



Project Ummeed

A Solution For Non-Renewable Power Generation

Energy is the backbone of human survival. Its various forms are deeply entrenched in essential scientific phenomenon. The most important form of energy, arguably, is electrical energy. The dependence of humanity on electrical energy has increased over time, with increase in the use of electrical appliances.

Electricity production, however, comes at a price: the environment.

Despite efforts to popularize and commercialize renewable sources of energy, fossil fuels have still retained their place as the primary source for electricity generation. Fossil fuels, despite being a convenient source of electricity, are evidently marred by Carbon Dioxide and Carbon Monoxide emissions during electricity generation. These emissions greatly contribute to air pollution, the subsequent effects of which are potent and well known. Thus, a transition into a sustainable world must require a transition into a sustainable source of electricity generation based on which the said world is modeled.

Biological Fuel is an underutilized resource when it comes to electricity generation. It offers a plethora of options for electricity generation, especially in a renewable manner, due to the wide range of organic substrates open for utilization in new methods of electricity generation aligning with the principles of Biochemistry. My project utilizes existing scientific principles along with a novel substrate to create an independent, reliable, renewable and efficient source of electricity, which is called the Enhanced Cathodic Substrate Fuel Cell (ECS Fuel Cell).

The Enhanced Cathodic Substrate is a biological substrate that comprises of three primary components: Cowdung, Sugarcane/Beetroot Extract and Compost/Benthic Mud. Each component plays an important role in the chemical processes taking place in the cell. The Fuel Cell is roughly based on the structure of an electrolytic cell, but has additional components and a different electron flow. It comprises of a Cathode, an Anode, a Salt Bridge and two copper wires. The Cathode contains the ECS. Cowdung and Compost naturally provide bacteria, which anaerobically breakdown the glucose present in the Sugarcane Extract. Temperature is maintained by the Compost in the container. This anaerobic breakdown leads to formation of Hydrogen Ions and Electrons. These travel through the Salt Bridge, containing frozen Agar-Agar Jelly. This Salt Bridge acts as a transport medium of Hydrogen Ions and Electrons to the Anode. The Anode contains salt water. Hydrogen Ions and Electrons react with the dissolved Oxygen to form Water. The Electrons flow back through the copper wire, connecting the Anode to the Cathode, thus creating a circuit which is self sufficient, with both reactions furnishing each other.

This setup generates electricity, and the voltage of electricity produced increases with time.

Testing of the four built prototypes on scales such as voltage production, durability and odour revealed that the Fuel Cell produces equal/higher electricity than tradition microbial fuel cell setups while being upto 10 times cheaper than them. And that is for a single cell. The generator module has produced electricity upto 1.2V and increasing.

Thus, the ECS Fuel Cell is a cheap, effective, reliable, sustainable, independent and renewable source of power generation, and can play a significant role in the transition of our world into a sustainable one.