



Bioelectricity Production from River Waste Water

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ABSTRACT

*Bioelectricity is one of the major non-conventional forms of the energy. The aim of this systematic study was to update the current state of research and to evaluate biological effects of static electric field. Developmental bioelectricity refers to the regulation of cell, tissue, and organ-level patterning and behaviour as the result of endogenous electrically mediated signaling. Cells and tissues of all types use ion fluxes to communicate electrically. The charge carrier in bioelectricity is the ion (charged atom), and an electric current and field is generated whenever a net ion flux occurs. Endogenous electric currents and fields, ion fluxes, and differences in resting potential across tissues comprise an ancient and highly conserved communicating and signaling system. In this current study MFC (Microbial Fuel Cell) from river waste water was prepared. These MFC contain copper wire (2.0 mm) as anode and aluminum plates as the cathode. When consistently water quality indices were checked, we found 10 % reduction in the values of BOD and COD. In this study we can see the continuous production of potential difference of 2 volts. It was also observed that Potential difference was increased after addition of 5% Methyl Orange within the river wastewater. The 5 days of Incubation period, increase in the potential difference was observed. Current study of the isolates confirmed that they have ability to convert organic matter of river waste water to nitrate and nitrite by nitrification process. In further study, the fish toxicity assay was performed using the selected *Cyprinus carpio* (Common carp) and *Poecilia reticulata* (Gappi) and found to have zero mortality rates after treatment.*

Key words: Bioelectricity, Nitrification process, Fish toxicity, Water quality indices.

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INTRODUCTION

Our regular life is totally dependent on electricity. Be it Lights, Fans, escalators, vehicles on the road, water supply to home; almost everything requires energy-“The electrical energy”. Now a day's electricity has reached to remote areas. Thus, resultant requirement of electricity is very high. Along with conventional production, bioproduction of electricity is very essential [12]. A way has been studied towards Green Energy. Bioelectricity is produced by the different phenomenon like electron transport chain reaction and glycolysis. Microorganisms also show potential to produce bioelectricity. Bacterial cultures also have ability to produce potential difference. For this Purpose we need to accessorize the bacteria with MFC (Microbial Fuel Cell). MFC is nothing but the apparatus which required to collect the electrons. The study of MFC was first used by [1][2] to generate electricity the *E. coli*. and electrodes. Biochemical fuel system generates electric current by diverting electrons produced in redox reaction. In MFC the anodes perform as electron donar and oxidizes compound and the cathodes perform as oxidizing agent or electron acceptor. MFCs can be grouped into two general categories: Mediated and Unmediated. In early 20th century, Mediated MFCs were common.

The mediator used for this was chemicals. Unmediated MFCs emerged in the 1970 in this type of MFCs bacteria are mediators and typically have electrochemical activity due to redox proteins such as Cytochrome on their outer membrane. In the 21st century MFC have started to find commercial use in waste water treatment. For the preparation of MFC reuse able plastic containers were used. Then these containers are attached with cathode (aluminum sheet) and anode (copper wire 2.0 mm). Then MFCs are connected in series to complete the circuit along with multimeter. The first reading of the sample was noted as ± 1.019 m volt. Microbial fuel cells (MFC) are having operational or functional advantages over the technologies currently used for generating energy from waste water. This study showed that production of large amount of electricity can be produce which can be used for household or small scale use. The bioelectricity production can be future project to be a good solution over a big problem of shortage of electricity and waste water management [5].

MATERIAL AND METHODS

Collection of sample: Sample of River waste water was collected in month of March, 2022 from local area of MulaMutha river, Manjari (Pune, Maharashtra)[6][7].

Preparation of MFC:

Microbial fuel cell (MFC) set up was prepared by using reusable plastic bottles. These bottles were attached with cathode (Aluminum Sheet) and anode (Copper wire 2.0 mm).

Checking of Water Quality Indices

The Physico-chemical parameters such as Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD))were analyzed at first day and five days using standard manual protocol.

The voltmeter is connected in a circuit in parallel to measure the voltage in the circuit[8][9].

In this study we have checked different water quality indices as Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), total suspended solids (TSS), Temperature and pH. In first observations COD values of the river waste water were high. COD of sample was in a range 600 to 900 mg/l. After treatment it showed 10 % reduction in COD values [3][4].

Determination of Fish Toxicity Assay

Aquatic Toxicity of river waste water was measured by fish bioassay. A river waste water can be tested for this criterion by placing some waste in a test water tank and introducing .The fish toxicity assay (RAR) was conducted with the selected *Cyprinus carpio* (Common carp) and *Poecilia reticulata* (Gappi) fishes. Mtsya beej kendra (Hadapsar) showed zero mortality rate at different concentration. At room temperature for 96 hours of incubation.[10] (Table 5)Waste is hazardous by aquatic toxicity1 if a 96-hour LC50 is less than 500 mg/liter.96-hourLC50 < 500 mg/l = acute aquatic toxicity For more information, here is the procedure for the acute aquatic toxicity bioassay per [11].

Bioelectricity Generation from Algal Biomass Using Microbial Fuel Cells (MFCs)

A six chambered MFC was constructed. Two holes of diameter 5 mm were made on each bottle lids for the insertion of the salt bridge and electrodes. Take a 700 ml river waste water sample in each microbial fuel cell. Then the circuit was completed by using electrical wire 0.5 mm . And LED bulb connected to anode and cathode, and then observe for electricity generation; By checking if the bulb glows or not [1][2][3].

RESULTS AND DISCUSSION

The experiment of bioelectricity was carried out for 120 hours i.e. 5 days in aerobic and anaerobic conditions. Outcome of these experiments showed bioelectricity production from River water sample.

Different water quality indices such as Temperature, pH, BOD, COD were checked. During the treatment there were no fluctuations in temperature. (Table 3.1)

[H+] ion potential plays very important role in Microbial Life cycle. During this whole process of bioelectricity production. There were no fluctuations in pH values. (Table 3.2)

pH values of river waste water was continuously checked by using pH meter and pH indicator strip

This is composed of naturally occurring microorganisms and organic load from commercial as well as Nitrifying biomass material. The potential difference is directly proportional to the number of microbial fuel cells (MFCs) and its seasonal condition whereas it is also dependent upon organic material present in it.

Table 3.1: Temperature of Five days

Temperature	Day1	Day2	Day3	Day4	Day5
Blank	31 ⁰ C	31 ⁰ C	31 ⁰ C	31 ⁰ C	31 ⁰ C
Sample	31 ⁰ C	32 ⁰ C	32 ⁰ C	34 ⁰ C	34 ⁰ C

Table 3.2: pH of Five days:

pH	Day1	Day2	Day3	Day4	Day5
Blank	7	7	7	7	7
Sample	6	6	7	7	7

Table: Determination of fish toxicity assay of Aqua RAR formulation

Recommended Family	Recommended Fishes	After treatment mortality rate is because no any death of fishes occur in water sample after treatment of MFC				
		DAY1	DAY2	DAY3	DAY4	DAY5
Cyprinidae	<i>Cyprinus carpio</i>	10	10	10	10	10
Poeciliidae	<i>Poecilia reticulata</i>	10	10	10	10	10

CONCLUSION

Bioelectricity production was carried out by microbial fuel cells [MFC] by using river waste water sample. This waste water sample was checked for its potential to generate bioelectricity under aerobic and condition. The experimental data showed the electricity generation by gradual increase from Day 1 to Day 15. Fish toxicity assay revealed that treated water is safe to release in normal waterbodies. The BOD and COD values and bioelectricity production of waste water sample was declined at the end of experiment.

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