International Journal of Advance Research in Science and Engineering
Volume No.07, Issue No.02, February 2018
www.ijarse.com
IJARSE
ISSN: 2319-8354

Generating Electricity with Microbial Fuel Cell (MFC)

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ABSTRACT

This paper reviews Microbial Fuel cell. First objective is to discuss microbial fuel cell. Second objective is to put forth various experiments done by me in generating electricity through microbial fuel cell. Till now majority of Microbial Fuel cell are using graphite as anode and cathode separated by Proton exchange membrane. I have used Graphite and Magnesium as electrodes for generating electricity in single chamber without any membrane. Uses of this MFC for various applications.

Last year I had submitted Paper "Innovative soil cell generating electricity from soil" in Indian Science congress (104th). And it was selected for poster presentation.

Keywords: Microbial fuel cell, Renewable energy, Free energy, perpetual energy, non-conventional energy

I INTRODUCTION

Today we face three major problems in the world first is availability of fresh water, Second is how to eliminate / reduce pollution and third is energy generation required to operate various equipment. On earth energy is available everywhere in the form of thermal, wind, sunlight, chemical, hydro etc. But as we have developed equipment which require electricity to work, we have to convert this energy available in various form into electricity.

At present I have carried out various experiments for generating electricity with microbial fuel cell from soil, which can provide sufficient energy to lit up LED lamp, charge mobile phone batteries or switch on sensors.

Microbial cell uses earth soil / mud (dirty) to produce energy along with clean water and also treats waste. Soil is available everywhere and microbes are present in all soils / mud. This Microbial fuel cell does not generate any hazardous waste, gives out clean water and clean energy.

Generally Microbial Fuel cell consists of Anode and Cathode separate by membrane. Container of Microbial Fuel cell is of polycarbonate/ glass. Anode and Cathode are from Graphite, but other materials are also used. Anode and Cathode are separated by Proton exchange membrane. Microbes in anode chamber react with organic material and produce electrons, protons and carbon dioxide. Electrons produced are transported from Cathode to anode through external circuit and light up the LED connected to it in the circuit. MFC can be single chamber or double chamber. While protons transported through PEM (Proton exchange membrane) to cathode.

In my experiments I have used Graphite and Magnesium with soil as substrate in single chamber MFC.

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II WORKING PRINCIPLE OF MICROBIAL FUEL CELL

Reactions at Electrodes

Considering Acetate as substrate, reactions taking place will be as per following

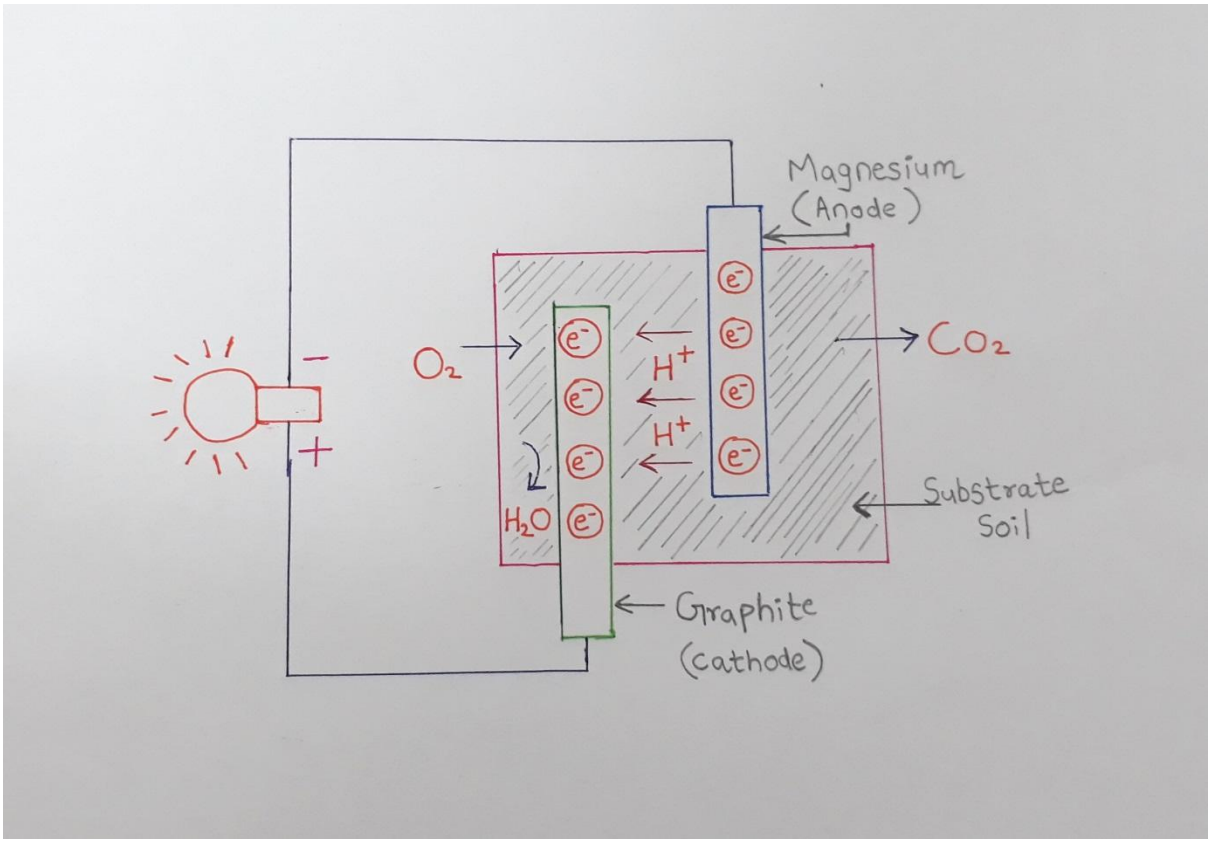
Reaction at Anode : $CH_3COOH + H_2O \xrightarrow{\text{Microbes}} 2CO_2 + 2H^+ + 8e^-$

Reaction at cathode: $O2 + 4e^- + 4H^+ \xrightarrow{\text{Microbes}} 2H_2O$

Total reaction : $CH_3COOH + H_2O \xrightarrow{\text{Microbes}} 2H_2O + 2CO_2$

Thus during MFC carbon di oxide is evolved at Anode and Water is produced at Cathode.

III SCHEMATIC DIAGRAM OF MFC



IV DEVELOPMENTS IN MICROBIAL FUEL CELL

First microbial fuel cell was developed by Mr Potter in year 1911which showed that electricity can be produced through organic material. In year 1931 Cohen further developed this MFC by producing around 35V. Different types of substrate, electrode materials, microbes have been tried over the period. Lot of research has being done to convert human waste for generating electricity during long flights (Cohen 1963),

V APPLICATIONS

Over the period due technological developments many devices have been developed which consume very less energy when it is compared to around 50 years back. For example LED lamps and mobile phones when compared to filament bulb and radios working on valves. Considering this we can use this electricity to power small electronic devices such as LED lamps / torches, charging mobile phone batteries, sensors in remote areas or spaceships.

MFC can be used for waste water treatments. MFC can convert biomass into electricity by metabolism activity of microbes. This serves the dual purpose generating electricity and waste water treatment.

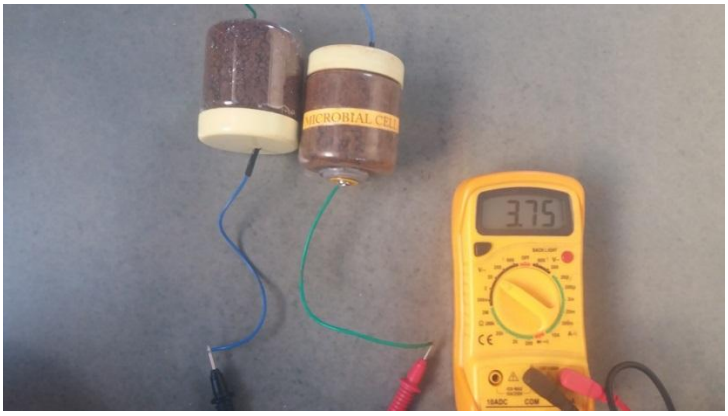
MFC can be used for production of hydrogen through microbial electrolysis.

VI RESULTS OF EXPERIMENTS CARRIED OUT

I had prepared. Single Chamber MFC by using soil, Electrodes are of Magnesium & graphite. Container is of polycarbonate. :

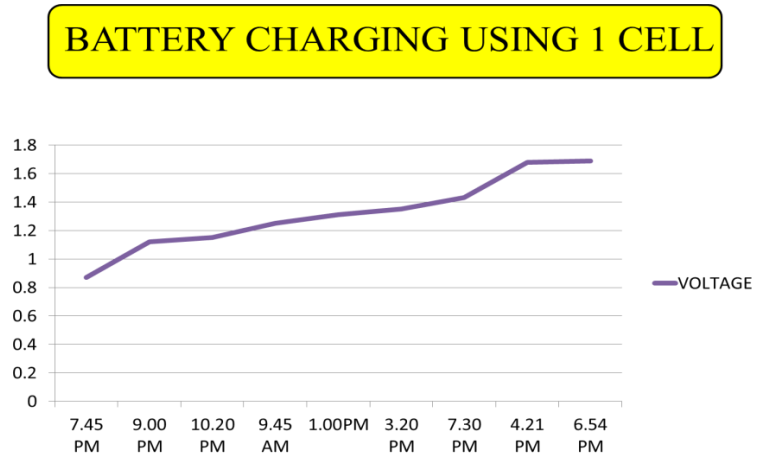
1) Around 1.8V produced with MFC. Photograph also shows moisture being produced during electricity

2) Around 3.75V produced with 2 MFC connected in series.



3) LED lighted with two MFC joined in series

4) Charging of batteries



VII CONCLUSIONS

MFC is a very ideal source for generating electricity. Lot of researches are being done in this field. Cross functional team from Electrical engineering, Chemical engineering, material science should come together and work in this area to come out a with a solution to develop a MFC which will be at low cost, easy to handle , maintenance free and generate sufficient voltage and current to successfully power the devices. At present real problem is the low current density and power. Presently this technology is at very infant stage, but research is being done and soon solution will be available due to which it can be commercialized and available for use for everybody.

VIII ACKNOWLEDGEMENTS

I would like to thank Prof S. M. More, Head of the Electrical Engineering Department for guiding me in my project. Also I would like to thank Prof . Swapnil Patil for advising me in this project. I would like to thank Guru Gobind Singh Polytechnic College for allowing me to complete this project as the part of independent student research.

REFERENCES

1) Innovative cell generating electricity from soil
Pawandeepsingh Dhingra, S. M. More, S. S. Patil
Guru Gobindsingh Polytechnic College, Nashik422009

2) Microbial Fuel Cells: Electricity Generation from Organic Wastes by Microbes
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3) An experimental study of Microbial Fuel cells for Electricity generating : Performance charaxterization & capacity improvement

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