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**EFFECT OF DIFFERENT YEAST EXTRACT
CONCENTRATION IN MEMBRANE-LESS MICROBIAL
FUEL CELL (ML-MFC) FOR ELECTRICITY GENERATION
USING FOOD WASTE AS SUBSTRATE**

by

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A dissertation submitted in the partial fulfilment of the requirements for the degree of
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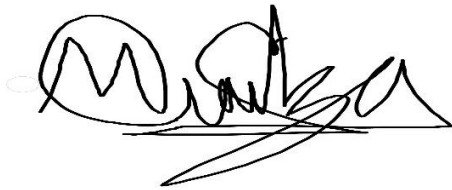
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This dissertation is composed of my original work and contains no material previously published or written by another person except where due reference has been made in the text. The content of my dissertation is the result of work I have carried out since the commencement of my research project and does not include a substantial part of work that has been submitted to qualify for the award of any other degree or diploma in any university or other tertiary institution.

A handwritten signature in black ink, appearing to read 'Mohammad Mirza Bin Mohammad Faizal', written over a horizontal line.

Mohammad Mirza Bin Mohammad Faizal
June 2020

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LIST OF SYMBOLS

Caption

° C

Celsius

%

Percent

**LIST OF
ABBREVIATIONS**

Abbreviation	Definition
MFC	Microbial Fuel Cell
ML-MFC	Membrane-less Microbial Fuel Cell
SDE	Substrate degradation efficiency
EB	Electrogenic bacteria
COD	Chemical oxygen demand
AAS	Atomic Absorption Spectrometry
YE	Yeast extract
W	Watt
TWh	terawatt hour
kWh	kilowatt hour
kg/m ³	kilogram per metre cube
mg	milligram
h	Hour
mg/l	milligram/litre
mW	milliwatt
mV	millivolt
min	minutes
ml	millilitres

KESAN PERBEZAAN KEPEKATAN EKSTRAK YIS DALAM SEL BAHAN BAKAR MIKROORGANISMA TANPA MEMBRAN UNTUK PENJANAAN TENAGA MENGGUNAKAN SISA MAKANAN SEBAGAI SUBSTRAT

Abstrak

Tenaga elektrik adalah tenaga asas dan penting dalam kehidupan seharian kita dan masih terdapat 14 % daripada populasi dunia masih tidak dapat akses untuk tenaga elektrik. Selain itu, 45 % komposisi sisa buangan yang dihasilkan adalah sisa makanan. Dengan itu, sel bahan bakar mikrobial (MFC) menjadi satu solusi atas keupayaannya untuk merawat sisa makanan dan menghasilkan tenaga elektrik. Kajian ini dijalankan untuk menggunakan sisa makanan yang diambil daripada E-Idaman, Kedah, untuk penghasilan tenaga elektrik dengan memfokuskan kesan perbezaan tahap ekstrak yis di dalam tanpa membran sel bahan bakar mikrobial (ML-MFC). Kultus bakteria elektrogenik yang bertindak sebagai penggerak penghasilan tenaga elektrik diambil daripada tanpa membran sel bahan bakar mikrobial (ML-MFC) yang berfungsi sebelum ini. Analisis terhadap sisa makanan dijalankan dan menunjukkan bahawa karbon mempunyai komposisi tertinggi dengan 30.02%. Berdasarkan kajian awal yang membandingkan tiga jenis strain bakteria elektrogenik yang akan digunakan di dalam tanpa membran sel bahan bakar mikrobial (ML-MFC), *Bacillus subtilis* sp. menunjukkan kadar tumbesaran spesifik, μ , (0.117 gL⁻¹/h) dan masa gandaan, *T_d*, (5.93 h) yang paling tinggi. Keupayaan tanpa membran sel bahan bakar mikrobial (ML-MFC) dinilai dengan menggunakan satu-faktor-pada-satu-masa (OFAT). Voltan (820 mV) dan ketumpatan kuasa (9576.14 mW/m²) tertinggi telah diperolehi dari 5 g/L ekstrak yis tanpa membran sel bahan bakar mikrobial (ML-MFC). Keefisienan penurunan substrat (12.3%), pengurangan COD (99 mg/L) dan biojisim (44.32 mg/L) tertinggi diperolehi daripada 15 g/L tanpa membran sel bahan bakar mikrobial (ML-MFC). Ini menunjukkan kepekatan ekstrak yis dan sisa makanan memberi kesan terhadap keupayaan tanpa membran sel bahan bakar mikrobial (ML-MFC).

EFFECT OF DIFFERENT YEAST CONCENTRATION IN MEMBRANE-LESS MICROBIAL FUEL CELL (ML-MFC) FOR POWER GENERATION USING FOOD WASTE AS SUBSTRATE

Abstract

Electricity is the basic energy in our daily life and there are about 14 % of global population that did not get the access to electricity. Furthermore, 45 % of the main composition of waste that produced daily is food waste. As a result, microbial fuel cell (MFC) become the solution as it has the potential for food waste treatment and electricity power generation. This study is being conducted to utilize the food waste that collected from E-Idaman, Kedah, to generate energy while focusing the effect of different yeast extract level in a membrane-less microbial fuel cell (ML-MFC). The electrogenic bacterial culture that acted as a catalyst for electricity power generation was isolated from previous working ML-MFC. The proximate analysis of food waste revealed that carbon has the highest composition with 30.02 %. From the preliminary study that compared three different strains of electrogenic bacteria to introduced in the ML-MFC, *Bacillus subtilis* sp. showed the highest specific growth rate, μ , (0.117 gL⁻¹/h) and doubling time, *T_d*, (5.93 h). The performance of the ML-MFC was evaluated using one-factor-at-a-time (OFAT) method. The highest voltage generation (820 mV) and power density (9576.14 mW/m²) were obtained in 5 g/L yeast extract concentration ML-MFC. The highest substrate degradation efficiency (12.3 %), COD removal (99 mg/L) and biomass (44.32 mg/L) were in 15 g/L yeast extract concentration ML-MFC. It showed that the yeast extract concentration and food waste affect the performance of ML-MFC.