

# OFF-GRID MICROBIAL FUEL CELL POWER DELIVERY SYSTEM

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## Introduction

### Project Statement

To enhance the electrical efficiency, scalability, and practicality of Off-grid Microbial Fuel Cell Power Delivery Systems for practical use in resource-constrained environments or remote areas.

### Specifications:

- Power density above 200mW/m<sup>2</sup>.
- Operational pressure below 1.5 Bar. Stable output voltage ranges from 5 – 12 V DC.
- Suitable for mass production.

### Constraints:

- Limited Voltage and Current Output
- Material Constraint
- Bacteria Species
- Wastewater Input

## How it works

### Chemistry Aspect

In the MFC, organic matter extracted from wastewater serves as the fundamental fuel source. Positioned at the anode, microorganisms intricately engage in metabolic processes, effectively breaking down complex organic compounds, like glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>), potentially through pathways like glycolysis. This metabolic breakdown, resembling a biochemical process, releases electrons as natural byproducts.

Organic Matter Oxidation at Anode

### Electron Flow in the Electrical Circuit

The released electrons, a direct result of organic matter oxidation, are deftly harnessed and directed through an external electrical circuit. This orchestrated electron flow serves as the elemental current, laying a robust foundation for the generation of electrical energy within the Off-grid Microbial Fuel Cell (MFC).

### Cathode Reaction & Overall Electrochemical Process

At the cathode, a dynamic collaboration takes place as electrons unite with oxygen molecules (O<sub>2</sub>), assuming the pivotal role of electron acceptors. Simultaneously, protons (H ions), having traversed the proton exchange membrane (PEM) from the anode, converge at the cathode. In this chemical alchemy, a transformative reduction of oxygen and protons occurs, culminating in the formation of water (H<sub>2</sub>O). This dual process transforms organic compounds, forms water, and generates electrical energy—highlighting the sustainable and dual-purpose nature of MFCs.

## Deliverables

- Working Prototype Proof of Concept
- Project Feasibility Study

## Conclusion

Through the ingenious integration of microbial processes and advanced electrical engineering, we have achieved a stable output voltage ranging from 5 to 12 volts (DC), powering diverse applications. Our design stands as a beacon of innovation, symbolizing the boundless possibilities at the intersection of microbiology, industrial engineering, and electrical engineering. As we look ahead, we envision a future where this technology continues to evolve, shaping a more sustainable and resilient world.

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## Product Form

