

A STUDY ON MICROBIAL FUEL CELL (MFC) TO POWER UNDERWATER MONITORING DEVICE

By

**SARAVANAN A/L RAVICHANTHIRAN
I14005634**

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APPROVAL

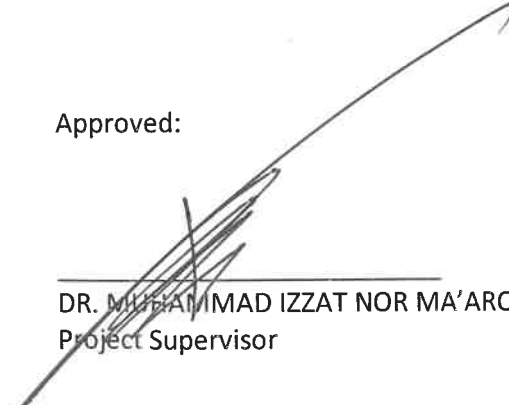
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saravanan a/l ravichanthiran

A project dissertation submitted to the
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Approved:



DR. MUBTAHIR IZZAT NOR MA'AROF
Project Supervisor

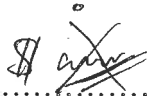
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April 2018

DECLARATION

I, the undersigned, hereby declare that this report is my own independent work except as specified in the references and acknowledgements. I have not committed plagiarism in the accomplishment of this work, nor have I falsified and/or invented the data in my work. I am aware of the University regulations on Plagiarism. I accept the academic penalties that may be imposed for any violation.

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Name

Saravanan A/L Ravichanthiran

Matrix No.

I14005634

Date

28 May 2018

ABSTRACT

A "Microbial Fuel Cell" also known as biological fuel cell impersonates the way bacteria behave in nature to generate current. A Microbial Fuel Cell converts the chemical energy through a catalytic reaction to electrical energy. A Microbial Fuel Cell consists of two different compartments namely an anode and cathode respectively. This project is done by using two compartments which are divided by a cation specific membrane which contains positively charged ions. In the anode, protons and electrons are produced as a result of the fuel oxidation by microorganisms. While the protons are moved to the anode via the membrane, the electrons are then moved to the cathode via an external circuit. In the cathode, both protons and electrons are used up to make a combination with oxygen in order to produce water. Malaysia has access to various renewable resources such as wind, ocean, biomass, solar and small hydro. Malaysia therefore has the potential to achieve sustainable energy. Several energy policies have been put in place to promote energy efficiency, quality of service and environmental safeguarding. However, there is still no proper collaboration between the government and the general public regarding the use of renewable resources at a faster rate. Therefore, the objective of this project is to study and analyse the requirements of a Microbial Fuel Cell to generate electricity, design and implement a Microbial Fuel Cell, validate and quantify the amount of bio-waste required to generate electricity and to validate and generate electricity using the Microbial Fuel Cell. Therefore, a system was fabricated following a proper methodology and several experiments were tested using different kinds of electrodes and resistor. These experiments are mainly to determine the voltages and power density to do further analysis and discussion. The system must be able to power an underwater monitoring device that was replaced with an LED as less voltage is needed to power up those sensors. There is a limitation associated with Microbial Fuel Cells which is their low power density. To have a better understanding of the different parameters and to optimize the production of electricity, more in-depth studies are required. The operating and production costs can be reduced while the power generation can be increased with ongoing improvements. Before Biological Fuel Cells can actually be produced and commercialized, a huge amount of improvement is required.

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DEDICATION

Author would like to dedicate this project to the people that help me get this far, without them author wouldn't be able to complete this project nor make this project happen. Firstly, author wants to dedicate this projects to author's friends that provided author with the recourse and the transportation to obtain materials to compose this project. Secondly, author wants to dedicate this project to author's own family whom have supported author throughout the journey in building and creating this project, without their help author wouldn't have been able to have such a great opportunity to develop this assignment. Lastly, author would like to dedicate this project to author's own life partner whom have supported me mentally and physically motivating author to not give up but to keep moving forward to complete this project.

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LIST OF ABBREVIATIONS

MFC	Microbial Fuel Cell
CEM	Cation Exchange Membrane
PEM	Proton exchange membrane
ATP	Adenosine Triphosphate
NADH	Nicotinamide Adenine Dinucleotide
EMF	Electromotive Force
OVC	Open Circuit Voltage
COD	Chemical Oxygen Demand
DO	Dissolved Oxygen
ERC	Energy Regulation Commission
PH	Hydrogen potential
NEMA	National Environment Management Authority
GOK	Government of Kenya
E.coli	Escherichia coli

NOMENCLATURE

<i>Symbol</i>	<i>Definition</i>
V	Voltage
R	Resistance
I	Current
P	Power
A	Amps
W	Watts
ΔG^0_r	Gibbs free energy
F	Faraday's constant
n	Amount of electrons per reaction mole of the substrate
T	Absolute temperature
ΔE	Potential Difference