CURRENT AND VOLTAGE DATA LOGGING FROM MICROBIAL FUEL CELLS USING *ARDUINO* BASED SENSORS

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ABSTRACT

Microbial fuel cells utilize exo-electrogenic bacteria in the anaerobic oxidation of organic substrates to generate electricity. Voltage and current are the primary output of the microbial fuel cells. In the present study, automatic current and voltage data logging into excel sheet using PLX DAQ application is described. The current and voltage are generated from double chamber microbial fuel cells loaded with cow dung and tomato wastes are linked with a NaCl salt bridge. An *Arduino* board micro-controller is programmed to read analog pins sensor data. The data was read from H-shaped MFC using a 25V voltage sensor and ACS712 current sensors. The data obtained shows a voltage range of 0.05 -0.34V, 0.0.03-0.356V and 0.00.08 – 0.35V with current range of 0.005 - 0.078mA, 0.001-0.084mA and 0.001 – 0.042mA in tomato, avocado and cowdung wastes, respectively

The evaluation of the Arduino UNO device for MFC voltage measurement showed that potentials from *Arduino* and millimeter were not significantly different. This method saves time and reduces voltage and current reading errors. Moreso, *Arduino UNO* has up to 5 channels (allowing the simultaneous Monitoring of five cells) whereas the multimeter Escort has only one.The results obtained from the research study concludes that there is no significant difference in voltage and current readings obtained using Arduino based sensors and multimeter and therefore recommend employement of Arduino based sensor in microbial fuel cells.
Keywords: *Arduino, tomato waste, Microbial Fuel Cells, Multimeter*

1.0: INTRODUCTION

The search for new energy sources able to grant efficiency and sustainability has become a central topic for research efforts all over the world (Logan, 2007). Microbial fuel cells (MFCs) have emerged in recent years as promising contributors to the transition to a low-carbon society, being able to mitigate emissions of greenhouse gases and reduce the dominance of fossil fuels. Probably the main reason that makes this technology so attractive is related to its working principle: MFCs generate electricity through the catalytic activity of exo-electrogenic bacteria involved in the anaerobic oxidation of organic substrates acting as low grade fuels (Logan, 2007). The energy produced by MFCs is relatively low compared to other fuel cell technologies; they can produce chemical energy from several classes of wastes, with the potential to effectively and directly convert several non-purified organic substrates into electrical energy (Nastro *et al.*, 2017).

A microbial fuel cell is a device that converts chemical energy to electrical energy by the catalytic reaction of microorganisms. A microbial fuel cell utilizes the electron extracting properties of special bacteria attached to the anode to produce electricity. Bacteria attached to the anode oxidize organic material releasing carbon dioxide and protons into the anode chamber solution. Electrons are transferred to the anode after which they flow through external conductor electrical to the cathode where they are consumed in the reduction of oxygen. Meanwhile protons cross into the cathodic chamber via a membrane. A current is therefore produced as there is a flow of electrons (Siddharth,