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Research Article

PREPARATION OF BIO-VOLTAIC CELL FROM THE EXTRACT OF DIFFERENT PLANT PARTS

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ABSTRACT
In the present investigation, power has generated from no or low cost plant parts such as peel skin of vegetables, Akashmoni leaf (*Acacia auriculiformis*), flower of Marigold (*Tagetes erecta*) and Tagar (*Tabernaemontana sananho*) and Star fruit (*Averrhoa carambola*). The extracts of different plant parts as mentioned earlier are used here as electrolytes, whereas traditional zinc anode and carbon rod as cathode are used. Maximum 11.06V electricity and 26.74 mA current were generated. Desired voltage and current within certain range may be generated in different combination of series and parallel connection and using different number of bio-voltaic cells. The bio-voltaic cells are used for charging mobile batteries, operating radio, electronic wall clock or any low power consuming circuits.

Keywords: *Bio-voltaic Cell, Akashmoni, Marigold, Tagar, Star Fruit, Extract, Voltage, Electricity*

INTRODUCTION
Efforts are being taken, now-a-days to explore the non-conventional energy sources because a large and cheap source of energy is essential for the development of a growing nation. Utilization of biomass energy has achieved a particular interest in this regard in recent years due to the gradual decrease of the sources of conventional fossil fuels.

It demands for an increased use of renewable energy sources like biomass. Due to the large sources and low economical aspects the biomass is a matter of interest so far the energy sources and availability is concerned (Rai, 2004; Balat, 2009; Sudhakar *et al.,* 2013).

Kaygusuz (2009) elaborately described the bio-energy as a clean and sustainable fuel. Datta (2003) first gave a new concept regarding biomass energy. He was able to generate electricity from certain succulent leaves like Bryophyllum.

For power generation in common voltaic cell, commercially available inorganic electrolytes are used. After discharge of exhausted battery it causes environmental pollution also (Velusamy and Visalakshi, 2007). Plant extracts may be used as electrolytes because all plant materials contain various types of inorganic and organic electrolytic substances, absorbed through their root system and metabolic pathways (Datta, 2003**)**. In the present study bio-voltaic cell is prepared through which power has generated from no or low cost plant parts such as peel skin of vegetables, Akashmoni leaf, flower of Marigold and Tagar and Star fruit (Kamranga).

MATERIALS AND METHODS
Preparation of bio-voltaic Cell
Bio-voltaic cell consists of two types of electrodes of different elements. Various types of electrodes can be used in this study. Carbon rod (5.6 cm X 0.7 cm) was used as cathode and zinc made one end closed cylinder (5.7 cm X 3.0 cm) was used as anode in the present experimental set up. The volume of zinc container was 40 cm^3. The carbon electrode was placed at the centre of the zinc container on the lid in such a way that it did not touch with the zinc anode as shown in the Figure 1.A. Each zinc container was filled up with 35 ml plant extract. The bio-voltaic cell, as described above was considered as one unit.
Such ten units were connected in series and parallel connection separately for further study. Separate sets were prepared for different five types of plant extracts (Figure 1.B & C).

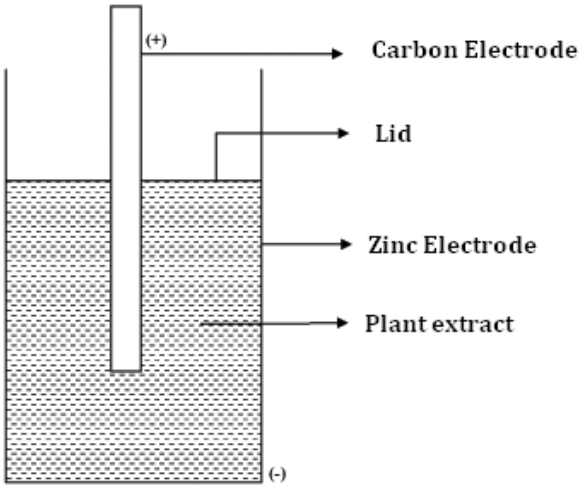

Figure 1.A: Schematic representation of a single bio-voltaic cell

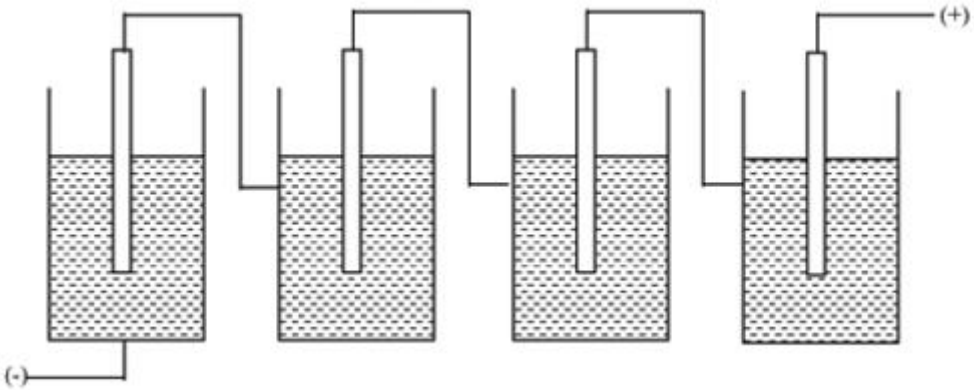

Figure 1.B: Bio-voltaic cells arranged in series connection

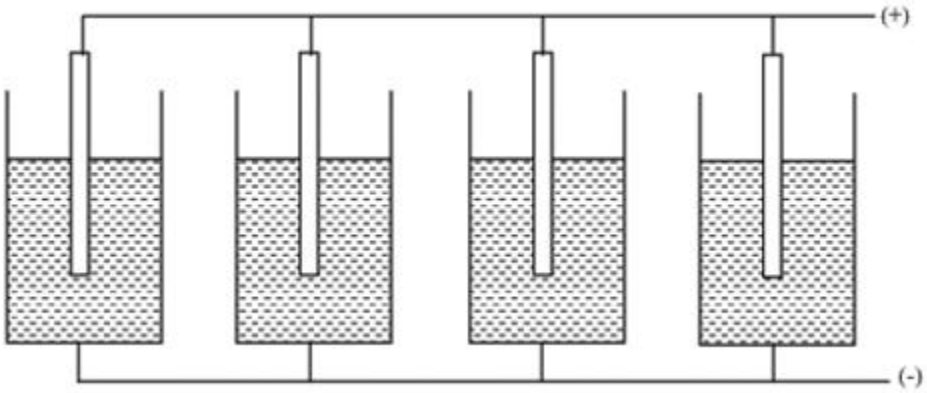

Figure 1.C: Bio-voltaic cells arranged in parallel connection

Preparation of Plant Extracts

In the present investigation, the following five plant parts were used to prepare electrolytes of the bio-voltaic cell –

1. Peel skin of vegetables
2. Akashmoni leaf (*Acacia auriculiformis*)

3. Flower of Marigold (*Tagetes erecta*)
4. Flower of Tagar (*Tabernaemontana sananho*) and
5. Star fruit (*Averrhoa carambola*).

Four hundred gram of each plant parts was taken and ground separately in a mixer grinder with double distilled water and final volume of decoction was made up to 1000 ml with double distilled water in each case. This plant extracts were used as electrolytes in bio-voltaic cell.

Determination of pH of Plant Extracts

Five mililitre of each aqueous plant extracts was taken separately and the pH of plant extracts have been measured by using digital pH meter (Systronics).

Measurement of Electricity

Ten units of bio-voltaic cells were connected in series and plant extract was poured in each cell as electrolytes. Separate sets were prepared for five different types of plant extracts. Voltage and current were measured with digital multi-meter. Similarly a parallel connection of ten bio-voltaic cells was prepared and the voltage and current were also recorded for each five different plant extracts (Figure 1.B & C).

RESULTS AND DISCUSSION

In the present study, aqueous extracts of peel skin of vegetables, Akashmoni leaf, flower of Marigold and Tagar and Star fruit were used as electrolytes in bio-voltaic cells. It has been observed that the pH of all these extracts is acidic except Akashmoni leaf (Table and Figure 3.A). It was important to mention that the generated electricity was higher in the plant extract with higher degree of acidity.

When ten bio-voltaic cells are connected in series it has been found that the maximum 11.06V electricity was generated in case of star fruit extract. Whereas these values were 10.50V and 10.52V respectively when Marigold flower extract and Akashmoni leaf extract were used as electrolytes. The values of generated electricity were 8.65V and 8.54V in case of peel skin of vegetables and Tagar flower respectively (Table and Figure 3.B).

It has been noticed that maximum 6.01mA current was obtained in case of Marigold flower when ten bio-voltaic cells were arranged in series connection. In the present experimental set up, the values of generated current were 5.92mA, 5.26mA, 4.5mA and 2.57mA in case of star fruit, Akashmoni leaf, Tagar flower and peel skin of vegetables respectively (Table and Figure 3.C).

Similarly we have connected ten bio-voltaic cells in parallel arrangement and have measured the generated voltage and current. It has been observed that, maximum 1.16V electricity was detected in case of star fruit extract whereas it was 1.08V both in case of Akashmoni leaf and peel skin of vegetables extract. Only 1.05V and 0.81V of electricity were obtained when Marigold and Tagar flower were used as electrolytes respectively (Table and Figure 3.B).

In parallel connection maximum 26.74mA current was generated in case of star fruit extract. When we used Akashmoni leaf extract as electrolytes, 25.10mA current was obtained. The values were 22.17mA, 20.12mA and 19.36mA in case of Marigold flower, peel skin of vegetables and Tagar flower extracts respectively (Table and Figure 3.C).

Table 1: pH, voltage and current generated in series and parallel connection of bio-voltaic cell

Sl. No.	Plant Parts	pH of Extracts	Type of Connections			
			Series Connection		Parallel Connection	
			Voltage (V)	Current (mA)	Voltage (V)	Current (mA)
1.	Peel skin of vegetables	5.3	8.65	2.57	1.08	20.12
2.	Flower of Marigold	5.2	10.50	6.01	1.05	22.17
3.	Star fruit	4.9	11.06	5.92	1.16	26.74
4.	Akashmoni leaf	7.0	10.52	5.26	1.08	25.10
5.	Flower of Tagar	6.2	8.54	4.50	0.81	19.36

Figure 2: A. Peel skin of vegetable, B. Flower of Marigold (Tagetes erecta), C. Flower of Tagar (Tabernaemontana sananho), D. Akashmoni leaf (Acacia auriculiformis), E. Star fruit (Averrhoa carambola), F. Illuminatio of LED with the lectricity generated in bio-voltaic cell, G. Measurement of electricity of bio-voltaic cell in digital multimeter

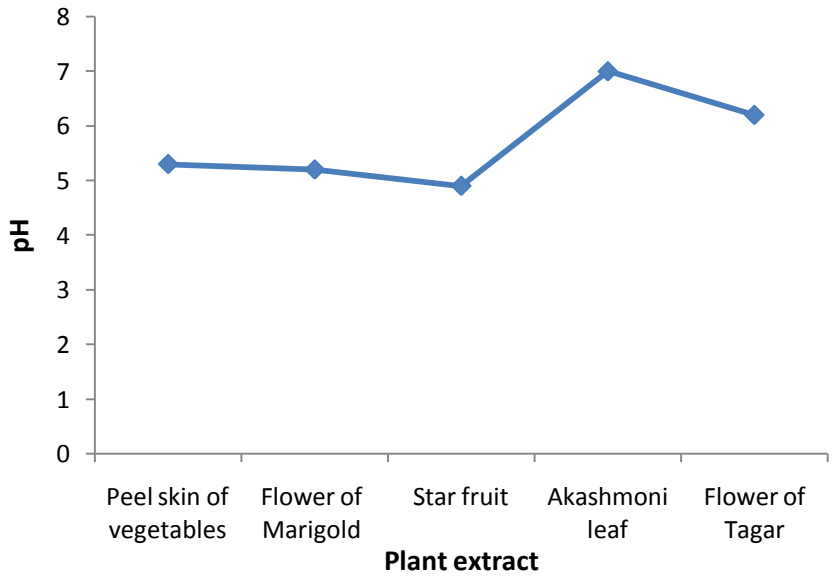

Figure 3A: pH of different plant extracts

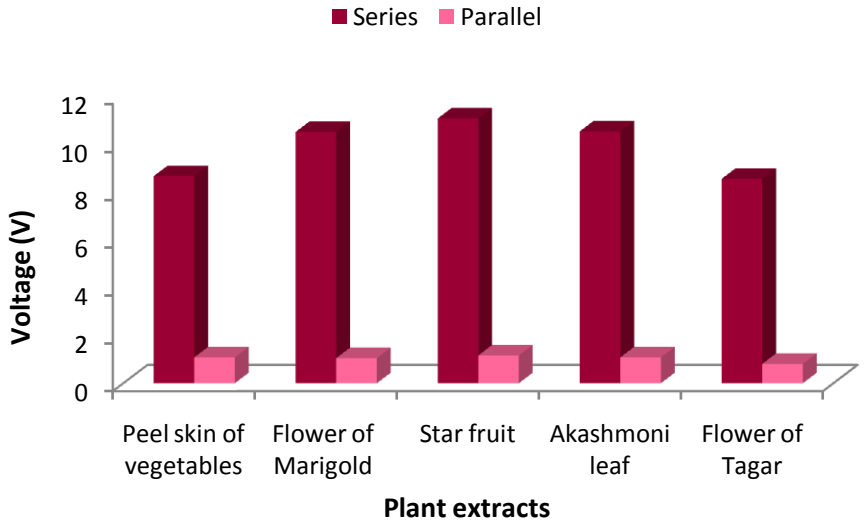

Figure 3: Voltage generated in series and parallel connection

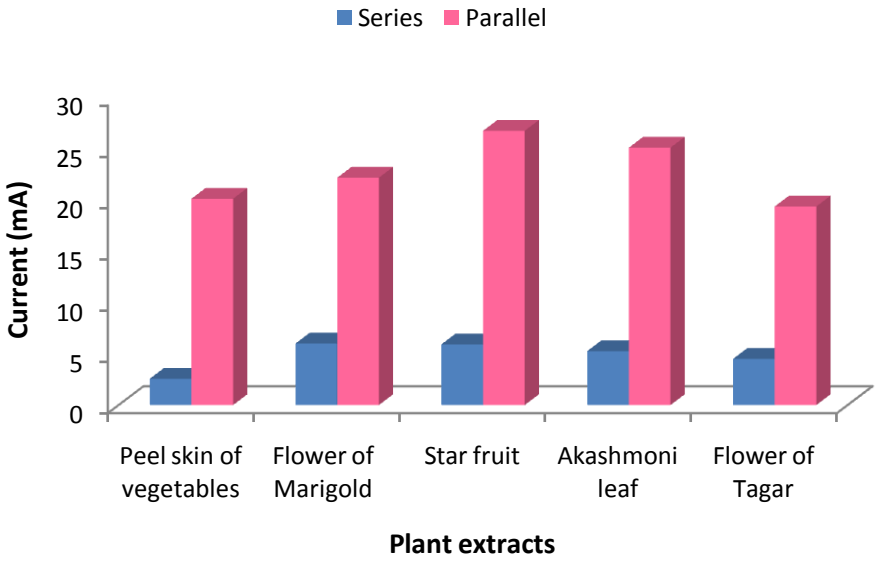

Figure 3.C: Current generated in series and parallel connection

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