PKL (Pathor Kuchi Leaf) Power Production Device - An Innovative Idea

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Abstract

Generation of electricity from Pather Kuchi Leaf is quite simple. Even it is possible to produce electricity from PKL for a layman. Since the produce voltage and current as well as the power is low there is almost no danger for human as the electricity has. To get the electricity from Pather Kuchi Leaf we have to undergo with some very simple process. These processes are as below:Collecting and making Juice of PKL,Collecting Zinc and Copper Plates as electrodes and the appropriate container, Placement the Zinc and Copper plates in the container and Connecting the Zinc and Copper plates in proper way.

Keywords: *PKL electricity, Combination, PKL unit Cell, PKL Module, PKL Panel, Local Action, Polarization, Series combination, Parallel Combination.*

I.INTRODUCTION

A simple PKL unit cell can be made from copper and zinc metals with solutions of PKL juice. In the process of the oxidation and reduction reactions, electrons can be transferred from the zinc to the copper through an electrically conducting path as a useful electric current. In 2008, Prof. Dr. Md. Kamrul Alam Khan was invented this PKL unit cell. The fabricated Unit cell of PKL electric voltage is around 1.1 volt. The PKL electricity depends on various parameters. The parameters are given by the following: Concentration of the malt, Area of the electrodes, Distance between the two electrodes,The constituent elements of the electrodes, The volume of the PKL malt / juice, The temperature of the PKL malt and The age of the PKL and P^H of the PKL juice.

II. Methodology

***II A. (i)* PKL Unit Cell**

The PKL unit cell is illustrated in Figure -1. It is the building block of the PKL power system.

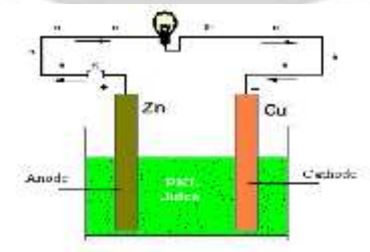

Figure-1: PKL Unit cell.

(ii) PKL Electric Module and Panel

A PKL unit cell can produce only 1.1 voltages which is not sufficient to meet the practical situation. Therefore to meet the practical application PKL cells are grouped in module and panel.

(iii) PKL Electric Module

It is made more than one Unit cell. The PKL Unit cells are connected by wires. The voltage of the electric modules is more than 6.6 volts. A six cell PKL module is shown in figure-2

Figure-2: PKL Electric Module and Panel.

(iv) PKL Electric Panel

It is made of more than one PKL electric modules by physically and electrically connected. The voltage of the PKL electric Panel is higher than the PKL electric modules. A PKL panel with three modules is shown in figure-3.

Figure-3: PKL Electric Module and Panel

(v): Collecting and Making Juice of PKL

In order to produce electricity from the leaf of the *Bryophyllum*, first of all, its leaves have to be collected and than blended by blenders. Thereafter a mixture, containing pest and water with proportion generally 8:1, will have to be prepared. This mixture can be used directly for electricity production. This juice can be filtered out to get the clean juice for the use of electricity generation. Figure 10.3 shows the picture of preparation process of juice.

Figure-4: Preparation of Juice of PKL.

After blending the juice is pouring and reserved in a plastic container or pot. This juice can be reserved / preserved there for long time. Figure 10.4 shows the picture of prepared juice.

Figure-5: Prepared Juice of PKL.

(vi): Preparing Electrodes

For the production of electricity we need to make the electrodes for the cell. We need two plates for the production of electricity. One is Zinc plate and other is Copper plate. Zinc plate acts as negative plate or negative terminal and copper plate acts as positive plate or positive terminal.In local market the Zinc and copper plates are available is large sheet forms. Though the Zinc plate is chipper but the copper sheet is relatively costly. But fortunately though the Zinc plates are dissolved in the solution during the production process of electricity but the copper plates do not dissolved. Figure-6 shows the typical preparation of Zinc and Copper plates.

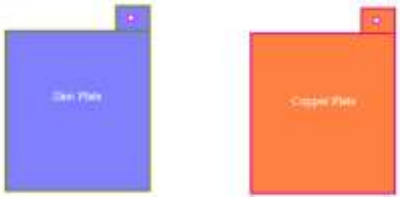

Figure-6: Preparing of Zinc Plates and Copper plates for use in the production of electricity from PKL cell.

(vii): Placement of Electrodes

At this stage we need the plastic container or pot to arrange the plates. We can also use clay pot as the substitute of plastic container. This plastic container can be easily found in the market in different size as battery box. Now the Copper plates and Zinc plates are placed or arranged in the container one after another. That is if we start with Zinc plate than first a Zinc plate than a Copper plate than a Zinc plate than again a copper plate and so on. In reverse way, if we start with Copper plate than first a Copper plate than a Zinc plate than a Copper plate than again a Zinc plate and so on. It should be noted that we have to follow only one sequence for all the cells in a particular battery arrangement. A typical sequence with Zinc plate is shown plate in figure-7.

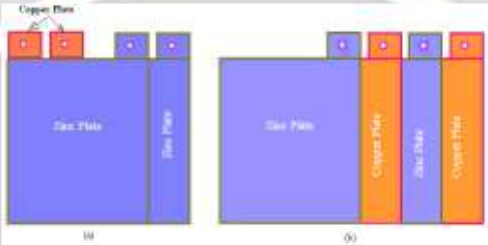

Figure-7: Arrangement of plates keeping Zinc plate first.

This arrangement of plates can also be done keeping the copper plate first i.e. first a Copper plate than a Zinc plate than a Copper plate than again a Zinc plate and so on. A typical sequence with Zinc plate is shown plate in figure-8.

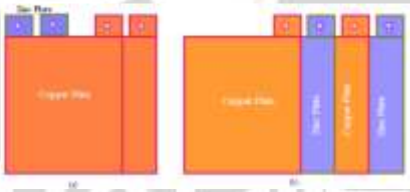

Figure-8: Arrangement of plates keeping Copper plate first.

II B. Making Connections between Electrodes

After placing the plates we need to make the internal connection between plates. It may be noted here that the Copper plate will be the Positive plate and the Zinc plate will be the negative plate. So in a particular cell we have to connect all the Zinc plates together and all the copper plates together. A typical illustration of connection is shown in figure 10.8 keeping the Copper plate first.

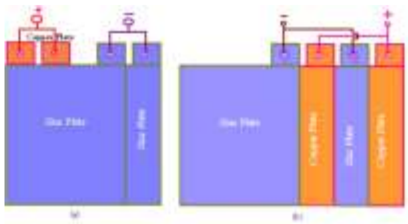

Figure-9: Connection arrangement of plates keeping the Zinc plate first.

For the group of plates keeping the Copper plate first, the same connection shall be made connecting all the copper plates in one group and all the Zinc plates in another group using copper wire. A typical illustration of connection is shown in figure 10.9 keeping the Zinc plate first. It can be pointed out here that between copper and zinc plate we must have to keep some gap so that the two plated never touch each other. Alternately we can use a suitable separator in between. But keep in mind that the plates should be as close as possible to get the better result.

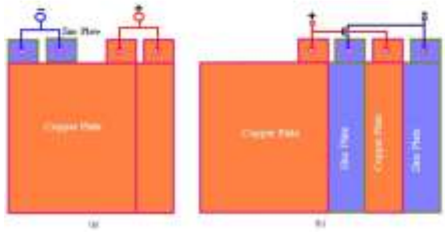

Figure-10: Connection arrangement of plates keeping the Copper plate first.

In this way Copper plat and Zinc plate should be placed to one cell. If we use more plates per cell current shall be increased keeping the per cell voltage fixed. Theoretically per cell voltage of PKL is 1.1 volts.

IIC: Series and Parallel Combination Characteristics of Cells

Series combination and parallel combination of cells is very much important to get the desired voltage and current as well as power from the system. These are discussed below.

IIC. **Series Combination of Cells**

When two or more cells are connected in series than the combination is called series combination of cells. In this case the positive terminal of one cell shall be connected with the negative terminal of the other cell and the positive terminal of that cell will be connected with the negative terminal of the next cell and so on. In this case the cells voltages are add to give the output voltage but output current remains the same as a single cell. This combination is used when the increased system voltage is required.

Let us consider the case of dry cell battery each cell with cell voltage 1.5 volts. Now if we want to run an appliance the voltage rating of which is 6 voltage than we need 6 divided by 1.5 equals 4 cells [i.e.6 /1.5 = 4 cells] in series to get six voltage and to get it we have to connect the sells in series. That is, the positive terminal of one cell shall be connected with the positive terminal of the load and negative terminal will be connected with negative terminal of the load or appliances. This arrangement is shown in figure-11 below.

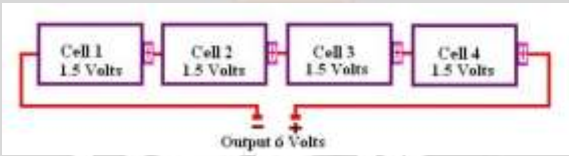

Figure -11: Series Combination of Cells. Voltage is four times higher of each cell voltage.

Here, each cell voltage = 1.5, Number of cell in series = 4
Therefore, System voltage = Each cell voltage × Number of cell in series. i.e. System Voltage = 1.5 × 4 Volts = 6 Volts.
System current = One cell current.
In general, For system voltage,

$$V_{System} = V_{Cell\ 1} + V_{Cell\ 2} + V_{Cell\ 3} + \ldots\ldots + V_{Cell\ n}$$

i.e. $V_{System} = \sum_{n}^{x=1} V_{Cell\ x}$ .For system current,

$$I_{System} = I_{Cell\ 1} = I_{Cell\ 2} = I_{Cell\ 3} = \ldots\ldots = I_{Cell\ n}$$

IID. Parallel Combination of cells

When two or more cells are connected in parallel than the combination is called parallel combination of cells. In this case the positive terminals of all the cells are connected together and forms the positive terminal of the system and all the negative terminals of all the cells are again connected together to form the negative terminal of the system. In this case the sells currents are add to give the output current but output voltage remains the same as a single cell. This combination is used when the increased system current is required. Let us again consider the case of same dry cell battery each cell with cell voltage 1.5 volts. Now if we want to run an appliance the voltage rating of which is 1.5 volts but current rating as high as four cells. In such case we need to connect the cells in parallel which will increase the system current four times but will keep the system voltage the same i.e. 1.5 volts. The positive terminal of all the cells shall be connected with the positive terminal of the load and negative terminal of all the cells shall be connected with negative terminal of the load or appliances. This arrangement is shown in figure-12 below.

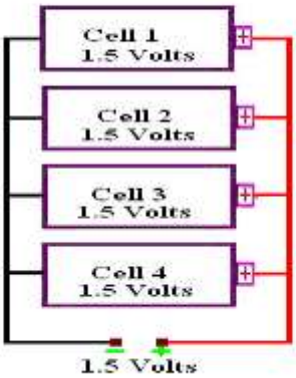

Figure-12: Parallel combination of cells. Current is four times higher of each cell current.

Here each cell voltage=1.5, Number of cell in parallel = 4
Therefore, System voltage = One cell voltage = 1.5 Volts.
System Current = Each cell Current × Number of cell in parallel. i.e. System Current = (Each cell current × 4) Ampere.
In general**,** For system Current,
$I_{System} = I_{Cell\ 1} + I_{Cell\ 2} + I_{Cell\ 3} + \ldots\ldots + I_{Cell\ n}$

i.e. $I_{System} = \sum_{n}^{x=1} I_{Cell\ x}$ .For system Voltage,

$V_{System} = V_{Cell\ 1} = V_{Cell\ 2} = V_{Cell\ 3} = \ldots\ldots = V_{Cell\ n}$
It can be noted here that for better combination and avoiding circulating current between cells voltage of every cells should be equal.

II.E: Series Parallel Combination of Cells

The most important and most useful combination of cells is the series parallel combination. In this case some cells are connected in series to form the required voltage. Now if the current or power requirement is higher than one cell then another series combination is formed and the later series combination is connected with the pervious series combination in parallel. In this way we can increase both the system voltage and current requirement. Here we can increase the power as we need. Let us again consider the case of same dry cell battery each cell with cell voltage 1.5 volts. Now if we want to run an appliance the voltage rating of which is 6 volts and current rating as high as three cells. In such case we need 16 cells to support the required power. We need to connect four cells in series to form 1.5 ×4 = 6 volts. Let us call this cell in parallel which will increase the system current four times but will keep the system voltage the same i.e. 1.5 volts. The positive terminal of all the cells shall be connected with the positive terminal of the load and negative terminal of all the cells shall be connected with negative terminal of the load or appliances. This arrangement is shown in figure -13 below.

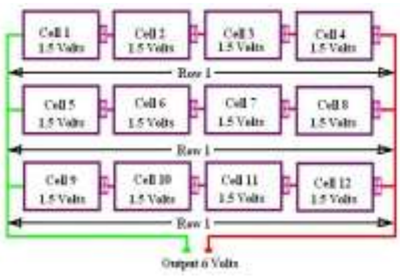

Figure-13: Series parallel combination of cells. Voltage is 4 times higher of each cell voltage and current is three times higher of each cell current**.**

Here each cell voltage = 1.5, Number of cell in a row = 4

Total number of row = 3. Therefore, System voltage = One cell voltage × Number of cell in one row, i.e. System voltage = 1.5 × 4 Volts= 6 Volts. System Current = Each cell Current × Number of row in parallel. i.e. System Current = (Each cell current × 4) Ampere.

In general, For system voltage,

$V_{System} = V_{Row\ 1} = V_{Row\ 2} = V_{Row\ 3} = \ldots\ldots = V_{Row\ n}$

Where, $V_{Row} = V_{Cell\ 1} + V_{Cell\ 2} + V_{Cell\ 3} + \ldots\ldots + V_{Cell\ n}$

i.e. $V_{Row} = \sum_{n}^{x=1} V_{Cell\ x}$

For system Current,

$I_{System} = I_{Row\ 1} + I_{Row\ 2} + I_{Row\ 3} + \ldots\ldots + I_{Row\ n}$

i.e. $I_{System} = \sum_{n}^{x=1} I_{Row\ x}$

Where $I_{Row} = I_{Cell\ 1} = I_{Cell\ 2} = I_{Cell\ 3} = \ldots\ldots = I_{Cell\ n}$

It should be noted that the number of cells in each row must be the same. Otherwise a circulating current will flow through the rows and no current or few current will flow through the load. The circulation current may lead to damage the system.

II F: Combination of Cells

The power we get from the cell of PKL is direct current (d.c.). The electrical appliances available in our country are of 6 volts, 9 volts, 12 volts etc. Since the practical appliances available in the market are of higher voltages than that of per cell voltage of PKL, so for the practical application we need to increase the system voltage by adding the multiple PKL cell in series. For example, we can get six voltage by connected the six PKL cell in series. Such an arrangement is shown in figure 10.13. Here six cells are used and connected in series. This will give an output voltage of 6 volts [theoretically 1.1× 6 = 6.6 volts]. But this will keep the current same i.e. output current remain the same as per cell current.

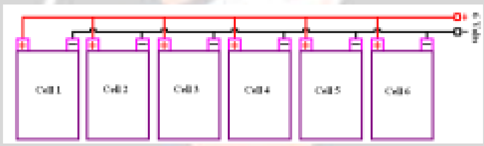

Figure-14: Six cells are connected in series for an output of six volts**.**

Similarly, if we want to increase both the voltage and current hence the power we need to go for series parallel combination of the PKL cells. This will increase both output voltage and current and hence the output power. Since the power in D.C. system is the product of voltage and current. Therefore, Power, P = V × I Watts. Where, P=Power in Watt,V=Voltage in Volts and I = Current in Ampere. Figure-15 shows such a system which will provide a output voltage 12 volts and will provide current equal to two PKL cells.

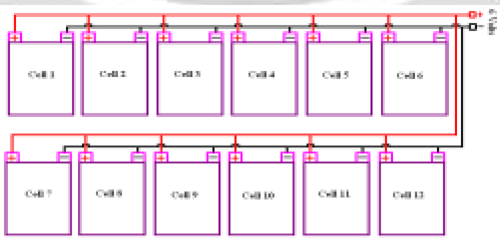

Figure-15: Twelve cells are connected in series parallel combination to get an output of 6 volts with increases power**.**

If we want to get more power we will need to use more cells in series parallel combination of cells.

IIG: Producing Electricity

When the connections of electrodes are ready we are at the final stage of producing electricity from PKL. At this stage the final task is to pouring the juice of PKL to the container or pot where the electrodes are placed. A chemical reaction is than taken place, which in turn, creates positive and negative potentiality around the plates. Now if we connect the Zinc and Copper plate through a proper load the current will flow from the cell to the external circuit.

Oxidation will occur at anode (Zinc) and reduction at the cathode (Copper). This will create a movement of electrons from zinc to copper and will produce current in the circuit. The net cell reaction will be as below:

$$Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$$

Thus metal at anode loses electrons and dissolved and metal at cathode gains electrons and grows. An experimental setup of the process is illustrated in figure -16 below.

Figure-16: Experimental Setup of Cells of PKL.

III: Problems of the PKL Electricity Production

As other cells PKL cell has also some common problem in producing electricity. It has been seen that there are two problems in PKL electricity generation system is Local Action and Polarization

IIIA: Local Action

The Zinc available in the market is not pure. When Zinc is used as anode and put into the PKL juice, it makes an small electric cell with the impurities. As a result Zinc plate destroys without any reason and it a great loss. This error is called local action. Generally it can be removed by mixing Hg layers on the Zn plate.

IIIB: Polarization

When chemical reaction starts in the PKL solution, then hydrogen ion (H^+) collects electron from the copper electrode and makes molecule of Hydrogen gas. As a result the potential of the copper plate increases. But when more Hydrogen gas (H_2) stores at Cu plate, and make a barrier to take electron from the copper plate. Therefore the potential of the Copper plate decreases and the flow of current is also decreases. This is called polarization. Generally using a brash or polarization reduction material has been used to reduce polarization. The $CuSo_4$ solution is also good for reducing polarization.

IV Conclusions

The generation of electricity from PKL is quite simple. This is the invention of our own. The poor villagers or the people in remote areas of the country can easily made it, can easily use it for their power requirement. It does not need any expensive material or does not need any in-depth knowledge about electricity to produce. Moreover since the generated electricity is of low voltage and does not use any harmful substance so it is also very much safe to produce and use. We can collect the PKL or can easily cultivate the PKL in a corner of our unused land. Easily collect the electrodes from the local market and can made it easily.

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