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Textile Wastewater Treatment and Electricity Generation by MFC Technology

A. R. Gaikwad
(Lecturer, Guru Gobind Singh Polytechnic, Nashik)

Harshwardhan Donde, Shubham P. Chavan, Parth S. Gupta, Apoorva Jadhav, Rahul G. Dagale
(*Student, Guru Gobind Singh Polytechnic, Nashik)*

ABSTRACT:
In the present scenario, water resource is very scarce. Environmental issues associated with disposal of waste water is not confined to developing countries. waste water sources are major cause of environmental pollution. This water must be properly treated before disposing it into environment so it will help in prevention of pollution of ground water source and underground water sources too. current waste water treatment does not meet's the expectation we need all over the world wide. As an alternative to existing treatment, microbial fuel cell technology can produce more electricity and is also cost intensive. here, we are presenting a review on microbial fuel cell for dye decolourization from textile industries. although the recent development in textile industries and its innovation, the waste generating through it is much harmful to environment (this article presents the possibility of energy generation and wastewater treatment).

1.INTRODUCTION

Demand or need of energy is increasing each year and thus more fossil fuels are depleted and more pollution occurs. Energy plays an important role in development of country as well as its economic growth. In a past years, the industrialization in most of countries like India is increasing rapidly. As a result of this, pollution all over the world is also increasing. This cumulative adverse effect of pollution must be reduced as for future growth of country. Current wastewater treatment processes are cost-effective. Microbial fuel cells technology is an ultimate solution for energy generation and treatment of waste water
through industries.

Textile industry is one of the most dye wastewater producing industry. The main aim of this research work is to examine the textile industry on its wastewater generation. Microbial fuel cell (MFC) is a fuel cell where chemical energy is converted to electrical energy by catalytic action of micro-organisms. In this, anode and cathode compartments separated by proton exchange membrane (PEM).

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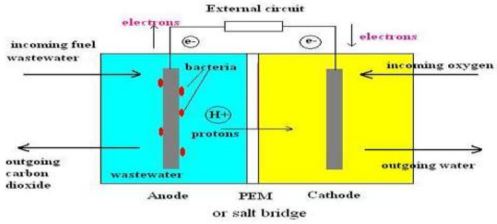

Fig. 1 Agar Salt Bridge

2. Material and Methods

1. Borosil Glass Bottle Of 1000ml capacity of customised size (standard size) was used as a scientific apparatus, manufacturing company (SCAM India) Nashik, India as a reservoir in MFC.
2. Electrode where extracted from exhaust0d everready batteries by graphite rods.
3. From local vendors, some electrical hardware where brought such as internal resistance, digital multimeter and copper wire.
4. Digital multimeter was used to record all voltages during experiment.

3. MFC Fabrication

One double chambered MFC reactor was fabricated. The reactor was fabricated using non-reactive plastic containers with total volume of 10 liters and the working volume was 7 liters. 1. Graphite rods from pencils 2.Aluminium mesh Electrode 3.Copper Electrode 4.Carbon electrode were used as both anode and cathode materials. The arrangement of graphite rods (75 mm in length & 2mm in diameter) was made in such a way as to provide the maximum surface area for the development of biofilm on anode. The electrodes were connected using copper wire. The anode and the cathode chambers were separated by proton exchange membrane (agar salt bridge). The length and diameter of the agar salt bridge is 5 inches and 1.5 inches respectively. The electrodes were placed in the chambers then were sealed, made airtight and were checked for water leakages.

Fig. 2 Double chambered MFC

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4. MFC Operation

The study was conducted by feeding textile wastewater MFC with different strengths separately (i.e., 100% strength without any dilution.) for Domestic waste Water sample. The anode chamber (anaerobic chamber) was filled with textile wastewater and the cathode chamber (aerobic chamber where oxygen was used as electron acceptor) was filled with KCL solution (catholyte). The internal wiring of anode and cathode was connected to a multimeter to complete the circuit. The entire setup was left for 1 hr for stabilization and the reading in the multimeter was noted down every 24hrs for 12 days of operation.

5. Results and Discussion

(By referring previous researchers)

pH: The pH is important in the dying as the solubility of the dyes depends on it. The pH is depending on the type of cloths processed. The least pH found in wastewater is 7. The maximum pH found in wastewater is 9. The detergents are alkali in nature and is used in large quantity.

Chloride: The least chloride discrepancy is 980 mg/l. The maximum chloride discrepancy is 2185 mg/l.

Nitrate: Nitrate is always greater than 100mg/L. Its minimum nitrate concentration 120mg/l. its maximum nitrate concentration is 627 mg/l

Total hardness: the wastewater values varied from 120 to 150 mg/l . the range for calcium was recorded from 13 mg/l to 29 mg/l and magnesium is in range from 1 to 29 mg/l. the calcium and magnesium represents the hardness of water

Sodium: It is ranged from 975 to 2330 mg/l. The potassium in the industrial wastewater is in lower concentration.

Sulphate: The concentration is varied from 307 mg/l to 2267 mg/l. The huge change in sulphate concentration is because of variety of clothes produced and chemicals used.

Bicarbonate: The range of bicarbonate is from 555 to 1464 g/l. The carbonate is in range from ‘nil’ to 120 mg/l.

The Zinc concentration found between 1 to 1535 µgm/l.

Manganese: It was recorded between 1 to 22 µgm/l.

Lead: Lead in textile wastewater was found between 11 to 61 µgm/l.

Copper: Copper concentration in wastewater from textile industry varies from 6 to 311 µgm/l.

Chromium: Chromium is a problem of textile industry. It is used for khakhi dyeing. It is ranged between 7 to 7854 µgm/l.

Iron: It is also used for khakhi dyeing. It ranges between 17 to 163 µgm/l.

Biochemical Oxygen Demand: BOD varies from 500 to 1010 mg/l.

Chemical Oxygen Demand: COD varies from 1600 to 3200 mg/l.

Electrical Conductivity: It is generally between range of 4430 to 8710 µs mean value 6709.17 µs.

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6. CONCLUSION

MFCs are a promising technology for the production of electricity from textilewastewater. Double chambered MFC were run parallel. The MFCs were operated by feeding textile wastewater sample.graphite lead electrode and carbon electrode are efficient than aluminium and copper electrode.