JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

"FUTURE IMPLICATION ON PHYTOREMEDIATION STRATEGIES IN PLANT MICROBIAL FUEL CELL FOR THE ASSESSMENT OF WASTEWATER QUALITY: A GREEN APPROACH TO SUSTAINABLE DEVELOPMENT"

Prof.Sunil Umachagi[1], Rakshit J Malode[2], Kiran Policepatil[3], Pavan Habib[4], Praveen Gulagannavar[5]

[1]Assistant Professor, Dept of Civil Engineering, Jain College of Engineering &Technology,Hubballi.
[2,3,4,5]UG Students, Dept of Civil Engineering, Jain College of Engineering &Technology,Hubballi.

Abstract : Management of wastewater and their disposal is very big problem faced by the world today, Characteristics of wastewater and their level of pollutants vary from industry to industry, brisk industrialization and urbanization in developing countries like India propound major problems in collection, disposal and treatment of effluents, this leads to public health problems and other environmental problems, for constructing a sustainable world we require to minimize the uses of fossil fuels and generation of pollutions. Agricultural waste, household waste and Industrial waste are best substrates for energy productions as they are rich in organic contents. This study has been undertaken to investigate the power generation and domestic wastewater treatment in Plant Microbial Fuel Cell [PMFC], Plant-microbial fuel cells (PMFCs) are an interesting renewable energy technology that has the potential to generate clean electricity without competing with agriculture for land space. We have used anode electrode as copper plate and cathode electrode as aluminum plate. During the study period we have observed that Voltage, Current and Power generation in plant microbial Fuel Cell with respect to 150 Ω were195mV, 1.3mA and 253.5mW respectively. At the end of 21th day 75% of BOD removal efficiency and 68% of COD removal efficiency were observed. During the study time we have also observed 40% of plant growth.

Index Terms **–Plant Microbial Fuel Cell, Electricity Generation, Wastewater Treatment, Genetically Modified Plants, Waste to Energy.**

I. INTRODUCTION

An extended discipline of Microbial Fuel Cells (MFCs) that uses plants as the source of microbial organisms and converts chemical energy to electrical energy is the Plant-Microbial Fuel Cell (PMFC). This technology has gained attention and has been continuously studied for the last decade in which claims to produce non-destructible and sustainable green electricity via living plants. Sustainable renewable energy is the next generation of energy transition and P-MFCs has great competency in reducing the dependence on the destructive use of fossil fuels. This bio-electrochemical system generates electricity concurrently without the need of disrupting the living plants thus defeating competition between arable lands for food production power generation plants that beguiles deforestation. It also eliminates the need of additional energy input from external sources as other biomass resources and renewable energy requires. With this alternative, the transport of biomass is no longer needed in which avoids the depletion of nutrients in the ecosystem. PMFC technologies are based on the principle of rhizodeposition, which is the excretion of organic compounds from the roots that is the source of electrons and electricity generation by electrochemically active bacteria in a microbial fuel cell. The PMFC is a version of a MFC where the system makes use of living plants as the source of microbial matter. Its roots are located within the anodic region assumed to be an anaerobic environment within the structured fuel cell allowing the system to act as a bioreactor that enables the conversion of chemical energy to green electrical energy. The requisite elements for Plant-Microbial Fuel Cell assembly are the electrodes, a membrane separator, an external circuit connecting the two electrodes and a resistor.

Objectives:

1.To study the characteristic of domestic wastewater. 2. To fabricate plant microbial fuel cell. 3. To generate electricity by observing its maximum power output. 4. To understand wastewater treatment efficiency in plant microbial fuel cell. 5. To define opportunities and limitations for the design of plant microbial fuel cell.

II.METHODOLOGY

1.Collection of domestic wastewater from Hubballi near Gabbur. 2.Fabrication of plant microbial fuel cell by selecting suitable electrodes, proton exchange membrane (PEM) and plant saplings. 3.Domestic wastewater and 30% of cow dung is then added to plant microbial fuel cell as substrate for electro chemical active bacteria. 4.After some days plant microbial fuel cell will start generating electricity. 5.Plants in plant microbial fuel cell will absorb contaminants from waste water through its roots (phytoremediation) during this stage wastewater has been treated up to some extent. 6.During operational period generation of electricity and plant growth will be observed by analyzing important controlling parameter like pH, COD, BOD etc.

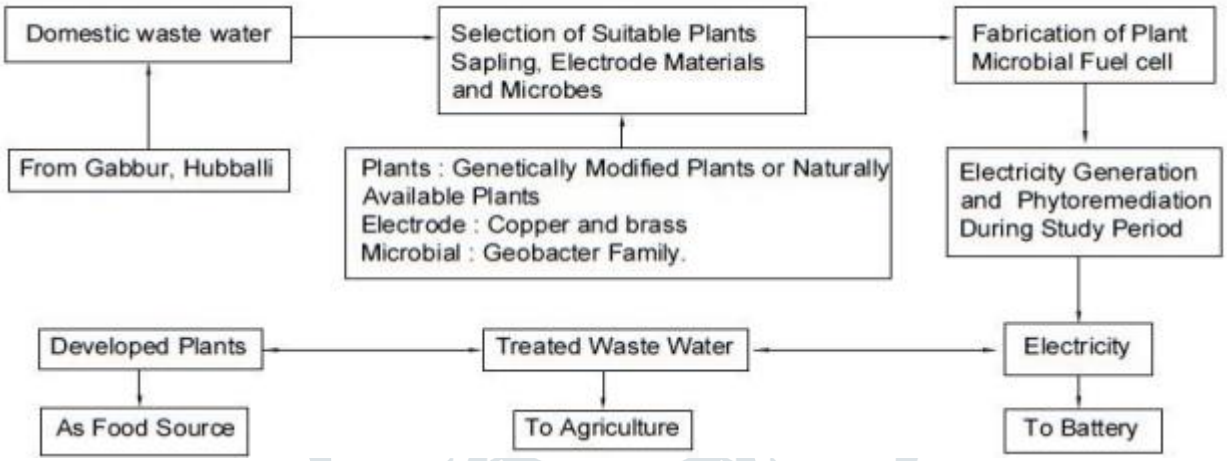


Fig: Process Flow Diagram

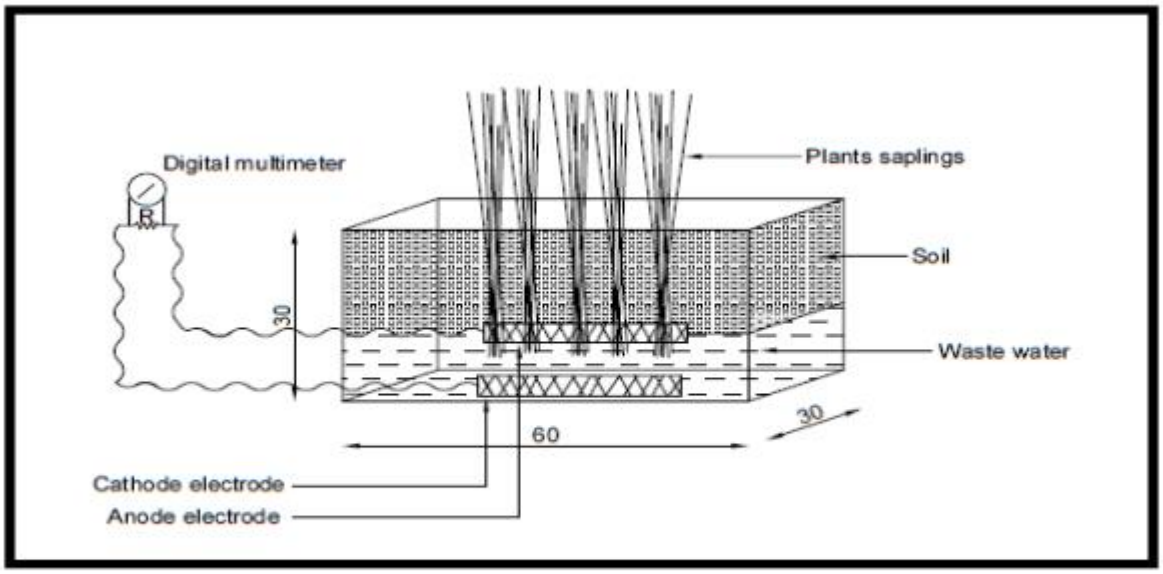
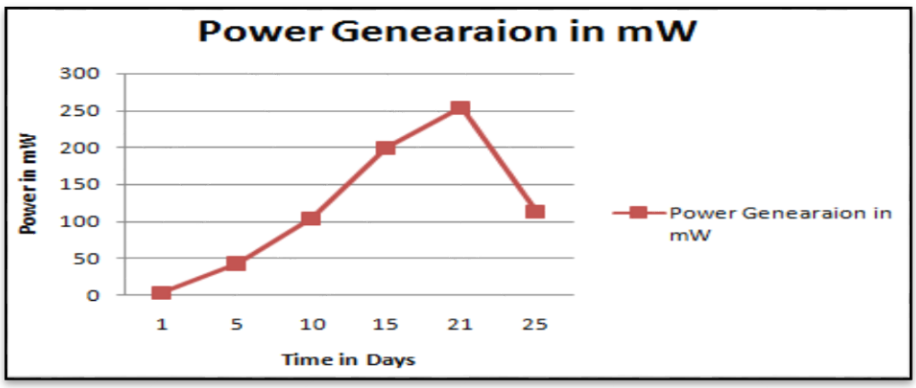


Fig: Experimental Model of the project work

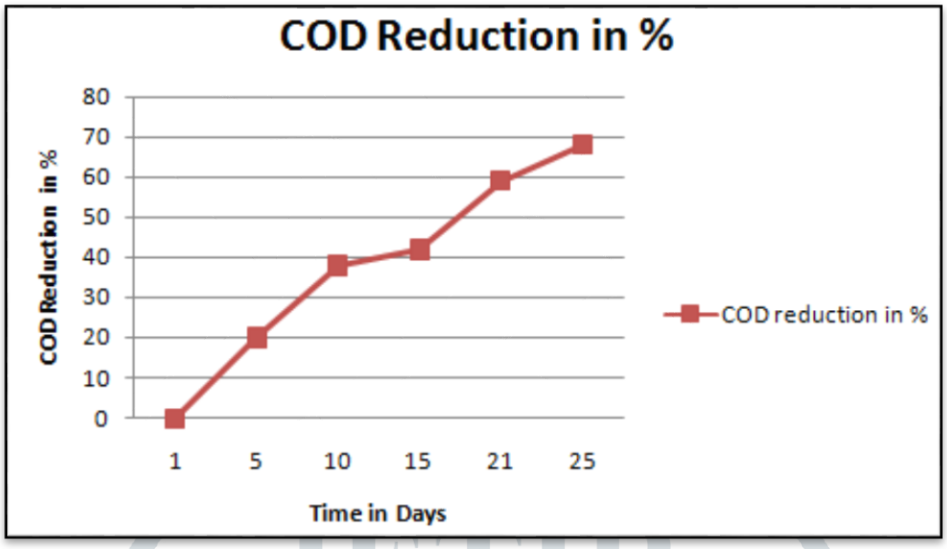
III.RESULTS AND DISCUSSION

1. Power Generation in Plant Microbial Fuel Cell [150 Ohm]



Above figure represents power generation in plant microbial fuel cell, at end of 21st day it was reached up to 253.5mW
Next day power generation in PMFC was decreased, this indicate that microorganisms have stops there degradation process. During the study time we have also observed 40% of plant growth.

2.COD reduction in Plant Microbial Fuel Cell



Above figure represents COD reduction in plant microbial fuel cell, at end of 21st day it was reached up to max COD removal as 68%. this indicate that microorganisms have utilize waste in wastewater for their degradation process. During the study time we have also observed 40% of plant growth, this concludes that Phytoremediation have been done in plant Microbial Fuel Cell. Also observed 75% of BOD removal efficiency

CONCLUSION

Based on laboratory experiments conducted, following observations are made:
1. Voltage generation in plant microbial Fuel Cell with respect to 150 Ω was 195Mv
2. Current generation in plant microbial Fuel Cell with respect to 150 Ω was 1.3mA
3. Power generation in plant microbial Fuel Cell with respect to 150 Ω was 253.5mW
4. At the end of 21th day 75% of BOD removal efficiency and 68% of COD removal efficiency were observed.
5. During the study time we have also observed 40% of plant growth due to Phytoremediation process.

.

REFERENCE

[1] Zain S M, Ching N L, Jusoh S, and Yunus S Y 2015 Different Types of Microbial Fuel Cell (MFC) Systems for Simultaneous Electricity Generation and Pollutant Removal J. Teknol. 3 pp 13–9
[2] Strik D P B T B, Bert H V M H, Snel J F H and Buisman C J N 2008 Green electricity production with living plants and bacteria in a fuel cell Int. J. Energy Res. no. November 2007
[3] Helder M, Strik D P B T B, Hamelers H V M, Kuhn A J, Blok C, and Buisman C J N 2010 Concurrent bio-electricity and biomass production in three Plant-Microbial Fuel Cells using Spartina anglica, Arundinella anomala and Arundo donax Bioresour. Technol. 101 no. 10 pp 3541–7
[4] Pamintuan K R S, Gonzales A J S, Estefanio B M M and Bartolo B L S 2018 Simultaneous phytoremediation of Ni2+ and bioelectricity generation in a plant-microbial fuel cell assembly using water hyacinth (Eichhornia crassipes) IOP Conf. Ser. Earth Environ. Sci. 191 p 12093
[5] Lu L, Xing D and Ren Z J 2015 Microbial community structure accompanied with electricity production in a constructed wetland plant microbial fuel cell Bioresour. Technol. 195 pp 115–21
[6] Deng H, Chen Z and Zhao F 2012 Energy from plants and microorganisms: Progress in plant microbial fuel cells Chem. Sus. Chem 5 no. 6 pp 1006–11
[7] Santoro C, Arbizzani C, Erable B and Ieropoulos I 2017 Microbial fuel cells: From fundamentals to applications. A review J. Power Sources 356 pp 225–44
[8] Gong X B, You S J, Wang X H, Zhang J N, Gan Y and Ren N Q 2014 A novel stainless steel mesh/cobalt oxide hybrid electrode for efficient catalysis of oxygen reduction in a microbial