Experimental Results of Photo Electric Plant

R Bharath Kumar[1], I.Jayanth[2], S S Ashrith[3], T Dharaniteja[4], N Sai Krishna[5]

[2]*Assistant professor,* [1,3,4,5]*Students*

Guru Nanak Institute of Technology

Abstract - Generating electricity from trees is the most recently developed technology, which was first developed in Netherlands and generated electricity from the Microbial Solar Cells (MSC). In this system plants absorb solar energy and uses electrochemically active microorganisms in the bio electrochemical system to generate electrical current. In this context electricity can be generated by inserting aluminium and copper electrodes. This technology is cheaper and economical to everyone by which we can produce 10v current.

I. INTRODUCTION

In day to day life there is much requirement of electricity, but now a day's electricity generation is standing on single leg task. Generating electricity is difficult task and expensive because of less sources availability and also there is a chance of decay sources in future. So definitely it leads to the electricity crisis in future. To overcome this dilemma, this process was discovered.

In Netherlands David strike along with his team have concluded that electricity can be generated from plants also. This process can avail 24x7 till the plant survives. Using this technology there will be a considerable change in world to generate electricity without polluting the atmosphere and Earth sources. This technology consumes very less space considerably.

In this process, the electricity is generated by using photosynthesis and electrolysis process. This process is affordable to every sector by which they can generate their own electricity in their residence. This process can be adoptable everywhere in the world where plants grow. When this process comes into existence, then there will be cheaper electricity and becomes easy to generate electricity using less apparatus.

What is photosynthesis?

This is a process that combines water, sunlight, carbon dioxide to produce oxygen and sugar to energy in chemical bonds. This is a process of making food by plants and Organisms to survive but all plants does not undergo photosynthesis.

Figure 1.1 represents the process takes place in trees

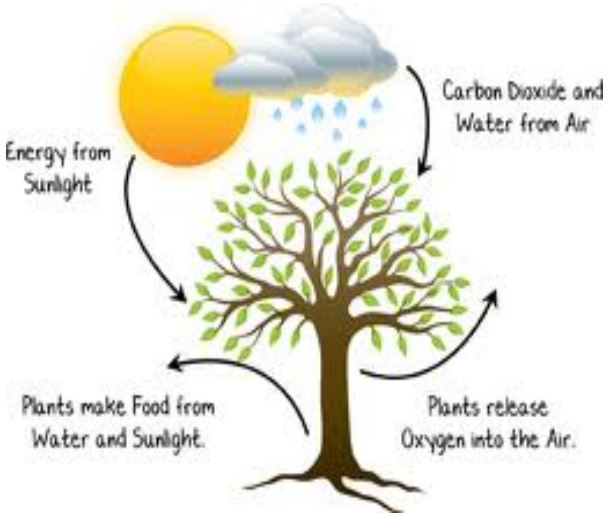


Fig 1.1 Process Takes Place in Tree

Why Photosynthesis?

It is a process of chemical reaction occurring directly or indirectly. For example trees produce sugar during this photosynthesis process. When trees undergo this photosynthesis process they undergo a process called respiration, which consumes carbon dioxide to produce oxygen. It is a chemical reaction which need for animals and human beings to live.

The chemical reaction for photosynthesis and respiration process

$$C_6H_{12}O_6+6O_2 \text{ ----------> } 6CO_2+6H_2O+36ATP$$

The process of photosynthesis

Photosynthesis, this process takes place in the plants leaves. The leaves are made up of very tiny cells. Inside these cells there are tiny structures called chloroplasts. Each chloroplast contains a green pigment called chlorophyll which gives green colour to the leaves.

- Chlorophyll absorbs sun's energy.
- It is the only energy that is used to split water molecules into hydrogen and oxygen.
- Oxygen is released into the atmosphere from the leaves.

- Hydrogen and carbon dioxide are used to form glucose or food for plants.

Some of the glucose is used to provide energy for the growth and development of plants while the rest is stored in leaves, roots or fruits which will be used by plants.

Here the process in great detail:

Photosynthesis occurs in two stages commonly known as Light dependent Reactions and Light independent Reactions.

Light dependent Reactions

Light dependent reactions occur only in the thylakoid membrane of the chloroplasts and these reactions occur only when light is available. During these reactions light energy is converted to chemical energy.

- Chlorophyll and other pigments absorb energy from sunlight and this energy is transferred to the photo systems which are responsible for photosynthesis.
- Water provides electrons and hydrogen ions but also produces oxygen.
- The electrons and hydrogen ions are used to create ATP and NADPH. ATP is an energy storage molecule and NADPH is an electron carrier/donor molecule. Both ATP and NADPH are needed in the following stage of photosynthesis.

Details about the flow of electrons through Photosystem II, b6-f complex, Photosystem I and NADP reductase have not been included here but can be found under the process of Photosynthesis in Plants.

Light independent Reactions

Light independent reactions occur in the stroma of the chloroplasts. Although these reactions can take place without light, this process requires ATP and NADPH which were created using light in the first stage. Carbon dioxide and energy from ATP along with NADPH are used to form glucose.

More details about the formation of sugars can be found in the process of Photosynthesis in plants.

II. WHAT IS ELECTROLYSIS?

Electrolysis refers to the decomposition of a substance by an electric current. The electrolysis of sodium and potassium hydroxides, first carried out in 1808 by Sir Humphrey Davey, led to the discovery of these two metallic elements and showed that these two hydroxides which had previously been considered as un-decomposable elements.

- Direct current is passed through the compound (the compound can be in molten or aqueous state).
- Electrical energy (From the direct current) is changed into chemical energy (the decomposition of the compound).
- One common example is the electrolysis of water, where water decomposes to hydrogen and oxygen.

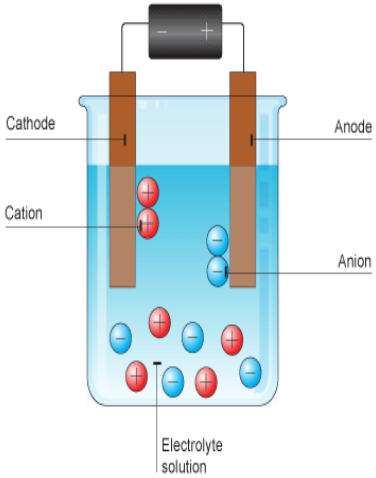


Fig 1.2 Electrolysis System

figure 1.2 represents the Electrolysis System

Main components of an electrolytic cell: Battery, Electrolytes, Electrodes.

The positive terminal of the battery is connected to the positive electrode (anode) while the negative terminal of the battery is connected to the negative electrode (cathode).

Electrolytes are usually made up of an ionic compound in solution or molten state OR aqueous solutions of acids or alkalis.

- Electrolytes conduct electricity with decomposition at the electrodes as it does so.
- Electrolytes can be classified into three categories: Non-electrolytes, weak electrolytes and strong electrolytes.

- Strong electrolytes = lots of ions to carry the charges from one electrode to the other. Examples of strong electrolytes: Strong acids or alkalis (sulphuric acid, aqueous sodium hydroxide), salt solutions (aqueous sodium chloride)

- Weak electrolytes = few ions to carry the charges from one electrode to the other. Examples of weak electrolytes: Weak acids or bases (Ethanoic acid, aqueous ammonia)

- Non-electrolytes = no ions available to carry the charges from one electrode to the other.

Examples of non-electrolytes: Pure water, organic liquids or solvents

Electrodes are conductors through which electrons enter and leave the electrolyte.

- Anode is the POSITIVE (+) electrode from which electrons leave the electrolyte (or the electric current enters the electrolyte)

- Cathode is the NEGATIVE (-) electrode from which electrons enter the electrolyte (or the electric current leaves the electrolyte)

- Electrodes are typically made up of inert materials (which do not participate in any redox reactions), such as carbon, platinum, titanium, or stainless steel. (NOTE: There are some cases where the electrodes undergoes redox reactions during electrolysis.)

III. CHEMICAL REACTION

cathode:	$Na^+ + e^- \rightarrow Na(l)$	E° = –2.71 v
anode:	$Cl^- \rightarrow ½\ Cl_2(g) + e^-$	E° = –1.36 v
net:	$Na^+ + Cl^- \rightarrow Na(l) + ½\ Cl_2(g)$	E° = –4.1 v

What happens during electrolysis?

- Negative ions (Anions) are attracted to the anode while the positive ions (cations) are attracted to the cathode.

- When the ions reach their respective electrodes, they will be discharged. (They lose or gain electrons and form neutral atoms)

- Hence, at anode, anions are discharged through loss of electrons; while at the cathode, cations are discharged through gain of electrons.

How can we generate electricity by photosynthesis?

The photosynthesis formula is C6H12O6

2C6H12O6 ----------→ 2C6H10O6+4(H+)+4e-

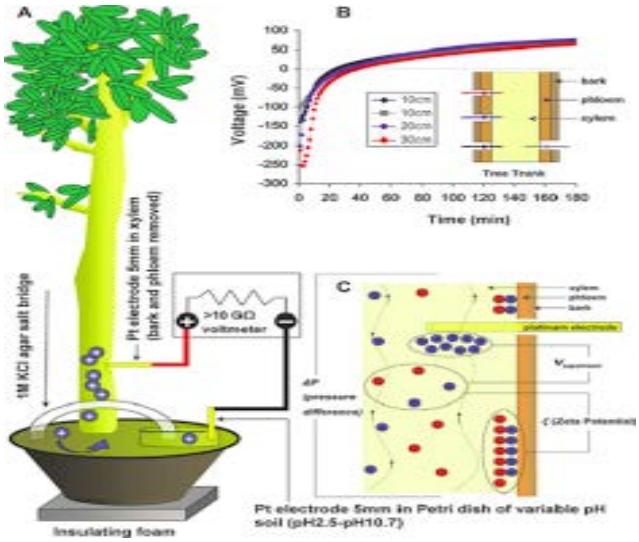
Photosynthesis is going to spilt into C6H10O6, 4H+ and releases electrons (e-)

By photosynthesis process we can generate electricity up to 0.1v normally. But by using another technique we can generate up to 10v.

Drove a copper rod (cathode) into tree until it touches the pith. Then dag a two feet hole just below the tree and fix aluminium electrode at the one end of the root and pour water. Then we will get '10v' electricity. Electricity is generated by electrolysis and photosynthesis process.

Electricity is produced by the attraction of positive and negative electrons. Here we are placing two positive electrodes even though we are getting electricity. The reason behind that is, when the electrons are released from the tree, they are attracted towards electrode and the electrode becomes negative. Thus one of the two positive electrodes is converted as negative. So the rupture of positive and negative electrons takes place.

fig(1.3)



fig(1.4)

Electricity generation from trees?

Usually, every tree consists of bacteria which help for the growth of plants as well as for photosynthesis process. Top soil of the tree is packed with bacteria that generate electricity when placed in microbial fuel cells [MFC]. Because bacteria laden soil is found only under the trees. MFC can make clean renewable electricity nearly any place around globe.

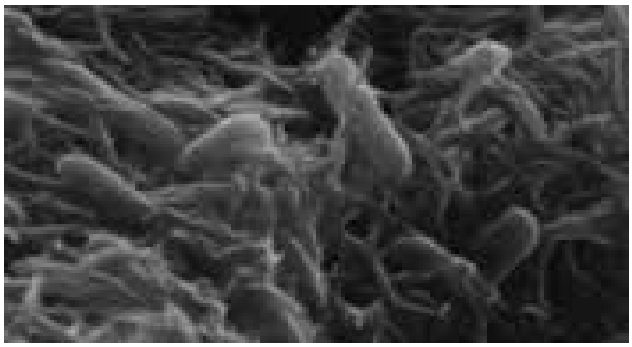
A MFC cell is also known as a biological fuel which is a device that can make use of microbes to generate electricity. MFC has two electrodes and has an area that separates the electrodes for an mfc to function. Electricity must flow into one electrode and leaves at the other electrode.

Figure 1.4 represents the generation of electricity from tree

How it is accomplished?

Every soil has the availability of some bacteria. This mfc uses the bacteria to generate electricity. These bacteria is known as electrogenic bacteria, includes the shewanella species(bacteria), which can be found almost in any soil on earth and the geo bacteria species which prefer living in soil, deeper parts of ground or even under the ocean where no oxygen is present. The soil bacteria eats away what ever present in the soil such as microscopic nutrients and sugars and in turn produce electrons that are released back into the soil. Electrons are the subatomic particles that have a negative charge. These electrons can be harnessed and used to generate electricity, which is a form of energy

Figure 1.5 represents the structure of shewanella bacteria



Fig(1.5)

How electricity is produced from plants

Normally, by photosynthesis process plants generate some organic matter ($C_6H_{12}O_6$). This organic matter is transferred into roots. Inside the roots, this organic matter is naturally divided into carbon dioxide and water and we place a membrane inside the ground. This membrane helps to divide two electrodes as anode and cathode. On the anode side the bacteria is divided into hydrogen (H+) and electron(e-). The electrons flows into the anode and are transferred with the help of wire. This energy can be used for flashing of led lights.

Fig(1.6)

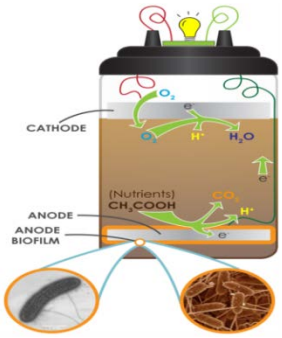
IV. EQUIPMENT

- voltmeter
- mfc
- copper electrodes
- aluminum electrodes
- wires

V. MICROBIAL FUEL CELL

A microbial fuel cell (MFC) or biological fuel cell is a bio-electrochemical system that drives a current by using bacteria and mimicking bacterial interactions found in nature. MFCs can be grouped into two general categories, that uses a mediator and mediator-less.

Figure 1.5 represents the structure of mfc machine



Fig(1.7)

VI. VOLTMETER

A voltmeter is an instrument used for measuring electrical potential difference between two points in an electric circuit. Analog voltmeters move a pointer across a scale in proportion to the voltage of the circuit; digital voltmeters give a numerical display of voltage by use of an analog to digital converter. The voltmeter in a circuit is represented by encircled 'V'.

Voltmeters are made in a wide range of styles. Instruments permanently mounted in a panel are used to monitor generators or other fixed apparatus. Portable instruments, usually equipped to also measure current and resistance in the form of a multimeter are standard test instruments used in electrical and electronics accomplishments. Any measurement that can be converted to a voltage can be displayed on a meter that is suitably calibrated; for example, pressure, temperature, flow or level in a chemical process plant.

Fig(1.8)

VII. FUTURE SCOPE

The generation of electricity from plants produces no green house gases, toxic waste and particulate matter. The dream is that we are generating electricity in any suitable wetland or wet area – including rice paddy fields, mangroves and salt marshes, which takes us to some of the most remote and impoverished parts of the world. It is in these off-grid communities that we believe in that the technology can make a real difference to people livings. The disadvantage of solar power is that the sun cannot be for 24 hours in a day. When the sun sets or on a cloudy day, the Solar PV panels stop producing electricity. If we need electricity at that circumstance, we have to get through some other sources and wind energy cannot be used all the time as there is a complexity of the area where should it be placed. As some of the renewable energy sources has some disadvantages, but electricity from plants is not temporary and will exist forever. Due to this afforestation will be increased. Since all this equipment is covered, there will be no effect by rains. Pollution will be minimum and greenary in the environment increases.

Both photosynthesis and electro chemical reactions are carried out by continuous growth of micro-organisms. This makes the system capable of self repair conferring a longer lifetime and low maintenance.

Another advantage is the use of reproducing organisms is that there is no need for special catalysts that are either costly or toxic thus MSCs can be applied in natural surroundings with no risk of pollution

MSCs have an organic material as intermediate energy carriers between the photosynthetic and electro chemical parts of the cell. This organic material accumulates in MSCs so that electricity can be generated in dark also.

Closed MSCs can preserve nutrients for the organism which can result in long term low maintenance power production. Integrated PMFCs can add value to other applications ,such as greenhouses with the food or flower production ,or rice paddy fields with rice production. In addition of waste water and surface water treatments can be integrated into PMFCs to supply extra organic matter for energy production. In real life MSCs need to compete with other renewable energy systems. Several factors such as energy yield and constant environmental benefits will all influence of outcome this completion.

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