste resulting in polluted landfill sites. Reusing or reducing biodegradable waste can improve waste management and bioremediation processes. Microbial fuel cells (MFC) are sources of renewable energy that can reuse biodegradable waste since bacteria in the cell consume waste to generate electricity. However, current bacteria used in microbial fuel cells are expensive and largely inaccessible. In this study, two easily accessible and low-cost microbial communities - Saccharomyces cerevisiae, topsoil- were tested to determine which increases bioelectricity production the most. A liquid phase and biofilm based MFC was constructed for the topsoil community along with a MFC made of S. cerevisiae monoculture. Dual chamber microbial fuel cells were constructed with biodegradable waste substrates and fifteen trials were performed for each microbial community. Data was analyzed for the voltage, internal resistance, current density and power density for each cell. Both topsoil phases outperformed S.cerevisiae.The power density for the topsoil biofilm MFC was 79.5% greater than liquid phase MFC and 214% greater than S.cerevisiae. The final current output for the biofilm MFC was 44% more than the liquid phase MFC and 188% more than S.cerevisiae and lit an LED brightly. The topsoil biofilm MFC was 93% cheaper than typical dual chamber MFCs and 97% as effective. All trials showed the potential of topsoil microbial communities in oxidation of biodegradable waste which can serve as an alternative energy mechanism in third world countries.

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