Design and fabrication of a LED lamp using potato extract for practical utilization

K.A. Khan[1], Hafijur Rahman Numan[2], Md.Khairul Islam[3], Mohammed Asraf Uddin[4], Md. Haidar Ali[5], Md Shahidul Islam[6]

[1]Department of Physics, Jagannath University, Dhaka-1100, Bangladesh.
E-mail: kakhan01@yahoo.com, Phone: 01911357447
[2]Department of Physics, Uttara University, Dhaka, Bangladesh.
E-mail: hrahmannoman@gmail.com, Phone: 01764210529
[3]Institute of Nuclear Medical Physics, Bangladesh Atomic Energy Commission
E-mail: khairulislambaec@gmail.com, Mobile: 01719847820
[4]Institute of Computer Science, Bangladesh Atomic Energy Commission
E-mail: asrafbaec@gmail.com, Mobile: 01924911650
[5]Institute of Computer Science, Bangladesh Atomic Energy Commission
E-mail: haiderdiu@gmail.com, Mobile: 01677080165
[6]Bangladesh Atomic Energy Regulatory Authority, Bangladesh Atomic Energy Commission, E-12/A, Agargaon, Dhaka, 1207, Bangladesh. E-mail: shahidul.baec@gmail.com, Phone: 01712454272

Abstract

In this study, we have observed the voltage and current of potato extract which are found and grown easily. We have conducted observations very carefully. We have found that the potato extract of these samples have significant amount of voltage and current. The discharge characteristic of a LED lamp was more effective than the other types of lamp as the Open circuit voltage, Short circuit current and Maximum power are more stable and steady in comparison with others. Potatoes contain vitamins, minerals, water, carbohydrate, protein and fiber. It is the presence of the water, sugars and acid within the potato that allows electrons to flow between the metals to form an electrical current. The copper and zinc react effectively forming electrodes, the zinc acts as the electron rich anode (positive) whilst the electron poor copper acts as the cathode (negative).

Keywords: Potato extract, LED lamp electricity, Open circuit voltage, Short circuit current.

I. Introduction

Electric power is a boon of the human civilization. Our daily life is completely depends on this energy[1-5]. There are many ways of generating electrical energy in the world today[6-8]. But these conventional ways of generating electrical energy have many disadvantages such as resource limitations and environmental pollution [9-10]. For this reason, Scientists are turning their attention to nonconventional sources[11-15]. Renewable energy sources are non-conventional sources[16-19]. In this study, we have designed a LED lamp using potato juice. We have measured the voltage from potato juice using an electrochemical cell[20-23]. We have observed that the voltage was stable until the potato were fresh. So we can come to a decision that fresh potato may be a source of electrical energy[24]. This work can play an important role in power generation for the near future.

II. Methods and Materials

II.A Materials

Potato extract, 1 LED lamp, Alligator clips, Copper plate, Zinc plate, Copper wires, Rubber band, Falcon tube, PVC plate(separator), Cock sheet.

II.B Methodology

First of all, we bought 500 grams of potato from the market. Then it was washed well carefully. Then it was prepared extract by a blender. Now put some potato extract into a falcon tube and measured the voltage and current by connecting a copper and a zinc sheet as a cathode and anode respectively with a pair of wires. After that it was

connected all the tubes together in series combination to increase the voltage(Fig.1). Finally it was sat up in a cock sheet to run the LED bulb(Fig.2)

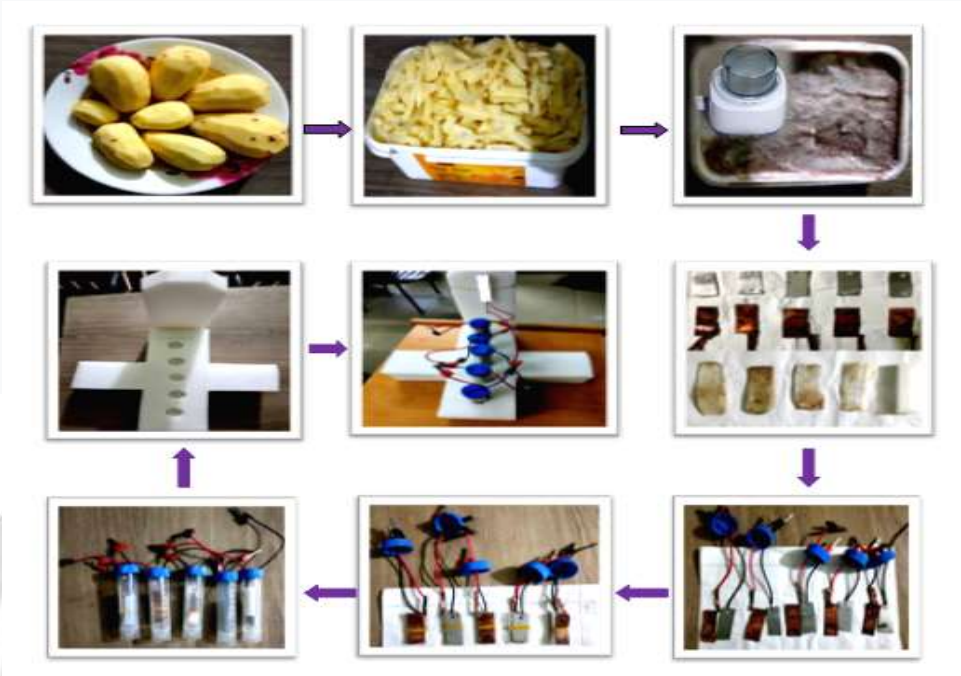

Fig.1 shows the Graphical representation of the method for practical application. It represents the procedure for from the initial step to final step of the device.

Fig.2 Experimental setup of a LED lamp using potato extract.

Fig.2 represents the finished product of the device. It is shown that the LED bulb is lighting for this system. The Current and voltage was measured by a calibrated multimeter.

Table.1: Table for data collection

Time duration (hrs)	Opencircuit Voltage, V_{oc}(V)	Load voltage, V_L(V)	ShortCircuit Current, I_{sc}(mA)	Load Current,I_L(mA)	Maximum Power, P_{max}(mW)	Load Power, P_L(mW)	Internal resistance, R_{in}(ohm)
00	4.50	2.56	6.10	4.50	27.45	11.52	0.74
10	4.35	2.55	5.80	4.40	25.23	11.22	0.75
20	3.40	2.54	5.50	4.30	18.70	10.92	0.62
30	4.25	2.53	5.30	4.30	22.53	10.88	0.80
40	3.10	2.52	4.90	4.10	15.19	10.37	0.63
50	3.50	2.51	4.70	4.00	16.45	8.79	0.74
60	4.00	2.50	4.70	4. 00	18.8	10.00	0.85
70	3.40	2.49	4.70	4.00	15.98	9.96	0.72
80	4.36	2.47	4.50	3.90	19.62	9.63	0.97
90	3.75	2.46	4.20	3.70	15.75	9.59	0.89
100	3.59	2.45	4.00	3.70	14.36	9.07	0.90

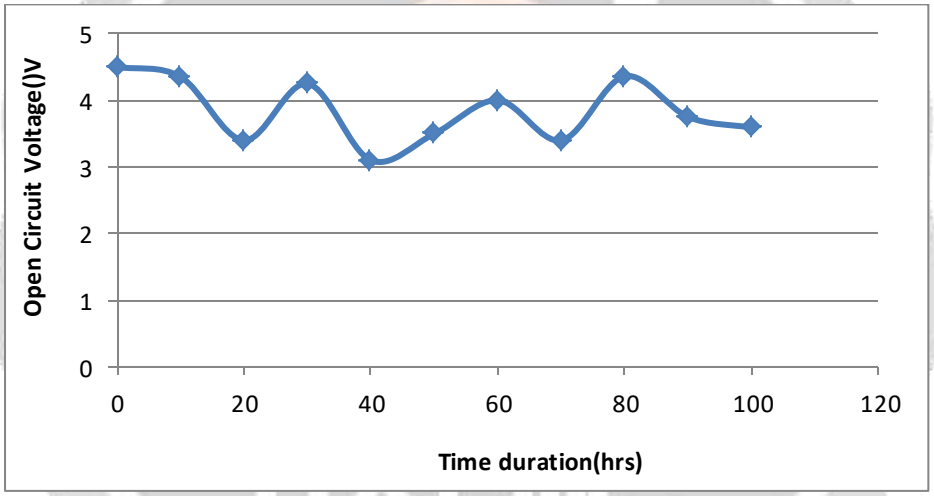

Fig.3 Open circuit voltage (V_{oc}) versus time duration (TD)

Fig.3 shows that the variation of open circuit voltage with the variation of time duration. It is shown that the open circuit voltage varies with time in a zigzag system. It is shown that the open circuit voltage was almost constant up to 10 hrs and then it deceased exponentially up to 40 hrs and then after it increases exponentially up to 70 hrs and finally it increases up to 110 hrs.

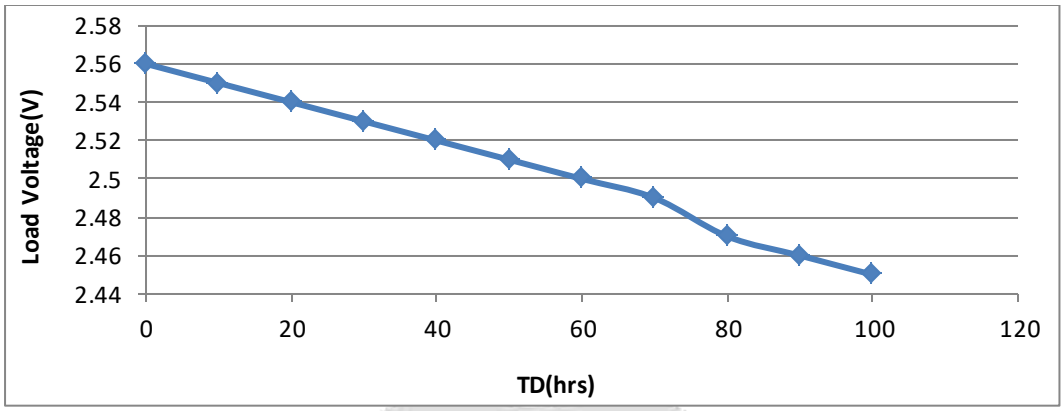

Fig..4: Short circuit current (I_{sc}) versus time duration (T.D.)

Fig.4 shows the variation of load voltage with the variation of Time duration(hrs).It shows that the load voltage decreases linearly with time up to 110 hrs. The maximum value of the load voltage is 2.56 volt and the minimum voltage is 2.45 volt. The load voltage difference is 0.11 volt. The maximum load voltage is 2.56 volt and the minimum load voltage is 2.45 volt. So that the difference is 0.11 volt.

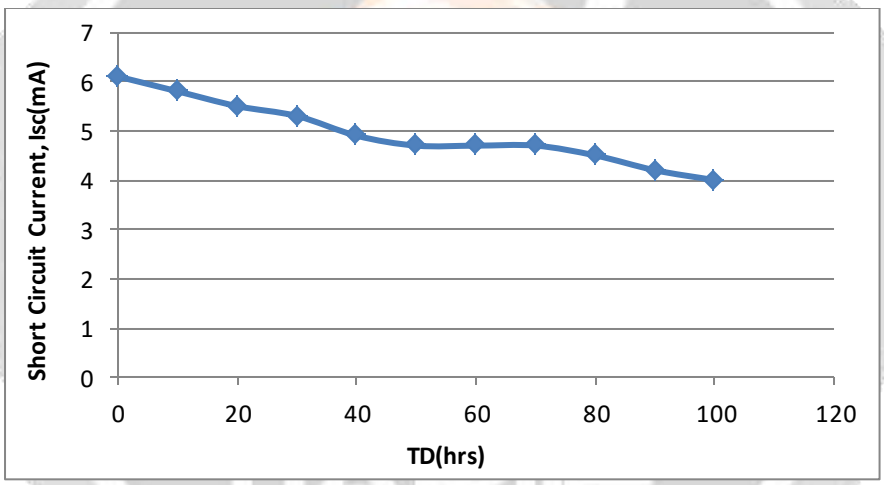

Fig..5: Short circuit current (I_{sc}) versus time duration (T.D)

Fig. 5 shows the variation of short circuit current with the variation of time duration. The short circuit current decreases exponentially up to 40 hrs and then increases exponentially up to 60 hrs and then after it increases exponentially up to 100 hrs and finally it increases linearly up to 110 hrs.

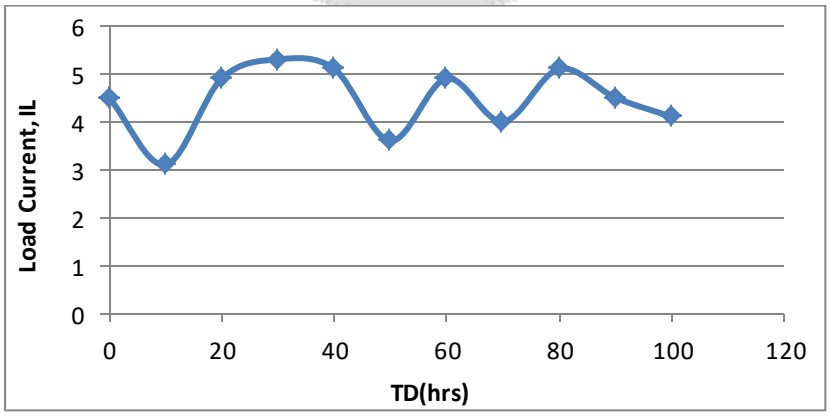

Fig..6: Short circuit current (I_{sc}) versus time duration (T.D)

Fig.6 shows the variation of load current with the variation of time duration. Firstly, load current decreases linearly up to 10 hrs and then increases exponentially up to 50 hrs and then after it increases up to 80 hrs and finally it increases exponentially up to 110 hrs.

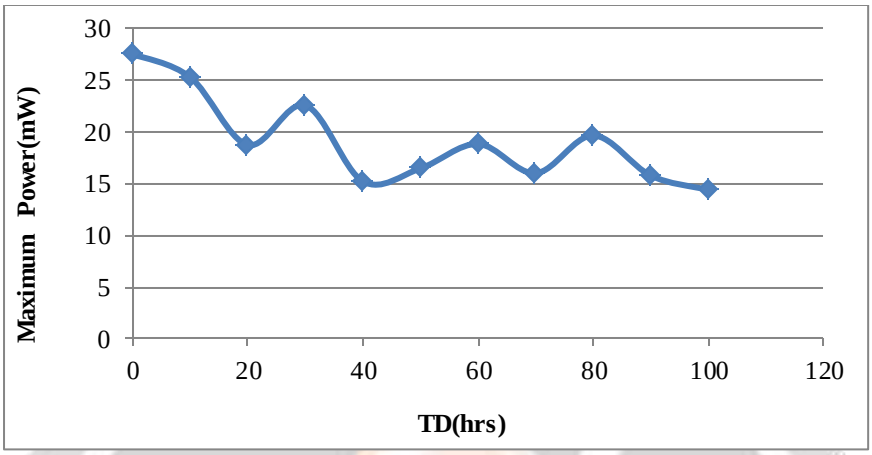

Fig.7 Maximum Power versus time duration (T.D.)

Fig.7 shows the maximum power versus time duration (T.D.).It is shown that maximum power decreases linearly up to 20hrs and then increases exponentially up to 40 hrs and then increases up to 70 hrs and finally it increases exponentially up to 100 hrs.

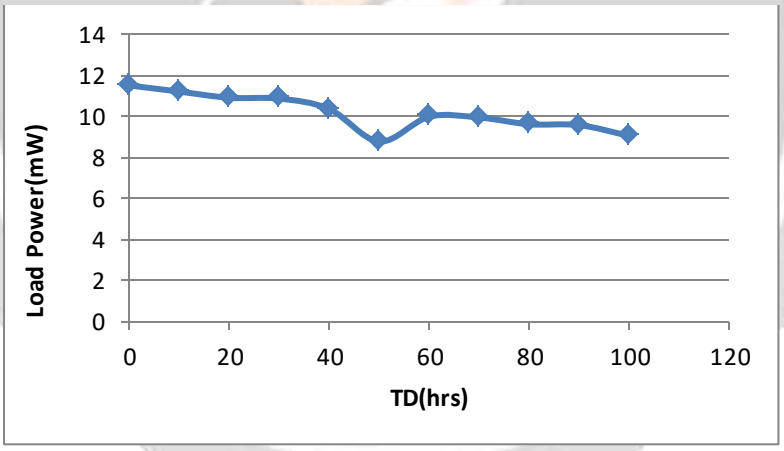

Fig.8 Load Power versus time duration (T.D)

Fig.8 shows the variation of Load power with the variation of time duration. It is shown that the load voltage decreases linearly with time duration up to 40 hrs. Then it decreases exponentially up to 60 hrs. Finally it decreases slowly up to 1000 hrs.

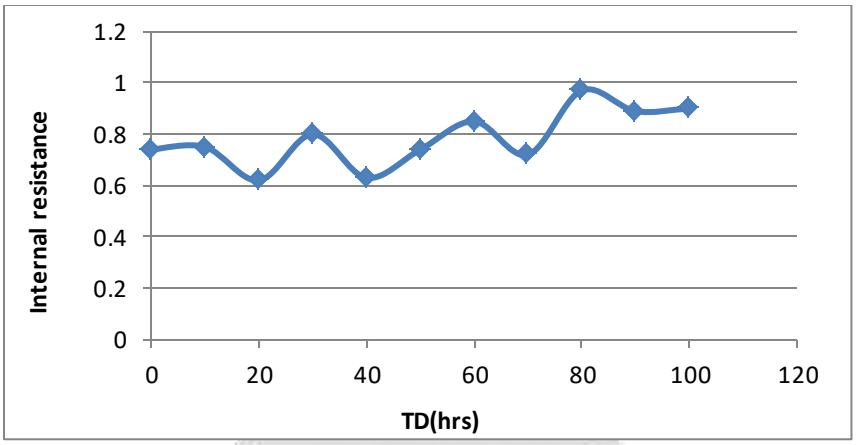

Fig.9 Internal resistance versus time duration (T.D)

Fig.7 shows the internal resistance versus time duration (T.D.).It is shown that internal resistance decreases linearly up to 20hrs and then increases exponentially up to 40 hrs and then increases up to 70 hrs and finally it increases exponentially up to 100 hrs.

IV. Conclusion

The fresh potato are available in our country due to the development of agriculture research. Anybody can harness this electricity as a homemade product. Anyone can Cultivate these vegetable potato in the garden to get homemade electricity instead of kerosene. This electricity can be used to power LED bulb. This is useful for remote areas of any country. This electricity is environmental friendly and low priced.

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