**International Journal of Chemoinformatics and Chemical Engineering**
Volume 8 • Issue 1 • January-June 2019

# COD Removal and Electricity Generation From Domestic Wastewater Using Different Anode Materials in Microbial Fuel Cells

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## ABSTRACT

Microbial fuel cells (MFCs) set a new trend of converting chemical energy or bio energy to electricity from wastewater (domestic and industries) at the same time removal of chemical oxygen demand (COD) from the wastewater. Electrical energy generated from microbial fuel cell could be used for small electrical device example biosensors. The main components of MFCs are the anode, and the cathode salt bridge. It contains an anode chamber and a cathode chamber which separate electrodes for the production of electricity, using wastewater in an anaerobic chamber helps grow native microorganisms. Adding substrates increases productivity of the electrons that are moving from the anode chamber to the cathode chamber by help of the salt bridge. Bioreactors based on power generation in MFCs are a new approach to wastewater treatment. Power generation and current is modulated in this system. If it is optimised, MFCs would prove to be new method to offset wastewater treatment plant operating costs.

## KEYWORDS

Bio Energy, Bio Sensors, Chemical Energy, Consortium Bacteria, Current Density, Micro Fuel Cell, Microorganisms, Negative Microorganisms, Power Density, Salt Bridge, Voltage

## INTRODUCTION

A fuel cell is a device that generates electricity by a chemical reaction. Every fuel cell has two electrodes called the anode and cathode. The reactions that produce electricity take place at the electrodes. Every fuel cell also has an electrolyte, which carries electrically charged particles from one electrode to the other, and a catalyst, which speeds the reactions at the electrodes.

Hydrogen is the basic fuel, but fuel cells also require oxygen. One great appeal of fuel cells is that they generate electricity with very little pollution–much of the hydrogen and oxygen used in generating electricity ultimately combines to form a harmless by-product, namely water. In practice, many fuel cells are usually assembled into a stack.

The purpose of a fuel cell is to produce an electrical current that can be directed outside the cell to do work, such as powering an electric motor or illuminating a light bulb or a city. Because of the way electricity behaves, this current returns to the fuel cell, completing an electrical circuit.

DOI: 10.4018/IJCCE.2019010101

Oxygen enters the fuel cell at the cathode and, in some cell types (like the one illustrated above), there it combines with electrons returning from the electrical circuit and hydrogen ions that have travelled through the electrolyte from the anode. In other cell types the oxygen picks up electrons and then travels through the electrolyte to the anode, where it combines with hydrogen ions.

The electrolyte plays a key role. It must permit only the appropriate ions to pass between the anode and cathode. If free electrons or other substances could travel through the electrolyte, they would disrupt the chemical reaction. They combine at anode or cathode, together hydrogen and oxygen form water, which drains from the cell. As long as a fuel cell is supplied with hydrogen and oxygen, it will generate electricity.

The MFC are bioreactors which converts chemical energy stored in the bonds of organic matters into electricity through biocatalysts of microorganisms (Kent, 2013). Anodic chamber and cathodic chamber are separated by salt bridge. That allows transport protons while blowing oxygen and other components (Prakash 2016). The anodic chamber degrades organic matter and produce electrons, protons and $CO_{2.}$ Salt bridge transport. The electrons and protons (Kent, 2013). In the cathodic chamber protons and electrons react with oxygen which is allowed to pass through the external load to generate electricity (Liu et al., 2005). MFC bio-electrochemical system that harnesses the natural metabolisms of microbes to produce electrical power. nutrients are consumed by Microbes in their surrounding environment and release a portion of the energy contained in the food in the form of electricity. MFC technology real-world applications limited, because of their low power density level of several thousand $mW/m^2$ (Prakash, 2016). The result of this study can be used to create more efficient on a large as a new sustainable energy source.

## DISCUSSION

The generation of electricity can be done by using microbial fuel cell. The two chamber MFC is widely using traditional method and inexpensive. Output of the MFCs power depends upon the type of wastewater used in experiment, type of presence of bacteria in wastewater, using of electrode materials and oxidation efficiency (Liu et al., 2005). The graphical plots show that the power production rate differ based on cathode and anode material used. The amount of power generated in these systems is affected by surface area of the electrodes and the surface area of membranes (Bruce, 2006; Oh et al., 2004; Oh & Logan, 2006). In cathode chamber the ferricyanide is can be used as an electron acceptor at high concentrations. But it is restricted to use in studying laboratories and for student research. Compared to platinum – catalyst it enhances the power level by 1.5 to 1.8 times, but compared to that oxygen is more suitable for using as electron acceptor in low cost (Oh & Logan, 2006).

The material which is used as anode must have good conductive property, biocompatible and chemically stable. Metal anodes also can be used (Tanisho et al., 1989), but the toxicity of even trace copper ions to bacteria copper is not useful. The above declared properties are matched with most versatile materials of carbon products. The graphite shows low output compared with carbon because; in some graphite materials are mould with copper.

From the graphical plots we observe more outputs with using of carbon rod at from startup time to end. Due to its observe capacity, the bio film was formed in the anode chamber while oxidation takes place. In first day overall highest value noted of 179.45mV. Temperature is important factor in the MFC, while reducing temperature output also decreased slightly. Also increasing volume of the flow rate production will be raised. From all wastewater samples power output was changed depends on atmosphere temperature, COD removal, anode catalyst and rate of oxidation. The food wastewater contains enormous number of microorganisms. Zinc has low conductive property. While the amount of COD increases as well as power produce will increase. At the day of 5 oxygen consume is low, at the same time power production is decreased. So, the using of electrodes and methods are most important in current generation.