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Electricity Generation and Treatment of Sea Water Using MFC Technology with Wetland Process

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***Abstract*: In today's era, we are facing 2 most dangerous issues i.e., Water Scarcity and Lack of Cheap and easily available energy. Clean potable water and Cheap Energies are the 2 most important aspects without which the survival of human being is not easy. The only water which is available in abundance is the sea water but, the problem is that the sea water can't be consumed by living organism to fulfill any of their demands for their survival. The other important element i.e. the energy is not available in abundance because since some decades we are using the non-renewable energy resources as a huge contribution towards the generation of energy of proving the energies to various machines, factories and other units which requires energy for it' proper functioning. However, there are other sources of energy i.e. the Renewable sources of energy such as solar power. Ocean energy, etc. but, they can't be used extensively by common man because they have high cost for their installation and maintenance. To find a solution to these problems, I have come out with a setup which treats and desalinated sea water as well as produces energy in a cheap and natural method without using any chemicals.**

***Keywords*: MFC Technology, Wetland Process**

1. Introduction

A. General

In order to treat water and produce energy we use a setup which performs both the work simultaneously. Fossil fuels are currently the main source of electricity production. Combustion of fossil fuels causes air pollution severely affecting human health and nature. This results in an increasing demand for renewable electricity sources. One of the emerging renewable electricity technologies is the plant microbial fuel cell (PMFC) as explained in chapter 1. PMFC generates electricity from the rhizo deposits of living plants. Naturally occurring electrochemically active microorganisms oxidize the rhizo deposits producing electrons at the anode of the PMFC. The electrons flow from the anode, via an external circuit where the electricity is harvested, to the cathode. At the cathode, the electrons reduce oxygen to water. PMFC is based on naturally occurring sustainable and renewable processes without net emissions and competition for arable land or nature. Large scale application of the PMFC is preferred in wetlands because a large waterlogged area is required. A microbial fuel cell is a bio-electrochemical device that harnesses the power of respiring microbes to convert organic subtracts directly into electrical energy. At it's core, the MFC is a fuel cell, which transforms chemical energy into electricity using oxidation reduction reactions.

2. Methodology

The model includes wetland setup with mangroves in it. The layers of wetland include gravels, jute cloth, foam board with tiny holes, bio filter paper, coarse sand, fine sand and mangroves with it's roots from bottom to top. When the sea water is added to the glass tank, the water infiltrates through the in sand and reaches the roots where the roots treat the salinity of the water by absorbing salts from the sea water and transferring it to the leaves. This water then passes through the bio filter which obstructs the fine sand, foam board which obstructs the coarse sand and jute which absorbs other suspended and colloidal impurities from the water. Then, this water passes through the gravels which conducts the anaerobic process where biodegradation occurs and removes some bacterial impurities from water.

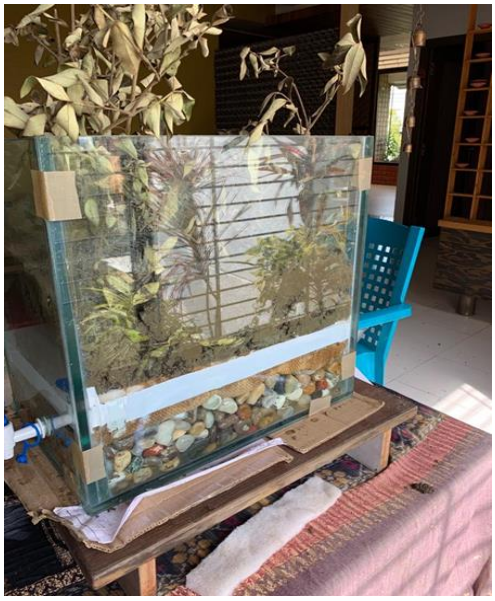

Fig. 1. Wetland Setup

After treatment of sea water, this water is collected through the tap and passed to the electrolytic chamber. When an organic fuel (collected water) enters the anode chamber, the bacteria set to work oxidizing and reducing the organic matter to generate the life sustaining ATP that fuels their cellular machinery. Protons, electrons and carbon dioxide are produced as by products, with the anode serving as the electron acceptor in the bacteria's electron transport chain.

The newly generated electrons pass from the anode to the cathode using the wire as a conductive bridge. At the same time. Protons pass freely into the cathode chamber through the proton exchange membrane separating the 2 chambers. Finally, an oxygen present at the cathode recombines with hydrogen and electrons from the cathode to produce pure water, completing the circuit. Replace that wire with a light bulb or some other device that requires electricity and you have effectively harnessed the power of microbes to solve your energy needs.

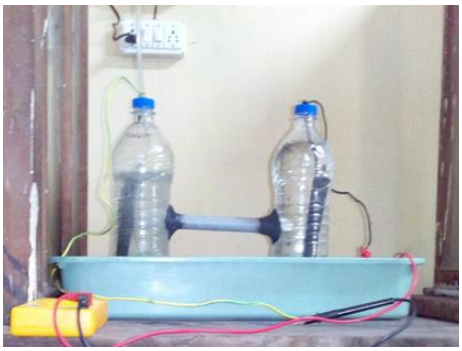

Fig. 2. MFC Setup

The materials used for the electrolytic chamber is copper wires which is used as a material for the external circuit that connects the cathode and anode. Aluminium used as anode and cathode. The conductive bridge is made by soaking a cotton rope overnight in salt solution.

The reactions that govern a MFC are:

Anode: H2 ◊ 2H+ + 2e

Cathode: $1/2O_2$ + 2H+ + 2e- ◊ H_2O

3. Future Scope

As there is an increasing need of fresh potable water and energy sources, this project has a great future scope as an economical, natural and safe methods to produce fresh useable water and generate electricity as it doesn't use chemicals. It only uses the natural elements available at very low cost without causing any harm to the environment.

4. Conclusion

The sea water which passes through the wetland setup and the electrolytic chamber not only treats sea water but also generates energy using the bacteria and microorganisms present in the wetland setup. The Principle of the wetland process is to filter the water and make it free from the suspended and colloidal particles and the aim of the electrolytic chamber is to use the microorganisms and bacteria from the wetland and produce energy by converting the chemical energy to electrical energy.

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References

[1] Aelterrnan, P., Rabaey, K., Pham, T.H., Boon, N. and Verstraete, W. (2006) Continuous electricity generation at high voltages and currents using stacked microbial fuel cells. Environmental Science & Technology 40, 3388-3394.

[2] B. E. Logan, "Microbial Fuel Cells: Methodology and Technology," American Chemical Society, pp. 1-10, 2006.

[3] B. E. Logan, Micorbial Fuel Cells, Hoboken, New Jersey and Canada: John Wiley and Sons Inc., 2008.

[4] M. Potter, "Electrical Effects Accompanying the Decomposition of Organic Compounds," royal society publishing, pp. 111-260, 1911.

[5] C. Hicks, "Morocco lights the way for Africa on renewable energy," the guardian, 2016.

[6] M. Laila and O. Naaila, "Water and wastewater management in Morocco: Biotechnologies application," Sustainable Sanitaton Practice, 9-16. p. 9, 2013.

[7] S. G. A. Flimban, T. Kim, I. M. I. Ismail, and S. Oh, "Overview of Microbial Fuel Cell (MFC) Recent Advancement from Fundamentals to Applications: MFC Designs, Major Elements, and Scalability," p. 48, Preprints 2018.

[8] K. Guo, D. J. Hassett and Tingyue Gu, "Microbial Fuel Cells: Electricity Generation from Organic Wastes by Microbes," Chapter 9 in Microbial Biotechnology: Energy and Environment edited by R. Arora, ISBN 978-1845939564, pp. 162-189, CAB International, Oxon, United Kingdom, 2012.