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**PATENT SEARCH (NOVEL, INVENTIVE, INDUSTRIAL PRACTICAL)**



# RECOVERY OF ENERGY AND SIMULTANEOUSLY TREATMENT OF DEWATERED SLUDGE USING MEMBRANE-LESS MICROBIAL FUEL CELL



**Problem Statement**

- Depletion of natural resources
- Global warming
- Fluctuation price of fossil fuel
- High cost of sludge disposal management and limited space for landfills
- Annual increase in volume of sludge at wastewater treatment plant

**Novelty & Inventiveness**

- Air cathode**  
It is a good innovation because there would not need the air sparging. Common Microbial Fuel Cell, they are using pump to supply air.
- Membrane-less**  
The innovation shows that dewatered sludge played a dual role, acting both as the nutrient-rich anodic and as a pseudo membrane to separate anode and cathode. In the Typical MFC, they use expensive Proton Exchange Membrane (PEM) for that purpose. Besides that PEM also contributed to the proton transfer efficiency, thus reduce the power generation.
- Mediator-less**  
A mediator is not needed to transfer the electrons in this invention. Commonly, expensive mediator such as methylene blue and neutral red is used for this purpose. In this invention, there exists active bacterium that will electrochemically transfer the electrons to the electrode inside the dewatered sludge.
- Co-culture (Synergy Strain A and Strain B)**  
The presence of Strain in this invention has the ability to transfer electrons as they secrete phenazine-based metabolites at the surface of the anode, thus improving the generation of energy. Additionally, Strain B acts as a good biocatalyst for Membrane-less microbial fuel cell (ML-MFC) and generate stable energy.



**Applicability**

Energy generated by the ML-MFC give the alternatives of natural resources hence reduce the fossil fuel dependency. It also can power small devices such as LED torchlight, fans and can act as a power bank.

**Product/Technology Readiness**

TRL 4 – Small scale prototype (built in laboratory environment)

**Research Achievement**

- 1<sup>st</sup> Runner up in Novel Research Innovation Competition 2015 (NRIC), project title "Generating green Electricity from Sewerage Sludge Using Microbial Fuel Cell".
- Grant
  - Research University (RUI) Grant entitle "Electricity Generation in Microbial Fuel Cell for Biological Treatment of Sewage Wastewater" (**RM135,000.00**)
  - Fundamental Research Grant Scheme (FRGS) entitle "Investigating the effects of process parameters on Electrogenic Bacteria from Dewatered Sludge for Electricity Generation using Membrane-less Microbial Fuel Cell" (**RM139,464.00**)
  - Short Term Grant (STG) entitle "Electricity Generation from Dewatered Sludge Using Microbial Fuel Cell" (**RM43,288.40**)
- Talent development - 1 PhD, 1 MSc, 1 Undergraduate
- Journal - 3 (ISI Q2, Q3 and Scopus).
- 2 Conferences Proceeding, 1 Book Chapter, 4 invitation speaker

**Intellectual Property**

The USM patent agent already declared that the use of Strain A and B are novel in ML-MFC

**Commercialization Potential**

The success of energy recovery from dewatered sludge has created a potential collaboration opportunity as many industries have wastewater and produce sludge daily. It also includes companies that are working with garbage disposal at the residential area. Currently Bioprocess Technology Division, from the School of Technology USM is going to sign a contract research agreement with E-Idaman Sdn Bhd to trial out this technology.

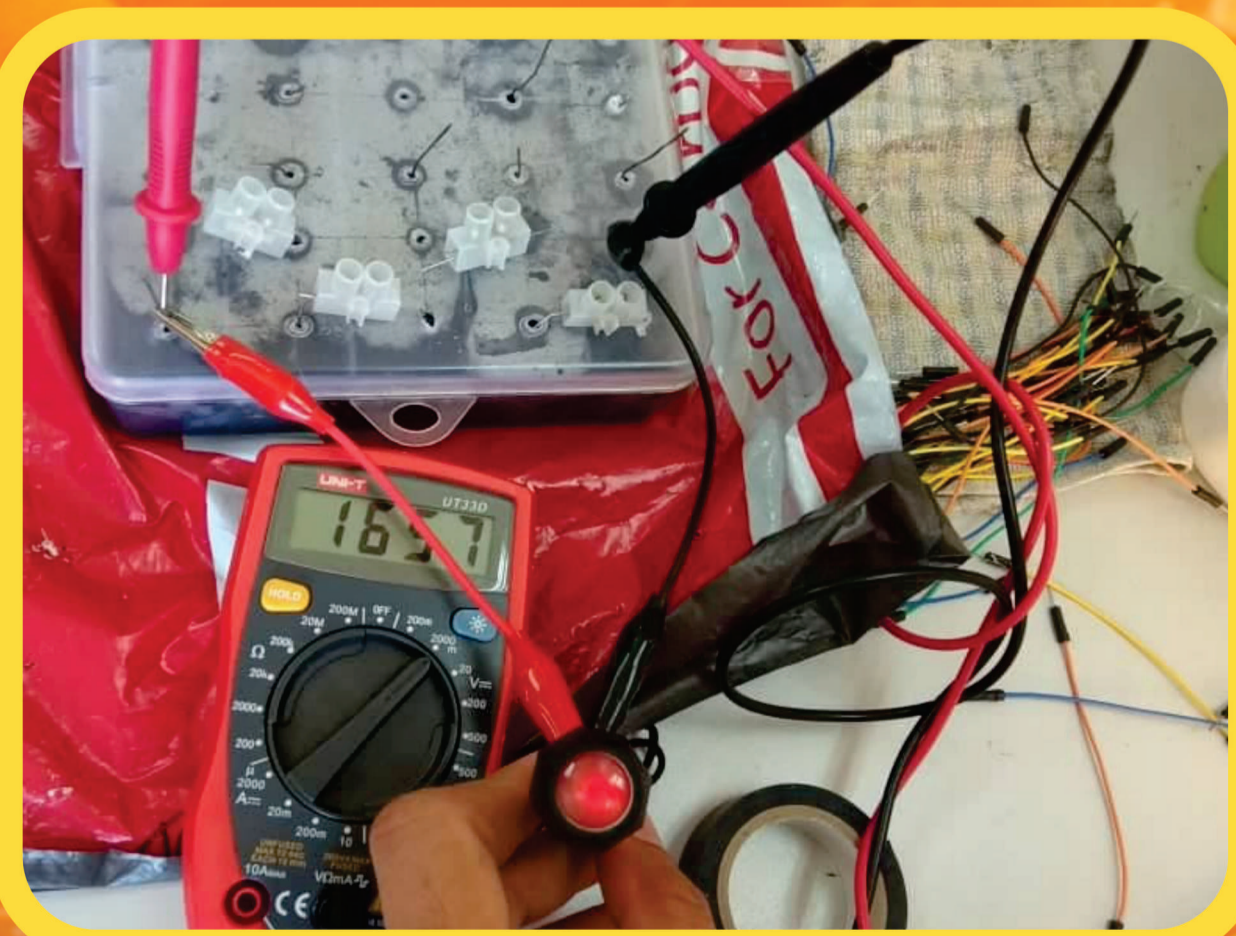
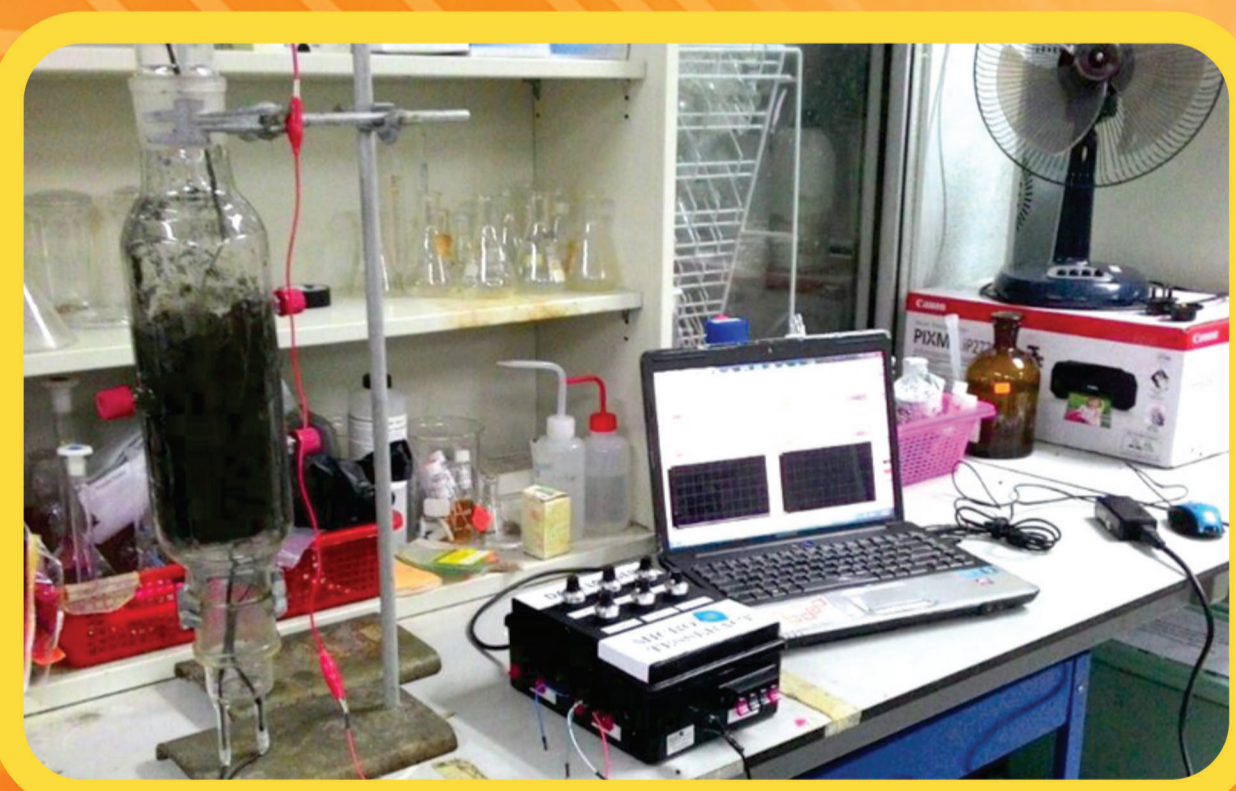
**Level of Impact**

**INDUSTRY:** alternative renewable energy for electricity and wastewater treatment, opportunity for industries to generate their own electricity supply

**ECONOMIC:** alternative cheap renewable energy from wastes instead of from non-renewable resources

**SOCIETY:** a cheaper renewable energy which is green and clean. By recycling biosolids, pollution due to its disposal can be reduced and provide free-pollution to the environment.

**SUSTAINABLE DEVELOPMENT:** reduce utilization of non-renewable resources (gas/fossil fuels) for electricity and reduce pollution potential



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