PRODUCTION OF ELECTRICITY WITH THE HELP OF MFC CELL

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Abstract - *A Renewable and clean forms of energy are one of the major needs at present. Microbial Fuel Cell (MFC) offers unambiguous advantages over other renewable energy conservation methods. Without any transitional conversion into mechanical power, fuel cells transmute chemical energy directly into electricity. The present study deals with the utilization of sewage sludge, which contains high level readily biodegradable bio waste and is also one of the major sources of environmental pollution, as substrate in MFC. MFCs usually consist of two compartments separated by a membrane that prevents oxygen diffusion to the anode and enables the resulting protons to reach the cathode. In the anode, a copper rod is used which collects the electrons produced by the substrate oxidation. In the aerobic cathode compartment carbon rods used. The oxygen which is reduced combines with protons which produces water. This water can be used in gardening purpose etc. The micro-organisms used as biocatalysts in the anode can be pure or mixed cultures, like the anaerobic sludge from a biological waste water treatment plant.*

Key Words: MFC, Renewable Energy, Microbial Fuel Cell, Waste water treatment, Clean energy

1.OBJECTIVE

Microbial Fuel Cells (MFCs) are devices that use bacteria as the catalysts to oxidize organic and inorganic matter and generate electricity. Several variations on the basic designs have emerged in an effort to increase power density or provide for continuous flow through the anode chamber. The main objective of the project will be to produce the clean and green electricity and also the treatment of the waste water which can be used in etc. To build low cost waste water treatment along with electricity production in developing countries and rural areas. To provide a new method to offset wastewater treatment plant operating cost, with less excess sludge production. To reduce the dependence on the fossil fuels and lower the amount of pollution. To increase power generation rate and lower their production and operating cost.

2.INTRODUCTION

Energy has been the major aspects in the evolution of civilization, as fossil fuels have taken care of industrial revolution part. The energy needs cannot be sustained by fossil fuels as they are not substantial enough because of their limited availability. So, the need of renewable alternative source of energy generation is needed. Microbial Fuel Cells (MFC) are among the most prominent biological systems for energy production. The possibility of using micro-organisms to generate electricity in fuel cells is based on the biochemical processes of energy production. Micro-organisms degrade organic compounds by removing electrons from these compounds (oxidation) and releasing them to a final receptor, such as oxygen. However, even in the absence of oxygen, certain bacteria can transfer electrons from organic compound oxidation to systems outside the cell. These bacteria, known as exoelectrogenic bacteria, have found application as biological catalysts in MFCs. MFCs usually consist of two compartments separated by a membrane that prevents oxygen diffusion to the anode and enables the resulting protons to reach the cathode. In the anode, a copper rod is used which collects the electrons produced by the substrate oxidation. In the aerobic cathode compartment carbon rods used. The reduced oxygen together with protons produce water which can be used in gardening work etc. The micro-organisms used as biocatalysts in the anode can be pure or mixed cultures, like the anaerobic sludge. Microbial fuel cells have become an interesting and promising area of research. There are many applications of MFCs which will help to reduce the use of fossil fuels and allow for energy gain from waste. MFC technology will help to bring the world to become a sustainable and more environment friendly place. In most MFCs the electrons that reach the cathode combine with protons that diffuse from the anode through a separator and oxygen provided from air; the resulting product is water. MFCs operated using mixed cultures currently achieve substantially greater power densities than those with pure cultures.

2.1Microbial Fuel Cell (MFC)

A Microbial Fuel Cell (MFC) is a bio-electrochemical system that drives an electric current by using bacteria and mimicking bacterial interactions found in nature. MFCs can be grouped into two general categories: mediated and unmediated. The first MFCs, demonstrated in the early 20th century, used a mediator: a chemical that transfers electrons from the bacteria in the cell to the anode. Unmediated MFCs emerged in the 1970s. In the 21st century MFCs started to find a commercial use in wastewater treatment. There are various types of MFCs used now-a-days. But the most prominent type of MFCs are Single Chamber MFC and Double Chamber MFC. A typical MFCs consists of anode and cathode, compartments which are separated by a cationic membrane. Microbes reside in the anode compartment where they metabolize organic compound. The metabolism of these organic compounds generates electrons and protons. Electrons are then transferred to the anode surface. From anode, the electrons move to cathode through the electrical circuit, while the protons migrate through the electrolyte. Electrons and protons are consumed in the cathode by reduction of soluble electron acceptor such as oxygen etc. Electrical power is harnessed by placing a load between the two electrode compartments. However, the use of oxygen could avoid the potential environmental pollution resulted from the use liquid-state electron.

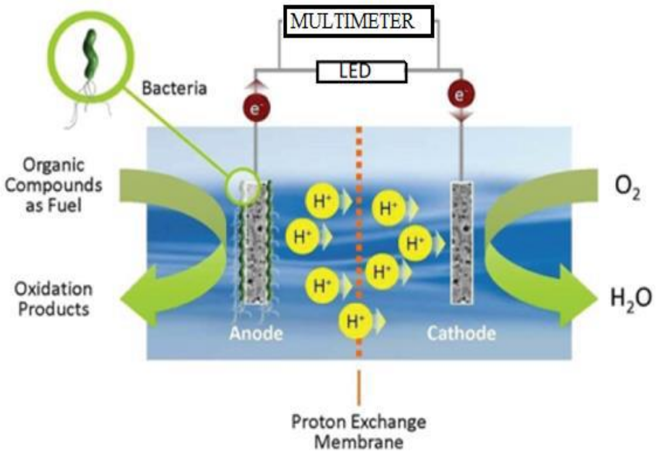

Fig -1: Basic figure of MFC

2.2 Double Chamber Microbial Fuel Cell

Double-chamber MFC is the simplest design among all MFCs. In a typical design, one container is used as anode chamber and a second container is used as cathode chamber separated by PEM. Usually in two chamber MFC, defined medium or substrate in the anode and defined catholyte solution are used to generate energy. In other words, the double chamber MFC is often operated in batch mode. The choice of catholyte in the MFC can define the nomenclature of the design. For example, if the air is used in the cathode to provide the electron acceptor, i.e. oxygen, then the MFC can be called chamber air-cathode MFC. Such MFCs may prove valuable to generate electricity in remote sensing areas.

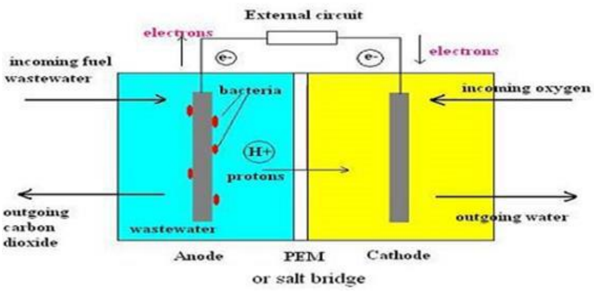

Fig -2: Basic figure of double chamber microbial fuel cell

2.3 Single Chamber Microbial Fuel Cell

This type of MFC is made up of one chamber only that contains both the anode and cathode, which was introduced by Doo Hyun Park and J. Gregory Zeikus in 2003. The anode is either positioned far or near to the cathode separated by PEM. It has been stated that by decreasing interelectrode spacing, internal ohmic resistance can also be diminished. This can be achieved by evading the use of catholyte as a result of joining two chambers and thus raises the power density. Such MFC is simple and economical and also produces much power in rival to double chamber MFCs. However, in single chamber microbial fuel cell the major problem such as microbial adulteration and reverse passage of oxygen from cathode to anode occur normally. Single chamber microbial fuel cells propose simpler and economical designs. Such MFCs generally have simply an anodic chamber with no requisite of air in cathodic chamber.

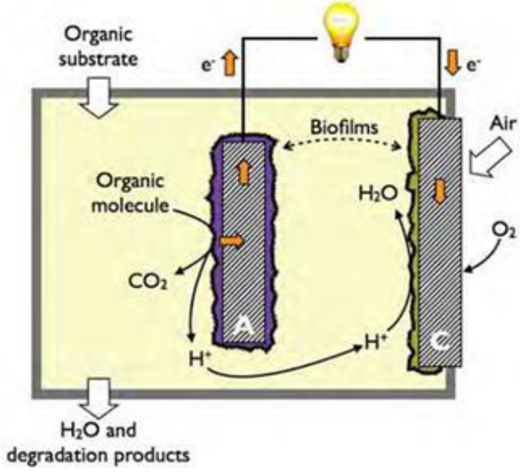

Fig -3: Basic figure of single chamber microbial fuel cell

2.4 How MFC differ from ordinary batteries

Just like a normal battery, associate degree MFC uses energy to get electricity. associate degree MFC has 2 electrodes control in separate chambers. The anode chamber that contains the bacterium is anaerobic. this implies that it doesn't contain gas. The cathode chamber is aerobic. which means it will contain gas. The reaction method happens within the bacterium living within the anode chamber. This takes advantage of the reaction that bacterium do naturally throughout metabolic process. lepton bonds hold along the molecules within the food that bacterium eat. The bacterium break those bonds to unleash the electrons. Electricity from plants by Plant-e BV (1:51 min.). Cellular respiration will continue for as long because the bacterium have food. bacterium will digest just about something. they'll digest body waste. they'll conjointly digest different waste merchandise like ammonia, ethanol, or acetate. This makes MFC technology extremely engaging. It will generate electricity and obtain obviate waste at identical time! Generating electricity victimization bacterium isn't a replacement plan. In fact, it's been around for over a century. therefore why hasn't MFC technology delivered on its promise yet? the look and materials wont to build the electrodes have greatly improved. However MFCs still generate comparatively low currents. Why? One reason is that electrons given off throughout metabolic process don't transfer well from the bacterium to the anode. Bacteria utilized in MFCs area unit referred to as exoelectrogens. they're electrochemically active and may transfer electrons outside their cells. The electrons they furnish off reach the anode in one in all 3 ways.

- They can be transported by macromolecule carriers on the cell surface.
- They can be exported through plasma membrane projections (nanowires).
- They can be secreted in chemical solutions (mediators).

3. WORKING

The main objective of this project is to develop a technology for production of electricity with renewable energy sources, in order that the utilization of fossil fuels is a smaller amount. The MFC is cell, that transforms energy into current victimisation oxidoreduction method. The key distinction is that MFCs believe in living biocatalysts to facilitate the movement of electrons. during this there square measure anode containers that consists of anode and cathode containers that contain cathode. each anode and cathode square measure separated by an iron selective membrane and connected at the side of external circuit within which load is connected. once associate degree organic fuel is fed in anode chamber, the bacterium oxidizes and scale back the organic concern generate life sustaining energy. The electrons pass from the anode to cathode through the external load affiliation. At a similar time, nucleons pass freely into the cathode through proton exchange membrane or salt bridge. Finally, associate degree element gift at the cathode recombines with H and also the electrons from the cathode to supply water, therefore finishing the reaction.

4. CONCLUSIONS

There is necessity to talk about low power densities in MFC operation by existing optimization of design to reduce the losses affected by activation, ohmic, and concentration over potentials. Further, losses caused by unnecessary reaction, for example, the direction oxidation of fuel by O2 diffusion into the anodic chamber or microbial metabolic reaction, which do not benefit the process, must also be targeted. On the other hand, increasing the system volumetric capacity must be attained short of internal energy losses. In this direction, stacking MFCs is a common choice to evade catastrophic losses. Furthermore, tubular and other stacked methodologies continue to be explored. Ongoing efforts are being made to establish batter electrons transfer mechanisms among the electrode surfaces and also by applying catalyst coating on the electrode surface. The MFCs is poised to change the visage of the energy scenario and waste water treatment process in the near future. However, this requires extensive research with respect to appropriate design of fuel cell, reduction in electron loss, etc. At present the MFCs are used for electricity production from waste water.

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