PREFACE

The objective of this thesis work proposes to design the novel architecture of fabricating a bio dry cell and new **S**oil microbi**A**l **F**uel cell (**SAF**) in simple steps. Based on this cost-effective, innovative design, we significantly increased the output power of the microbial fuel cell and potentially established a unique design platform for a scalable and sustainable low-cost microbial fuel cell stack for a stand-alone renewable energy system.

This research work also presents a methodology to generate electricity from kitchen waste. A Green Energy Conversion System (GECS) is developed and designed for this purpose as a personal power generation scheme. This design produces 0.8V/50mA in raw power and which will not serve end-use purposes. To solve this issue, it is combined with a booster circuit which has been developed in this research work it uses low loss boost convertor circuit to step up the voltage and current to useful level up to 5V/200mA.

The present research work reports the novel approach to develop the Bio dry cell and Soil microbial fuel cell. The prime purpose of this research work is to provide a technological solution for addressing waste management and power generation from the waste in the green and biocompatible manner. The fuel cell can continuously generate electricity from respiratory activities of bacteria while degrading the organic waste despite the vast and promising potential of the bio-energy to ensure uninterrupted green energy generation, the technology has not been able to make a successful impact at a commercial level. This shortfall remains principally connected to a persistent performance limitation and the engineering bottlenecks in its scale-up. In the present reported work, we describe an indigenously designed, low cost, self-sustainable and scalable bio dry cell and soil microbial fuel cell with significant power enhancement by maximizing bio-energy capture capability, bacterial attachment, and maintenance of air moisture bubble volume in well-controlled brick shape microchambers.

GECS starts with microbial metabolism from organic-rich materials such as food scraps, manures, plant waste, etc. The electrodes are placed in the cell structure to capture the energy produced by GECS. The proposed Green Energy Conversion System will operate to provide more practical, cleaner, economical and less pollutant energy in poor rural and off-grid environments unlike highly pollutant energy methodologies existing today. This approach is trying to keep the system in a simple, innovative construction whose main characteristic comprises the organic wastes and sustainable electrodes to provide reliable power to electrical load under the direct energy conversion system. Green Energy conversion System is designed and operated using organic waste as a substrate and as an origin of microorganisms for the anodic chamber. Organic waste activated sludge provided a bacterial consortium predisposed to the solubilization of particulate matter and utilization of substrates generally found in wastewater as well as in the surrounding environment. Dissolved oxygen and ferricyanide held utilized as the electron acceptors in the catholyte.

Microbial fuel cell associations are composed while operating under identical conditions but using the two different electron acceptors. Comparisons obtained based on the electricity generation observed during MFC operation, an organic waste status of the waste activated sludge anolytes and the population level physiological profiling of the microbial communities in the anolytes. Electrons liberated during substrate utilization in the anodic chamber traveled to the air cathode chamber where they reduced the electron acceptors. The anode and air cathode chambers are connected by a straightforward proton exchange membrane-less to leave during cation migration. Various soluble carbon sources from kitchen waste did dose to the microbial fuel cells based green energy conversion system at regular intervals throughout the operation via direct injection to the anolyte chamber. Meanwhile, bovine serum albumin dosing, average potential production levels reached 0.065 mW and 0.150 mW for the evaporated oxygen microbial fuel cell and the ferricyanide microbial fuel cell, respectively. These are 100% and 35% greater than the energy generation levels observed throughout the rest of the investigation. Increases in current production held witnessed following the dosing of sodium acetate, glucose and bovine serum albumin obtained from the extracts. Neither increase in current is seen accompanying solution glycerol dosing. A solution of Sodium acetate dosing triggered an immediate response, while glucose and bovine serum albumin responded in roughly 5 minutes. A chemical oxygen requirement mass balance happened measured concerning both microbial fuel cells. The lack of balance closure held attributed to unmeasured methane production.

A collection of particulate organic waste activated sludge components remained observed for both microbial fuel cells. The anolyte pH during the performance is typically less than waste activated sludge pH, which is attached to volatile fatty acid accumulation in the anolytes during fermentation processes. Community-level physiological profiling is achieved through the analysis of ecological data obtained with a bio dry cell box. Samples are plated and analyzed under anaerobic conditions, mimicking the environment in the anode chamber of the MFCs.

A review on Microbial Fuel Cells principles and applications, its design aspects for green energy conversion system and emerging issues from the last decade are explained and demonstrated in detail. The study starts with describing the widespread perception of green energy and commonly used microbial fuel cells in green energy conversion system. Then it presents additional particulars on GECS active model and utilization. It does hold by GECS design methods in addition to overviews of different engaged biological and electrical parameters. The GECS overview along with its merits and demerits, the principle of operation, the mathematical modeling and electrodes design for the GECS powered by various bacterias, and its addition converter energy collecting perspectives are described and illustrated appropriately. In previous research in this field, despite their potential, today's possible microbial fuel cells are costly regarding fabrication, output power and demonstrate persistent performance limitations