

# Charging of Mobile Phones by Using Living Plants

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**ABSTRACT:** Increased electrical energy demand has shifted our approach to go for distributed generation in the form of renewable .Wind power and Solar power has contributing a lot in reducing carbon footprint at present. But this electrical energy source enhance oxygen productivity either it can do good to increase flora and fauna. We have experimented concept of fuel cell with plants where plants use sunlight from the sun and carbon dioxide from atmosphere and use them for food production for their own need and part of this organic material is deposited into soil via roots as waste product. This organic material is a food for anaerobic bacteria (microorganisms) for their metabolism process and in that process they release electrons as waste product. Those electrons are captured by anode and sent to cathode via load circuitry and get reduced at cathode side completing designed circuit. With this concept and boosting the output with help of boosting device will charge cell phones and light up LED bulbs.

**KEYWORDS:** Bacteria,Rhizodeposition,Flora and Fauna.

## I. INTRODUCTION

In this paper we are going through the concepts related to plant electricity and experimental studies of various plant and soil. As soil contain organic matter deposited from atmosphere as plants, dead animals residues and in various forms .Waste water which contain anaerobic bacteria and bacteria from ponds which are exposed vigorously to anaerobic conditions. As we collect this will chose plants based on their photosynthesis rate, root structure ,leaves structure and place them into glass structure framed with specific volume designed for studying plant growth and output electrical parameters from anode cathode circuitry. We have chosen soil samples based on soil testing department data and glass casing is decided by us at our convenience.

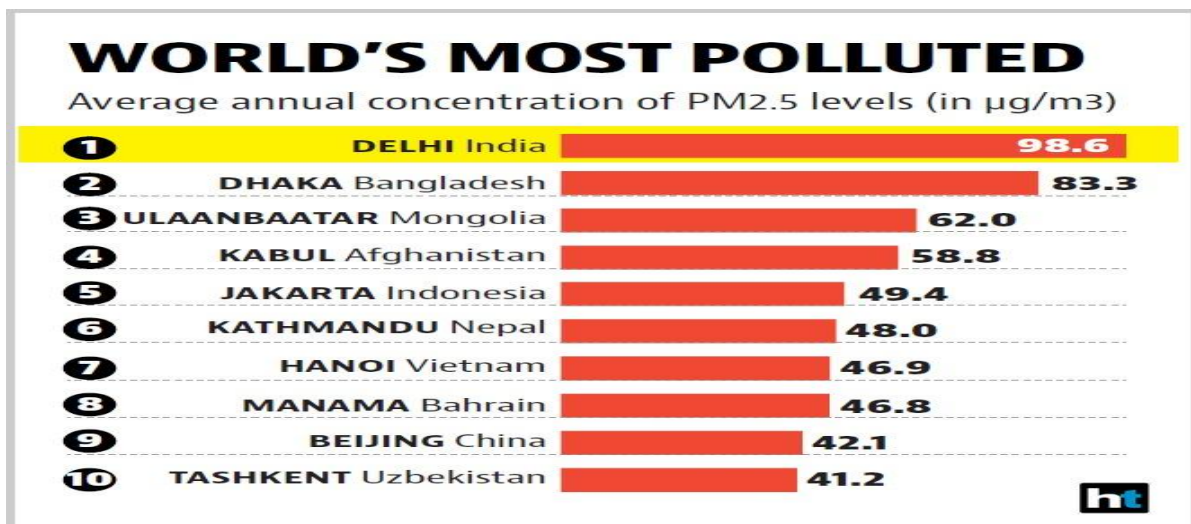


Figure 1Graph for pollution

Conversion of waste to energy via a biological process establishes microbial fuel cells (MFC) as a prominent source of sustainable energy. MFC has been investigated for bioelectricity production through organic degradation of wastewater by microbial consortium. The potential of MFC applications in biosensors, desalination and hydrogen gas production has been explored. Many descendants of an MFC have been developed in recent years based upon the configurations, structures and purposes such as sediment MFC, mud MFC, soil MFC, constructed wetland MFC, photosynthetic MFC



and biovolt-photogalvanic MFC. A plant microbial fuel cell (PMFC) is a promising modification of MFC that exercises the unique plant-microbe relationship at the rhizosphere region of a plant and converts solar energy into bioelectricity. In-situ bioelectricity and biomass production, rather than the supply of external substrates, make this technology different from traditional MFCs. Thus, designing and understanding PMFCs should be viewed from a biosystems engineering perspective rather than only through MFC methodology. Plant-microbe harmony at the soil interface, driven by rhizodeposition coupled with efficient engineering, ultimately directs towards its real applications. Thus, this paper reviews three main paradigms. Firstly, effects of plants in PMFC via rhizodeposition and photosynthetic activity are explored. Secondly, the role of microbes driven by soil physiochemical and biological characteristics are shown. Thirdly, the engineering aspects involved in designing an efficient configuration are revealed and an attempt is made to interpret the PMFC with biosystems principles. Furthermore, an overview of a PMFC system is done, along with the future perspectives and challenges.

The positive and negative terminal of the electrode was determined according to its electrochemical potential, E. Therefore, the electrode with higher and lower electrode potential,  $E^0$  was selected as anode and cathode respectively. Simultaneous oxidation reduction process occur at anode and cathode allow the flow of negative ions to the anode and positive ions to cathode.

## II. RELATED WORK

### Material

Three glass casings are designed with 18cm\*18cm\*18cm, 25cm\*25cm\*25cm and 30cm\*30cm\*30cm respectively with small hole at the bottom of the cubical glass to let excess water out of casing. For experiment no.2 we took a three plants of same species having fibrous roots named lucky bamboo (*Dracaena*) and planted them in three pots of equal diameter. Three Cu and three Zn are taken and constructed in a chronological order. Dimensions are decided based on our previous experimental studies performed. Based on reactivity series anode and cathodes are chosen with dimensions 15cm\*5cm for all three designed casing. Copper and zinc electrodes are chosen; zinc as anode and copper as cathode electrode. Soil 1 has red granular content and is normally found in plateau. Soil 2 is from normally found at the banks of river and ponds. Soil 3 has mixed components of both these soils and these soil components are tested for electrical conductivity, its carbon content, water storing capacity, calcium carbonate, PH for to determine its acidic and basic nature from GOVERNMENT SOIL TESTING DEPARTMENT, PUNE, INDIA. LED bulbs of different rating and luminescence power, boosting circuit with specification mentioned in the paper in later sections.

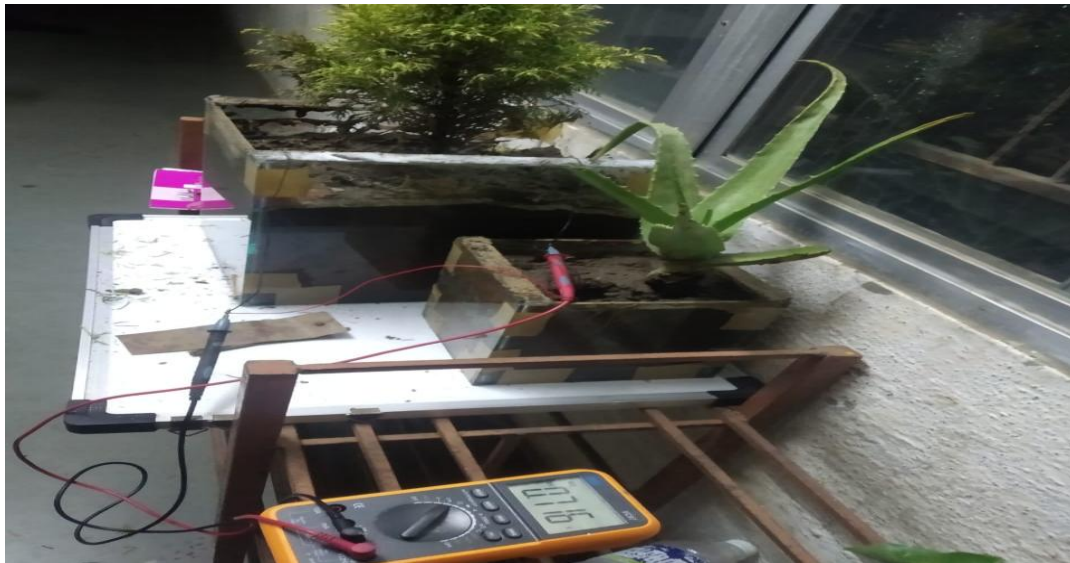
## III. METHODOLOGY

Following initial conditions are considered as Standard Test Conditions.

1. At this 18.729.197,73.429724 location solar radiation data is downloaded from internet.
2. Operating temperature is room temperature.
3. Initial days plants are totally exposed to sunlight.
4. No extra boosting material added to increase conductivity of soil.
5. Plants are added adequate amount of water for their survival.
6. Precise Multimeter is used to measure open circuit voltage as no load is applied initially.

Results and Discussion for conditions considered for experiment 1.

Sr. No	Morning Reading( mV)	Afternoon Reading(mV)	Night Reading(mV)
1(Aloe Vera)	622	713	532
2(Aloe Vera)	641	732	601
3(Aloe Vera)	630	744	595
Sr. No	Morning Reading( mV)	Afternoon Reading(mV)	Night Reading(mV)
1(Hibiscus)	844	903	822
2(Hibiscus)	847	904	801
3(Hibiscus)	798	904	719



**Figure 2**Experimental Setup

For experiment 2 following test conditions were considered

Experiment no.1 does not fulfill our requirements, by referring research paper combination of Cu-Zn electrodes gives the maximum output. We took a three plants of same species having fibrous roots named lucky bamboo (Dracaena) and planted them in three pots of equal diameter. Three Cu and three Zn are taken and constructed in a chronological order.

**Construction**

As per conclusion soil with most humus, microorganism, chemically active bacterial content is chosen. Copper electrode working as cathode placed in the bottom most part of PMFC and plant is mounted on cathode such that roots of the plants are expose to the cathode. Anode i.e. Zinc is placed on the top and exposed to the atmosphere. Following readings are taken

Plants	Voltmeter reading after 1hr( mV)	Voltmeter reading after 2hr (mV)	Voltmeter reading after 3hr(mV)(Steady state)
Plant1	0.415	0.801	0.921
Plant2	0.402	0.782	0.894
Plant3	0.422	0.825	0.951

By taking two casings circuitary in series we get 1.4V at steady state condition.

Whole three plants setup is combined and connected in series for boost up after steady state. Thereafter current(in mA) is taken approximately 200mA is recorded. Total voltage of whole circuitary is 2.7V.



Figure 3 Final result

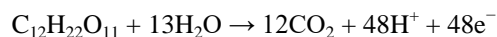
The output from 3 casing is from 1.1V to 3V and current is 200mA. By referring the readings design of booster is done.

Specification:

1. Input Voltage:0.9-5V;Output voltage:5V
2. Maximum Output Current:600mA
3. Up Voltage:0.9V;output current:7mA
4. Input Voltage:1-1.5V;output voltage 5V;current 40-100mA
5. Input Voltage:1.5-2V;output voltage 5V;current 100-150mA
6. Input Voltage:2-3V;output voltage 5V;current 150-380mA
7. Input Voltage:>3V;output voltage 5V;current 380-600mA
8. Typical Conversion Efficiency:96%

#### Generating Process Reaction

When microorganisms consume a substance such as **sugar** in aerobic conditions, they produce **carbon dioxide** and **water**. However, when **oxygen** is not present, they produce carbon dioxide, **hydrons (hydrogen ions)**, and **electrons**, as described below:<sup>[1]</sup>



Microbial fuel cells use **inorganic** mediators to tap into the **electron transport chain** of cells and channel electrons produced. The mediator crosses the outer cell **lipid membranes** and **bacterial outer membrane**; then, it begins to liberate electrons from the electron transport chain that normally would be taken up by oxygen or other intermediates.

The now-reduced mediator exits the cell laden with electrons that it transfers to an electrode; this electrode becomes the anode. The release of the electrons recycles the mediator to its original oxidized state, ready to repeat the process. **This can happen only under anaerobic conditions**; if oxygen is present, it will collect the electrons, as it has greater **electronegativity**.

In MFC operation, the anode is the terminal electron acceptor recognized by bacteria in the anodic chamber. Therefore, the microbial activity is strongly dependent on the anode's redox potential. A **Michaelis-Menten** curve was obtained between the anodic potential and the power output of an **acetate-driven MFC**. A critical anodic potential seems to provide maximum power output.<sup>[2]</sup>

#### IV. CONCLUSION

Till date we have achieved 2.7v constant DC voltage from the circuit we have designed and configured circuit for maximum electrons capture by using anode electrode with greater surface area for electrons conduction. By using Booster circuit as per above mentioned specification we achieved constant voltage of 5V DC.



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