Study of an Experimental Microbial Fuel Cells for Domestic Waste Water Treatment & Performance Characterization

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***Abstract*: Energy problem is a global issue that has a serious effect on many countries in the world. The demand for energy is currently growing far greater than the supply of the nationally generated energy. In order to overcome energy crisis and the output pollution of the generation, it is suggested to use the Microbial Fuel Cell (M.F.C). M.F.Cs are devices that use bacteria as a catalyst to oxidize organic and inorganic matters and generate electric current. With the modifications that are suggested by this study, there will be clean, available and suitable energy source. Besides having the property of being efficient, eco-friendly and Cheaper than the other resources, it can utilize the sewage to generate electricity and produce clean water, which mean cleaner environment with a great supply of energy and clean drinkable water. Facing challenges that affect the development of the M.F.Cs is an important aspect to be studied, so our study suggests solutions nearly for all the challenges facing them like the types of the electrodes, output pollutants, the catalyst in the cathode chamber and the real application.**

***Keywords*: Microbial Fuel Cell, Anode, Bacteria, Cathode, Agar, Biofilm, Catalyst**

Introduction: Renewable energy field is the majority of the current age because of its importance in developing the humanity. The demand for energy nowadays is going far greater than the generated energy. There are many renewable and nonrenewable energy sources like the fossil fuels and wind energy. There is no effective way to keep us working with fossil fuels and reduce greenhouse emissions. The efficiency is an essential component of any plan to get us back on the track of balanced growth. So, new energy sources and technologies must be developed to achieve the required efficiency. Also, their output pollution should be taken in mind as it may affect the environment. As a result, these new solutions should produce carbon dioxide at a lower rate. If we see the example that in man's life-essential activities, wastes are produced, a technology that can use these wastes and turn them into useful energy, is probably the most close-to-Nature form of energy production. In order to decrease the pollution and find an eco-friendly energy source, it is suggested to use the microbial fuel cells (MFC). MFCs are devices that benefit from the natural metabolism of microbes to produce electrical power. There are many challenges facing the MFCs such as the output pollutants and how to reduce them, best electrodes to get the highest performance, suitable substrate to provide food for the bacteria (microbes), facing limiting factors of the MFCs, the cost of the catalyst and its performance, the exchange field, and the best design for all the project. Unlike costly and difficult to be obtained energy alternatives, this device provides inexpensive energy source for any person at any time. As a result from these challenges, this research is proposed to be figured out to help solving them, that's why there can be found new, efficient and clean energy sources. Also, it is said to help finding clean environment with more energy sources and clean water from the technique of wastewater treatment by the M.F.C projects. This technology is under supervision for large scal economic output. Well multiple application of this mehod made it fessiable for small case study.

Agar Salt bridge assembly

Salt bridge was prepared by 0.4 c.m. diameter level cylinder. This salt bridge was arranged with sodium chloride and 5.5 % of Agar is added than the solution was boiled for some time. The concoction was put into the tube and permitted to harden. This salt bridge was used to insert into the consequent microbial fuel cell and potted with help of tape.

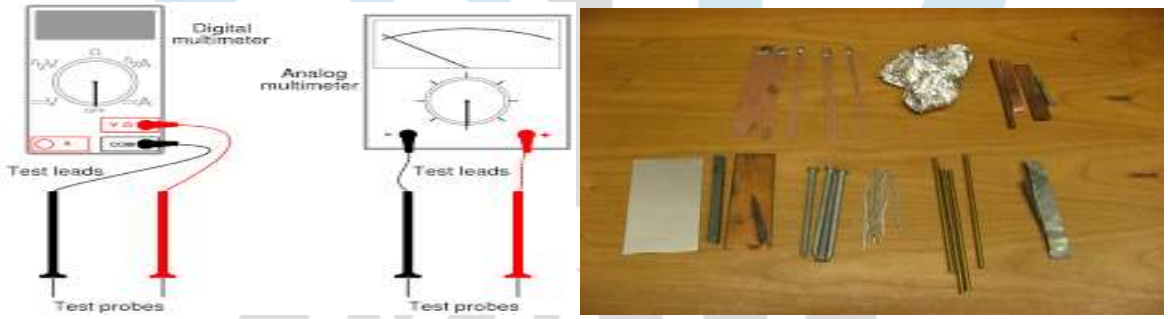
Fig:- Microbial Fuel Cell in series

MFC mechanism

MFC is assembly of different Electrodes, Anode chamber, Cathode Chamber and Salt Bridge. The effluent is filled in anodic chamber. to forms a bridge between cathodic andanodic chamber the salt bridge is fabricated. Make possible the movement of ions (protons). Steel and Graphite are used as electrodes of diffrent cross section area.

MFC assembly

In this case study two chambered fuel cell was Used. Two plastic bottles of 1000 ml capacity.
with radius 10 mm were in use for the experiment and indicated as cathode and anode. Two holes were made of diameter 5 mm and 1.6 mm on both the plastic bottles for the introduction of the salt bridge and electrodes. To fill anode chamber distilled water is used and for the cathode chamber and Dairy waste water with activated yeast was used and both chamber lids were bunged air tight and potted with the help of tape.



Collection of Waste effluent and Analysis of Characteristics:

Domestic waste water effluent is collected from model science school hostel Mandla. More than two waste water effluent sample is taken from source. Collected sample of waste water effluent is put in the refrigerator at 4ºC for process of slow down the microbial activity. This waste water sample is non noxious and wealthy in organic matter and this effluent is analyzed in the laboratory to come across the preliminary personality of the waste water effluent which are Total dissolved solid, Chemical oxygen demand, Biochemical oxygen demandand the experiment outcome are revealed in Table-1 below

Point	Characteristics	Results
1.	Colour	Light green
2.	Odour	Bad
3.	pH	6.4
4.	BOD (**mg/Liter**)	310
5.	COD (**mg/Liter**)	607
6.	TDS (**mg/Liter**)	490

Table 1. Preliminary Characteristics of Domestic Wastewater

Experimental setup:

The Basic arrangement of double chember microbic cell for waste water treatment and electricity generation contains following items:

• two plastic bottles of 1000 ml capacity.

• Salt bridge to interconnect the bottles.

• two electrodes.

• multimeter for voltage measuring.

• yeast as an accelator.

Result and discussions

Removal efficiencies along with the electrical properties are monitored for each experimental setup and experimental setup with stainless steel of larger surface area showed higher removal efficiency and stable electrical properties. The extent of COD removal is noted as 93.98%, whereas BOD removal efficiency is 90.63% as comparing with all other results. Graphical representation of in electricity genration with respect to various experimental setups are shown Below.

Characteristics of Domestic Wastewater

Sl No.	Parameters	Before	After
1.	Colour	Light green	Light green
2.	Odour	Bad	Bad
3.	pH	6.4	6.6
4.	BOD (mg/L)	310	261
5.	COD (mg/L)	607	492
6.	TDS (mg/L)	490	349
7.	Maxmium voltage (V) - .098		

***Conclusion*:** From the experimentation named Study of An Experimental Microbial Fuel Cells fo Domestic Waste Water Treatment & Performance Characterization conclusions is that the present study successfully presents the MFC as an excellent resource recovery technology in the Domestic wastewater treatment and off- grid electricity production.The good outcomes and consequences of using two different types of electrodes (Stainless Steel and Copper) as anodic and cathodic electrodes in MFC are monitored and Stainless Steel is found significantly better in terms of both treatment efficiency and electricity generation

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