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Non-Conventional Power Sources: Part-I. Study on the Qualitative Aspects of the Leaves of *Vinca rosea* as New Nonconventional Bio-Electrochemical Low Power Source^Ψ

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Abstract: Bio-chemical properties of plant leaves have been used to develop the nonconventional bioelectrical energy sources for micropower electronic devices and are termed as bio-emf-devices (BEDs). The peculiar characteristics details of the Bio electro devices using leaves of ornamental importance and ayurvedic medicinal plant from the family Apocynaceae viz. *Vinca rosea* have been studied. The qualitative aspects of the leaves to develop non-conventional bio-electrochemical low power sources have been attempted. Here qualitative result indicates the possible involvement of bio-activities in the operational mechanism of bio-emf-devices.

Keywords: Nonconventional bio-electrical energy sources, Bio-chemical properties, Bio-emf-devices (BEDs), Apocynaceae, *Vinca rosea*, Low power sources.

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INTRODUCTION

The plant parts like leaves are natural biosystem, which contain different inorganic and organic ions¹. The controlled and regulated ionic motion makes a biosystem different from a usual physical electrolytic system. Thus, the plant parts may be defined as "bio electrolytic systems" or "bio-power conducting systems". As a good ionic conductor² is a prerequisite condition for a battery material. Hence we thought of exploring the possibility of using the plant parts viz. leaves as new nonconventional material for developing low power sources for micro-electronic devices i.e the small technological object or an appliance.

Intensive survey of the literature showed that the variation of pH in case of *Hydrilla-verticiliata* has been correlated with the time as variant³. Recently, report⁴ showed that the leaves can be used to generate electrical power practically. Herein we present results on development and characteristics of Bio-electro devices using leaves of the ornamental importance and ayurvedic medicinal plant from family Apocynaceae viz. *Vinca rosea*. The emf (potential) variations with the time for Bio-electro devices with time and temperature for bioelectro devices made using biofluid have been studied. The results of qualitative aspects showed the involvement of bioelectro chemical properties of plant leaves in the operation of bio electro devices.

EXPERIMENTAL

A cell is constructed containing various conductors (viz. copper and zinc) is prepared using metallic plates of surface area of (2.5 x 6) cm². A 1 to 2 mm thin plate of or a paper made of teflon with a central hole is affixed on one side of each of the metallic plates. The electrodes are washed, cleaned and polished before employing them to construct a unit of Bio electro devices (BED).

RESULTS AND DISCUSSION

Results of the experiments done i.e variations in the potential using *Vinca rosea* leaves have been discussed with respect to time and temperature, under open circuit conditions.

Variation of Potential with Time: The results of Bio electro devices under open circuit condition for potential variations are shown in **Fig. 1**.

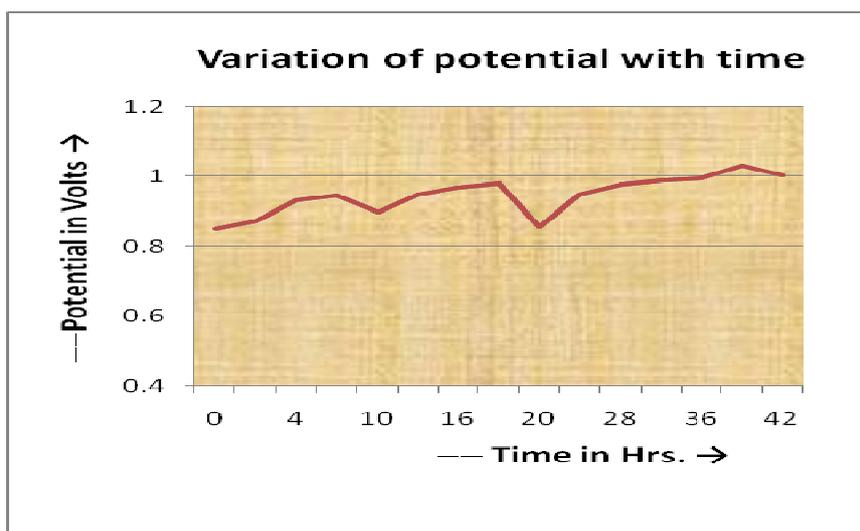


Fig. 1: Variation of potential with time period of bio electro devices for *Vinca rosea* (under open circuit condition).

Table-1: Results of bio electro-device for voltage and time for biofluids of *Vinca rosea* from family Apocynaceae (under open circuit condition)

Sr. No.	Time, in hrs.	Voltage, in V
1	0	0.850
2	2	0.872
3	4	0.932
4	8	0.948
5	10	0.900
6	12	0.950
7	16	0.970
8	18	0.981
9	20	0.855
10	24	0.950
11	28	0.978
12	32	0.989
13	36	0.996
14	40	1.032
15	42	1.003

The Bio electro devices gave initial value of as 0.850 V, at temperature 32°C, which changed with time and did not follow any definite trend, over all it increases very slowly. It have been noted that its value is even larger than the initial value. Therefore, it is difficult here to appeal the electrochemical principles⁵ to evaluate value theoretically. The variations are possibly bio-originated.

The phytomarkers (phytochemicals) may be responsible for the observed process of variations of potential. These, observations thus indicate about an involvement of a large number of energy producing bioelectro chemical reactions in the operation of Bio electro devices. The bioelectro potential (BEP) of plants has recently attracted attention^{3,6}.

Variation of Potential with Temperature: The results of bio electro devices under open circuit condition for potential showed initial value 0.850 at 32°C (the values at different temperature are indicated in Table-2) and shown variation with temperature 27, 32 and 37°C as 0.848, 0.850 and 0.852 V in case of *Vinca rosea*. The graphical representation of the values were shown in **Fig. 2**.

Table-2: Results showing potential at different temperature for biofluids of *Vinca rosea*.

Sr. No.	Temperature, °C	Potential, V
1	27	0.848
2	32	0.850
3	37	0.852

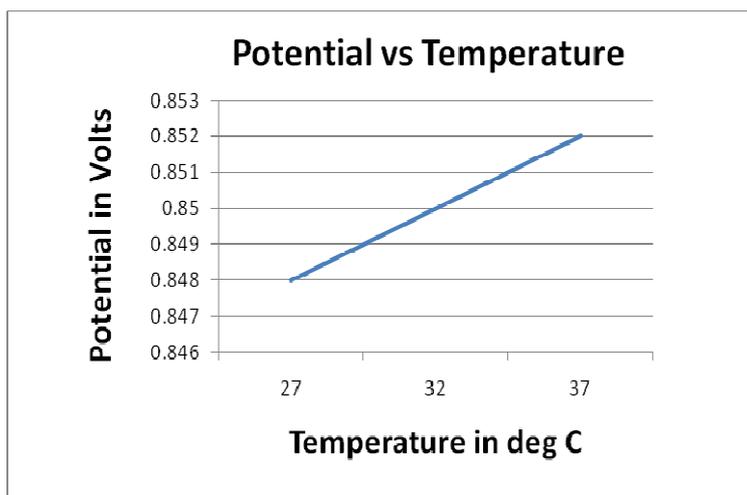


Fig. 2: Variation of potential with temperature for *Vinca rosea*.

CONCLUSION

Though the operational mechanism of Bio electro devices is yet to be investigated clearly, its prospective use to energizing micro-electronic circuits seems very exciting and of much practical value. We have been successful in operating various small electronic devices. Further experiments on the homo electrode pair Bio electro devices to establish the role of bioactivity in the operation of Bio electro devices are underway in our laboratory.

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