CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.3596298

Available online at: http://www.iajps.com *Research Article*

ANALYSIS OF WASTEWATER TREATMENT THROUGH MICROBIAL FUEL CELL

Samia Saeed[1], Muhammad Arsalaan Naveed[2], Umar Sultan[3]
[1]Quaid-i-Azam University, Islamabad
[2]Khawaja Muhammad Safdar Medical College, Sialkot
[3]District Head Quarter Teaching Hospital Gujranwala

Article Received: October 2019 **Accepted:** November 2019 **Published:** December 2019

Abstract:
Introduction: *Waste treatment is a problem for all human settlements from small villages to large cities. The traditional method of aeration produces a water which, although clear of solid matter, is rich in nutrients and has devastating effects when discharged into sea or freshwater.* ***Aims and objectives:*** *The basic aim of the study is to analyse the wastewater treatment through microbial fuel cell in Pakistani environment.* ***Material and methods:*** *This descriptive study was conducted in Quaid-i-Azam University, Islamabad during January 2019 to October 2019. All the laboratory-grade biochemical likes urea (Carbamide); malt (Germinated barley); yeast (Saccharomyces Cerevisiae); glucose (Monosaccharide); fructose (Levulose); xylose; ribose (Pentose sugar); protease (Peptidase); amylase (Glycogenase); xylanase (Rhodothermus obamensis) and ligninase (Lignin peroxidases) were used in experiment and purchased.* ***Results:*** *Different industrial wastewater namely Sugar Industry (SI), Brewery Industry (BI), Dairy Industry (DI) and Lather Industry (LI) were used to check the significance of open voltage production. The result presented in Fig. 2(a). From the presentation, it can be seen that the voltage increase with an increase in the number of experiment days at fixed internal resistance 60ohm. Maximum open voltage 1.18 V (current = 19.6 mA and power density = 3.5 mW/m^2) showed by sugar industry wastewater than 1.15 V.* ***Conclusion:*** *It is concluded that the application of different strategies to overcome the inherent limitations of the mixed microbial metabolisms and other associated operational problems will increase the practical feasibility of bioenergy generation from wastewater.*

Corresponding author:
Dr. Samia Saeed,
Quaid-i-Azam University, Islamabad

QR code

Please cite this article in ***press Samia Saeed et al., Analysis Of Wastewater Treatment Through Microbial Fuel Cell.,*** *Indo Am. J. P. Sci, 2019; 06(12).*

INTRODUCTION:

Waste treatment is a problem for all human settlements from small villages to large cities. The basic processes developed for waste-water treatment (activated sludge, trickling filters and lagoons) were developed over a century ago, and have changed little with respect to the fundamental approach of oxidising organic matter to remove the organic load on receiving water bodies [1]. The traditional method of aeration produces a water which, although clear of solid matter, is rich in nutrients and has devastating effects when discharged into sea or freshwater. Waste-water treatment remains an economic burden to industries and the public.Organic matter in waste-water has energy value, particularly industrial and agricultural waste-waters which have high concentrations of organic matter. It is estimated that domestic waste-water contains 93 times more energy than the treatment consumes [2].

Biodigestion of waste-water sludge has been a step forward, producing biogas which can be used in internal combustion gas engines to produce electricity, but is an involved process that requires large digesters with a low efficiency factor and a low thermal efficiency gas engine [3]. The most successful and widely used biological technology for wastewater treatment is the activated sludge process. In the process, pumping and aeration are the predominant energy consuming, for example, 21% of the total treatment energy demand is consumed by pumping and 30 to 55% consumed by aeration [4].

Microbial Fuel Cell (MFC) is defined as a biologically catalyzed electrochemical system, which can directly convert the chemical energy from an organic substrate to electrical energy through a cascade of redox reactions in the absence of O_2 [5]. Bacteria grow and proliferate by undergoing catalyzing reactions with various chemical compounds and through metabolic pathways producing energy [6].

Theoretical background

During these processes, some bacteria can oxidize reduced substrates, and a coenzyme acts as an electron carrier. The electrons carried down the respiratory chain, in turn, translocate protons and subsequently a chemical energy potential (a proton gradient), it is this chemical energy that can be converted to electrical energy in the MFCs. The electrons then have to be transferred to an electron acceptor, such as oxygen to complete the oxidizing reaction. Microbial fuel cells (MFC) have the potential of solving another humanitarian challenge; excess wastewater [7].

Aims and objectives

The basic aim of the study is to analyse the wastewater treatment through microbial fuel cell in Pakistani environment.

MATERIAL AND METHODS:

This descriptive study was conducted in Quaid-i-Azam University, Islamabad during January 2019 to October 2019. All the laboratory-grade biochemical likes urea (Carbamide); malt (Germinated barley); yeast (Saccharomyces Cerevisiae); glucose (Monosaccharide); fructose (Levulose); xylose; ribose (Pentose sugar); protease (Peptidase); amylase (Glycogenase); xylanase (Rhodothermus obamensis) and ligninase (Lignin peroxidases) were used in experiment and purchased. The microbial fuel cell was constructed according to a novel design as follows. A flask (1-L capacity) was used as the anode chamber, and the cathode chamber was a cylinder of Perspex (capacity of 125 mL) with two end pieces, one of them with a hole was fixed to the anode chamber [8].

The experimental setup of the microbial cell is shown in Fig. 1.

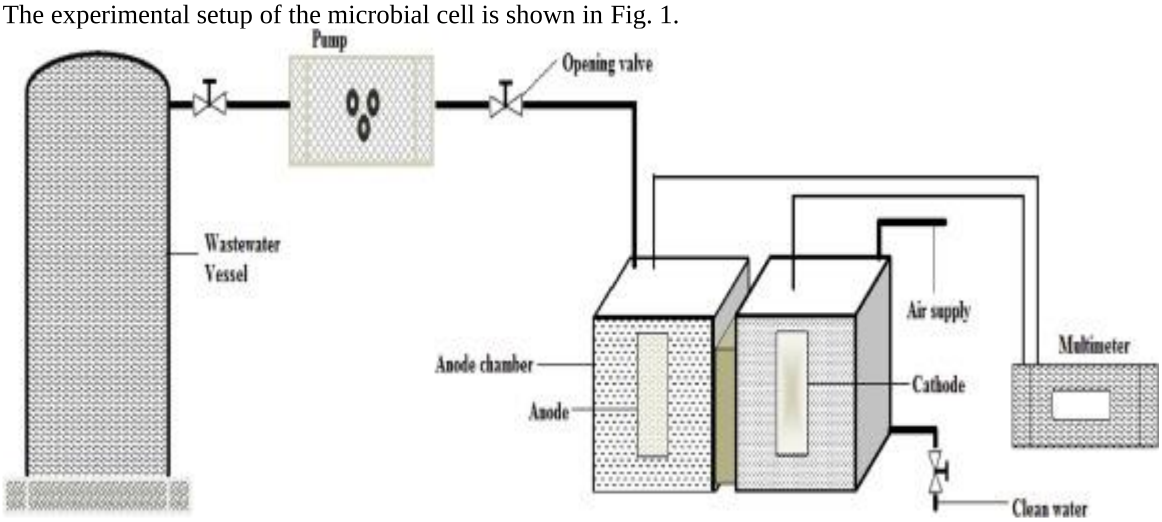
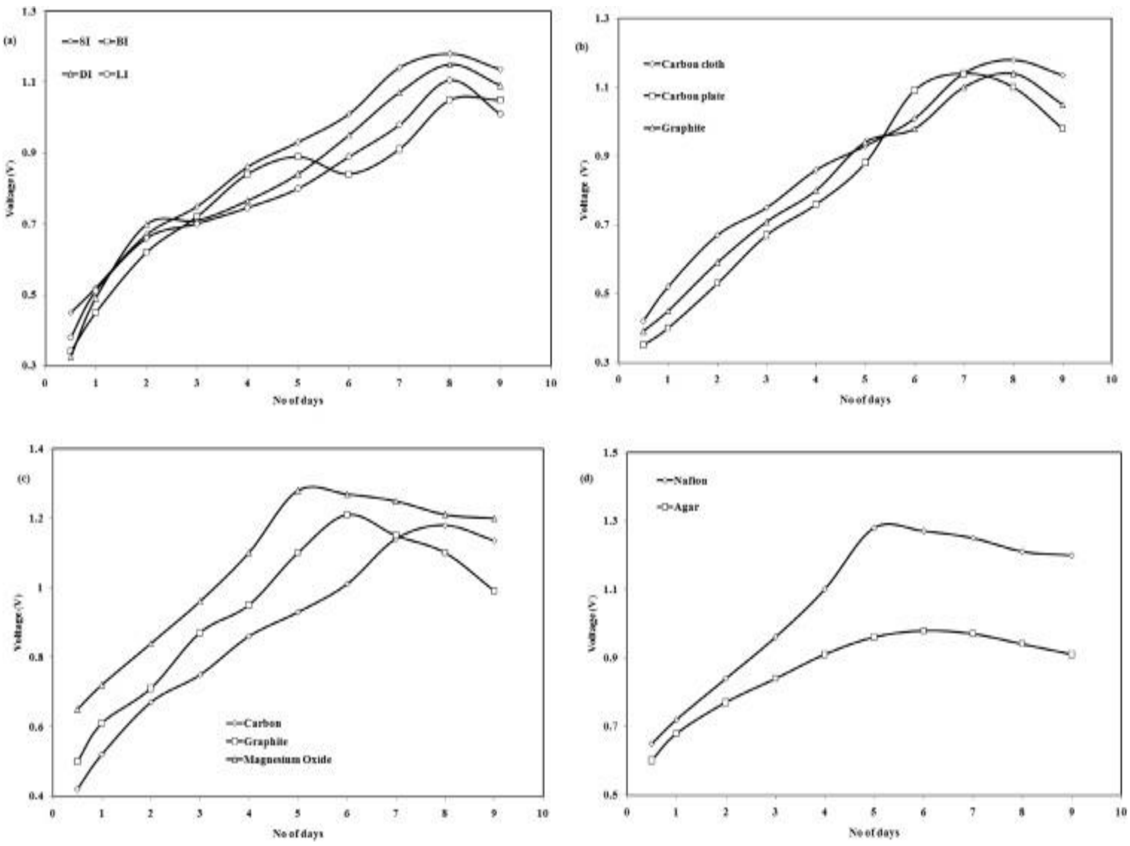


Fig. 1. Experimental setup for microbial fuel cell for wastewater treatment.

Statistical analysis
To determine the microstructure scanning electron microscopy analyser (FE-SEM, HITACHI, S-4700) was employed. The cathode samples were characterized for crystal phase identification by Powder X-ray diffraction (XRD) spectroscopy performed with XPERT-PRO PAN. Analytical X-ray diffractometer and it is operated at 45 kV and 30 mA.

RESULTS AND DISCUSSION:

Different industrial wastewater namely Sugar Industry (SI), Brewery Industry (BI), Dairy Industry (DI) and Lather Industry (LI) were used to check the significance of open voltage production [9]. The result presented in Fig. 2(a). From the presentation, it can be seen that the voltage increase with an increase in the number of experiment days at fixed internal resistance 60ohm. Maximum open voltage 1.18 V (current = 19.6 mA and power density = 3.5 mW/m^2) showed by sugar industry wastewater than 1.15 V (current = 19.1 mA and power density = 3.39 mW/m^2) dairy industry, followed by brewery industry 1.05 V (current = 17.5 mA and power density = 2.82 mW/m^2) and minimum leather industry 1.01 V (current = 18.4 mA and power density = 3.1 mW/m^2) in eight days of the experiment [10].



CONCLUSION:

It is concluded that the application of different strategies to overcome the inherent limitations of the mixed microbial metabolisms and other associated operational problems will increase the practical feasibility of bioenergy generation from wastewater. A combination of carbon paper (anode) magnesium oxide (cathode) and Nafion exchanger of the microbial fuel cell was found appropriate for the treatment of sugar industry wastewater.

REFERENCES:

1. B Logan: "Producing methane from electrical current generated using renewable energy sources using methanogenic microorganisms"
2. S Cheng, et al: "Electricity generation from synthetic acid-mine drainage (AMD) water using Fuel Cell Technologies**",** Environmental Scientific Technology, 2007.
3. B Logan: "Electricity and hydrogen production using microbial fuel cell-based technologies" www.engr.psu
4. N Garba: "An overview of the substrates used in microbial fuel cells", Greener Journal of biochemistry and biotechnology, 2017.

5. Muskateem: “Electrode materials for microbial fuel cells: nanomaterial approach”, Mater Renew Sustain Energy 2015.
6. M Rahminijad, et al: “Microbial fuel cell as new technology for bioelectricity generation: A review”, Alexandria Engineering Journal 2015.
7. V Chaturvedi: “Microbial fuel cell: a green approach for the utilization of waste for the generation of bioelectricity” , Bioresour. Bioprocess., 2016.
8. A Parkash: “Microbial Fuel Cells: A Source of Bioenergy”, J Microb. Biochem. Technol., 2016.
9. Gil GC, Chang IS, Kim BH, Kim M, Jang JK, Park HS and Kim HJ. (2003). Operational parameters affecting the performannce of a mediator-less microbial fuel cell." Biosensors and Bioelectronics 18(4):327-334.
10. ü Kim HJ, Park HS, Hyun MS, Chang IS, Kim M and Kim BH. (2002). A mediator-less microbial fuel cell using a metal reducing bacterium, Shewanella putrefaciens. Enzyme and Microbial Technology 30(2):145-152.