

Plant-e

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Abstract- The electricity produced from coal, natural gas and other fossil fuel are non- renewable. After some period of time, these sources will become extinct. Hence, we need a more sustainable form of energy. In this paper we present a method of harvesting electrical energy from living *Plants. Plants store chemical energy in their roots in the form of chemical sugar bonds. When Electrodes are placed in the roots, the ions move towards the electrodes and this flow of ions produce electricity.* The electrodes used in this research are copper and iron. The overall purpose of this research is to produce electricity using more sustainable sources.

Keywords:-Photosynthesis, green house, microbial fuel cell, rhizobium.

I. Introduction

As government of India has taken the initiative to make India a developed nation viagenerating 175 GW of renewable energy by the year 2022; we researched a new idea for the same purpose. Imagine charging your phone using electricity generated by the plants in your windowsill. Our research aims at making this a reality with the technology introduced by Wageningen University at Netherland in 2007. This is based on a natural process and safe for both the plant and environment. Over the past centuries, the world has got polluted due to the usage ofHydrocarbon energy sources such as petroleum, coal and other fossil fuels. The increase in the use of these fuels will lead to their extinction in the future. The ever rising cost of fossil fuels hinders the economic growth as the production of goods and cost of shipment are dependent on the cost of fuels. The increasing demand and rising cost affect the trade and causes poverty.

The energy is obtained from coal and other natural gases by combustion. Due to this, emission of carbon dioxide takes place which causes greenhouse effect. This result in the increase in temperature and leads to the deterioration of the global environment. The governmentEncourages to provide an opportunity for mitigation of greenhouse gas emission and reducing Globalwarming by using conventional energy sources.

II. Principle

The research focuses on generating electricity from plants. The process does not affect plants as well as environment. Plants make their own food by photosynthesis [4].Photosynthesis is the process by which the green plants and certain other organisms convert solar energy into Chemical energy. During photosynthesis in green plants, solar energy is captured and used to convert the water, carbon dioxide, and minerals into oxygen and energy rich compounds is shown in figure. Photosynthesis is the process by which plants, some bacteria and protozoa utilize the energy which is available from sunlight to produce glucose from carbon dioxide and water. Although vast variety of plants are available locally but a few are utilized, having larger potential; considering the aspects of easy embedding and stem moisture content.

III. Microbial Fuel Cell

A microbial fuel cell is a bio electrochemical system making use of biocatalyst for converting chemical energy into electrical energy. This microbial fuel cell is a device that converts chemical Energy into electrical energy with the helpof micro-organisms. Carbon dioxide returns to the Atmosphere.[6]

When the anode and cathode are inserted near the root of plant, electrons areattracted towards anode due to positive charge of anode and photons are attracted

towards Cathode due to the negative charge in the cathode. During the initial stage of insertion of Electrode, 0.410v is produced. After one hour, the voltage is increased to 2.217v due to Photosynthesis process. The voltage obtained increases as the time of photosynthesis increases. Finally, the voltage reaches 2.427v. It is clear that the voltage obtained is directly proportional to time of photosynthesis and the graph given below depicts the relationship clearly[8].

Materials used

1. Copper electrolytic refined copper anodes having high purity must be used. The purity of the Copper anodes must be 99.98%.
2. Iron has metallic bonds, which makes the electrons free to move more than one atom. Iron is the good conductor of electricity.

V. Experimental Details:

Six plants were taken for this research. The experimental set up is as shown in following figure 1.

Copper is used as the anode and iron is used as the Cathode. Length of the rod used is 20 cm and the diameter is 6mm. The electrodes are placed in series connection for the flow of electrons to produce electricity. The reactions at the electrodes are as shown below.

1. Anode $2C_6H_{12}O_6 + 4H + 4e$
2. Cathode $CO_2 + 4H + 4e \rightarrow 2H_2$
3. Resulting net reaction $2C_6H_{12}O_6 + O_2 \rightarrow 2C_6H_{10}O_6 + 2H_2O$

Glucose is produced by the plants during the process of photosynthesis. Part of the energy is taken for the growth of plants and remaining is littered into the soil. Electrochemical active Bacteria called rhizobium are present in the roots of the plants [1]. They are found in the nodules of the roots of leguminous plants and act as nitrogen fixing agents. The rhizobium bacteria decompose the glucose. As a result of this, carbon dioxide, photons and electrons are produced.

Investigation of type of electrode-

Though large numbers of electrodes are available, the best pair that produces the highest power output has to be determined prior to any further optimization attempts. Copper and iron Electrodes are taken for our research because they are locally abundant and easily available. The positive and negative terminal of the electrode was determined according to its electrical Potential.

The connection diagram is as shown in following figure.2. The electrode with higher and lower electrode potential was selected as Anode and cathode. Simultaneously oxidation and reduction process occurs at anode and cathode allows the flow of negative ions to the anode and positive ions move towards cathode.



Fig.1. Experimental set up

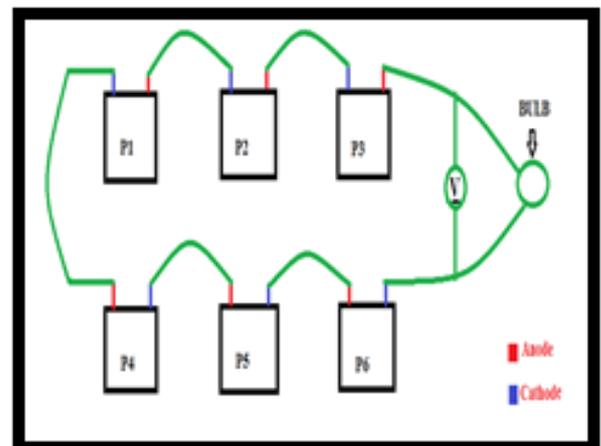


Fig.2 Connection of electrodes

IV. Investigation on the Potential Applications

There is vast variation between countries in the method of generation of electricity concerns the global environment. In France, only 10% of electricity is generated from the fossil fuel, thus is higher at 70% and china is at 80%. Most scientists agree that emission of pollutants and green- house gases from fossil fuel based electricity generation account for significant portion of world greenHouse gas emission. To overcome this problem, organic energy potential can be used for small scale applications like low electrical consumption instruments, lads, charging mobiles, or incorporated into a green roof to generate Electricity for a building as well as insulating it. We

can generate large amount of electricity from wet lands, rice paddles and deltas.

Highlights

1. Maintenance and installation cost- It requires a low maintenance and installation cost.
2. Electricity generation – It generates electricity and does not cause any harm to plants during the process of generation.
3. Electricity can be generated 24/7.
4. Can be implemented anywhere - Living plants are literally green power source and are easily available, hence can be implemented anywhere such as roof top gardening, house gardening, government parks ,offices etc.
5. Can be utilized as plant cell battery.
6. Helps to reduce the greenhouse gases and thus becomes best way to reduce global warming-‘A global hazard’.

VI. Results and Discussion

After performing the experiment we found that a single normal plant is capable to generate 500-600 mV of DC. The capacity of generating electricity gets increases after the addition of each plant that means generation increases as the number of plants gets increases and the rate of photosynthesis increases . Plants like tulsi, aloe vera, teak, etc., are capable enough to generate more electricity than normal plant (nearly upto 1V).

VII. Conclusion

In this research, we investigated a renewable energy source from living plants. We present a method of extracting electrical energy from living plants. Insertion of anode and cathode near the Root of plant causes the electrons to be attracted towards anode due to its negative charge and Photons are attracted towards cathode due to its positive charge. From a normal plant an average value of voltage about 500-600mv is produced. It is efficient than conventional electricity production and there is no Pollution. Various plant likes tulasi and aloe-vera give high voltage due to high Rate of photosynthesis. Our research thus provides society with the knowledge and tools needed for developing a cleaner and renewable energy production and for more efficiently utilizing the different forms of energy and resources available.

XI. References

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