

## **Novel Investigation trail on bio-fuel cell by various fruits waste in Domestic juice shops or hotels**

T.Sathish

Department of Mechanical Engineering, Saveetha School of Engineering, SIMATS, Chennai 602 105, Tamil Nadu, India

Author Email: [sathish.sailer@gmail.com](mailto:sathish.sailer@gmail.com)

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*Biofuel cell, electricity, juice wastes, electrolyte, solid waste management.*

### **ABSTRACT**

In this investigation deals with the various fruit wastes available in domestic juice shops or hotels for bio-fuel cell arrangement. Electricity production and waste management both are the major research area in the current situation among the world. In this study deals with the both waste materials of juice shops, hotels and etc., were converted into the materials of fuel cell. This will lead to the power generation. The amount of power production maybe low but the utilization of the waste materials leads to solid waste management also. There are different types of fruits wastes are available in the juice shop among them segregation of these fruits leads to the comparison of the outcome of the fuel cell. In this study deals the Apple, Orange, Lemon, Citrus limetta (Sweet lemon) and mixing of all of these wastes in to the bio fuel cell electrolyte solution in the common arrangement.

## **1. INTRODUCTION**

In the world there is no one is the waste we can reuse or recycle them for our convenient outcomes and uses [1]. The waste materials of any product can be converted in to the desirable product or reusable things. In this investigation deals with two main concepts one is reuse of waste materials and another one is power generation by using the reuse materials. Reuse of various fruit juices wastes considered like waste of Apple juice, Orange juice, Lemon Juice, and Citrus limetta. These wastes can be used in the bio fuel cell as the electrolyte solution. Bio fuels cell are the recent trend in the power generation and fuel cell vehicles around the world. There are different modern advances with various functions of Biofuel Cells were discussed by [2] F. Davis and S. P. J. Higson.

Cohen B [3] explained about the Microbial fuel cells (MFC) accomplished of creation of potentials in overload of 35 V. Conventional resource of power is certainly indefensible [4]. Mostafa Rahimnejad et al [5], discussed about the electricity production from natural substrate in group and constant flow MFC process. There are different types of anode, cathode, intermediate membrane and electrolytes were identified through [6] to [12]. The different designs of Abiotic glucose fuel cell such as stacked assembly, depletion, single layer

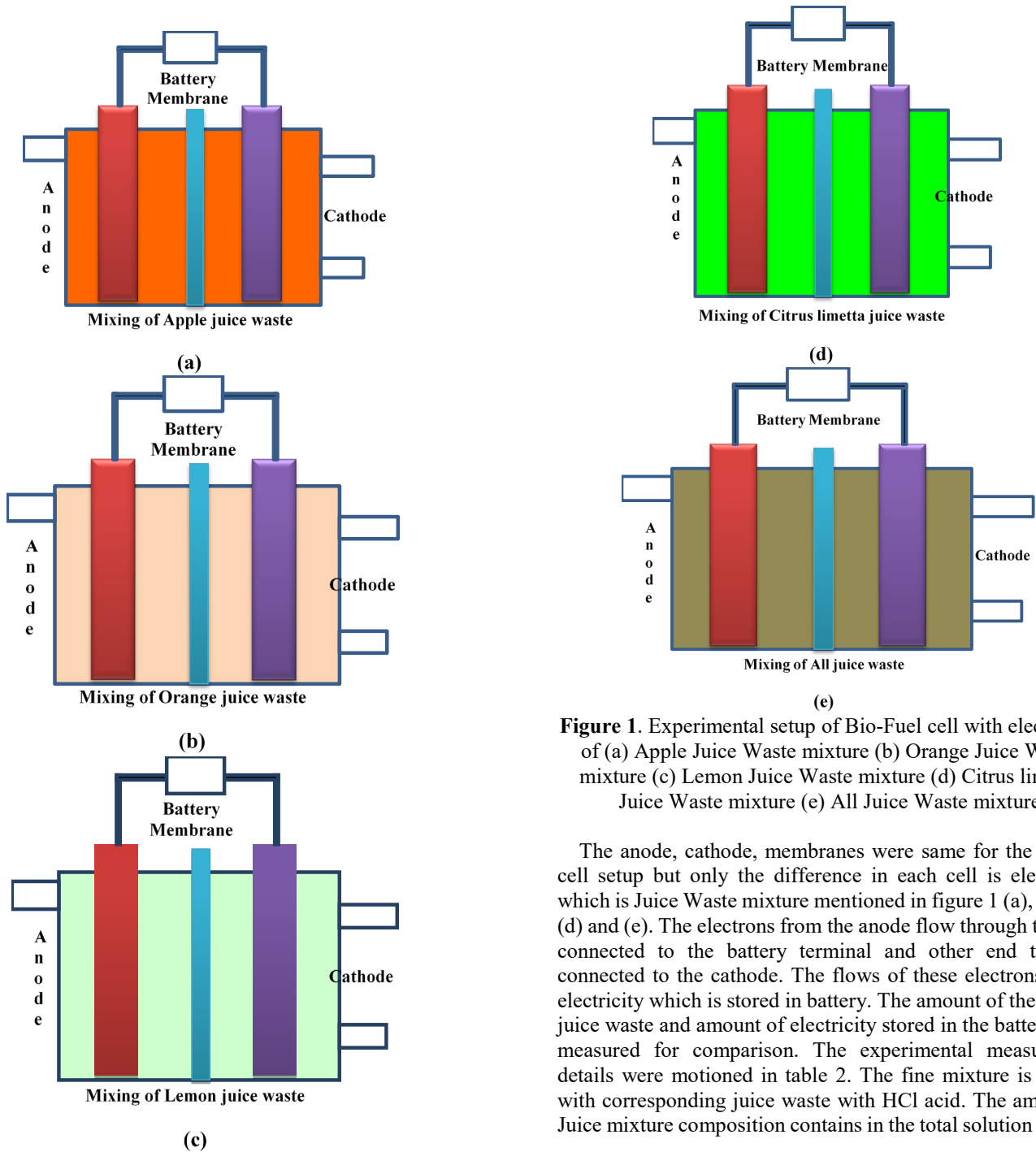
design methods were analyses to used the methods, construction and working of the bio fuel cells from [13] to [17].

## **2. EXPERIMENTAL PROCEDURE**

Bio Fuel cell contains the anode, cathode, membrane, electrolyte solution and connections were made as per the traditional method of depletion design in construction. The details of the experimental details were mentioned in the table 1. All the bio fuel cells with the various concentration setups were shown in figure 1.

**Table 1** Details of All bio-fuel cell details

Bio-fuel cell Number	Electrolyte	Anode	Cathode	Membrane
1	Apple Juice Waste mixture	Platinum rod	Carbon rod	Polymer electrolyte Membrane (PEM)
2	Orange Juice Waste mixture	Platinum rod	Carbon rod	PEM
3	Lemon Juice Waste mixture	Platinum rod	Carbon rod	PEM
4	Citrus limetta Juice Waste mixture	Platinum rod	Carbon rod	PEM
5	All Juice Waste mixture	Platinum rod	Carbon rod	PEM



**Figure 1.** Experimental setup of Bio-Fuel cell with electrolyte of (a) Apple Juice Waste mixture (b) Orange Juice Waste mixture (c) Lemon Juice Waste mixture (d) Citrus limetta Juice Waste mixture (e) All Juice Waste mixture

The anode, cathode, membranes were same for the all fuel cell setup but only the difference in each cell is electrolyte which is Juice Waste mixture mentioned in figure 1 (a), (b), (c), (d) and (e). The electrons from the anode flow through the wire connected to the battery terminal and other end terminal connected to the cathode. The flows of these electrons create electricity which is stored in battery. The amount of the mixing juice waste and amount of electricity stored in the battery were measured for comparison. The experimental measurement details were motioned in table 2. The fine mixture is created with corresponding juice waste with HCl acid. The amount of Juice mixture composition contains in the total solution volume

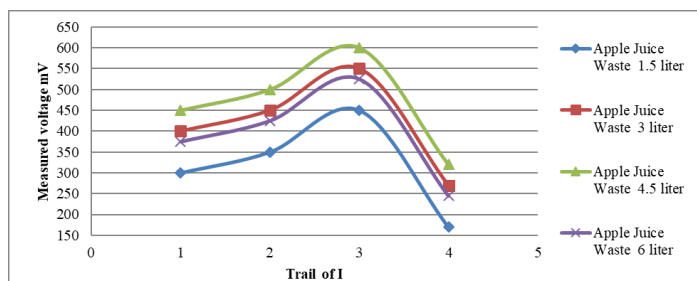
of 7.5-liter capacity cell. In the combination from 1a to 5d have HCl in the remaining amount of the total volume. The amount of electricity produced were measured by voltmeter with respect to time.

**Table 2.** Experiments details of Amount of juice mixture in 7.0-liter capacity cell

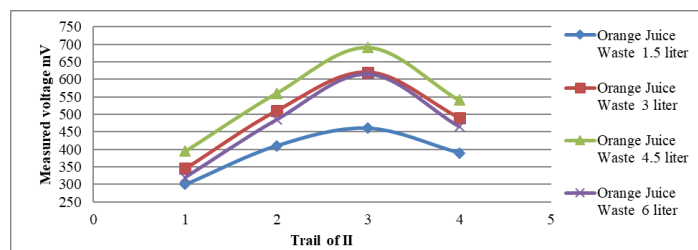
Trial number	Amount of juice mixture	Details
I	1	1.5 liter
	2	3.0 liter
	3	4.5 liter
	4	6.0 liter
		Fine mixture of Apple Juice Waste mixture with HCl
II	1	1.5 liter
	2	3.0 liter
	3	4.5 liter
	4	6.0 liter
		Fine mixture of Orange Juice Waste mixture with HCl
III	1	1.5 liter
	2	3.0 liter
	3	4.5 liter
	4	6.0 liter
		Fine mixture of Lemon Juice Waste mixture with HCl
IV	1	1.5 liter
	2	3.0 liter
	3	4.5 liter
	4	6.0 liter
		Fine mixture of Citrus limetta Juice Waste mixture with HCl
V	1	1.5 liter
	2	3.0 liter
	3	4.5 liter
	4	6.0 liter
		Fine mixture of All Juice Waste mixture with HCl

### 3. RESULTS AND DISCUSSION

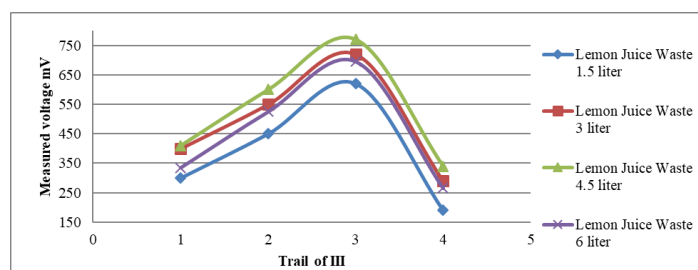
There are five different trails were made as per the table 2 and each trail consist of four combination of tests with respect to the combination of the electrolyte mixing with juice waste with HCl. In Figure 2 mentioned the Average of 24 hours measured voltage in mV for Apple juice waste used in Bio fuel Cell as a graphical representation with the concentration of four different combination of Apple juice waste with HCl. Similarly Figure 3, Figure 4, Figure 5 and Figure 6 were mentioned the average of 24 hours measured voltage in mV for Orange juice waste used Bio fuel Cell, Lemon juice waste used Bio fuel Cell, Citrus limetta juice waste used Bio fuel Cell and mixing of all juice waste used Bio fuel Cell respectively. In each plots explained the detailed of variations of experimental results.



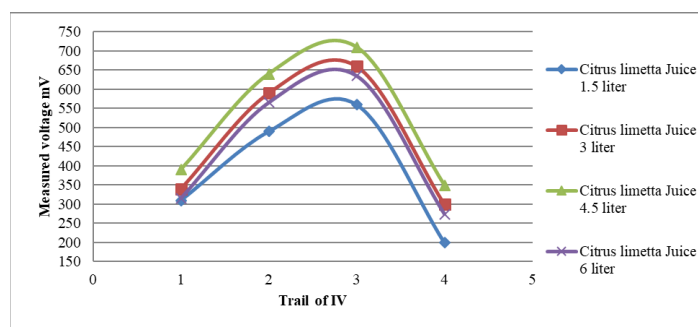
**Figure 2** Average of 24 hours measured voltage in mV for Apple juice waste used Bio fuel Cell



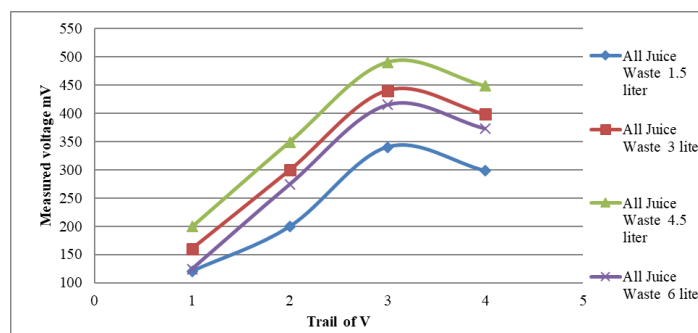
**Figure 3** Average of 24 hours measured voltage in mV for Orange juice waste used Bio fuel Cell



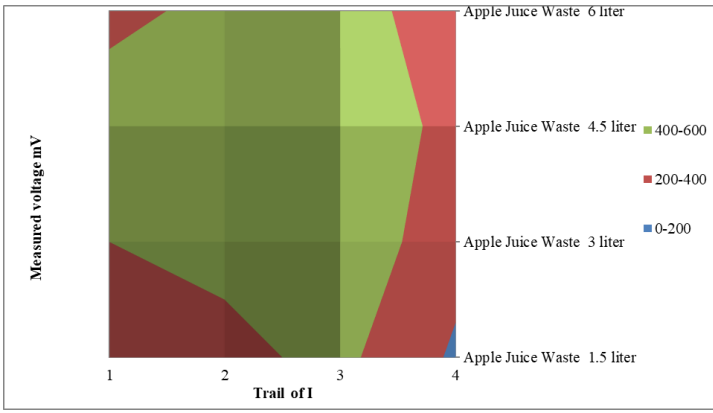
**Figure 4** Average of 24 hours measured voltage in mV for Lemon juice waste used Bio fuel Cell



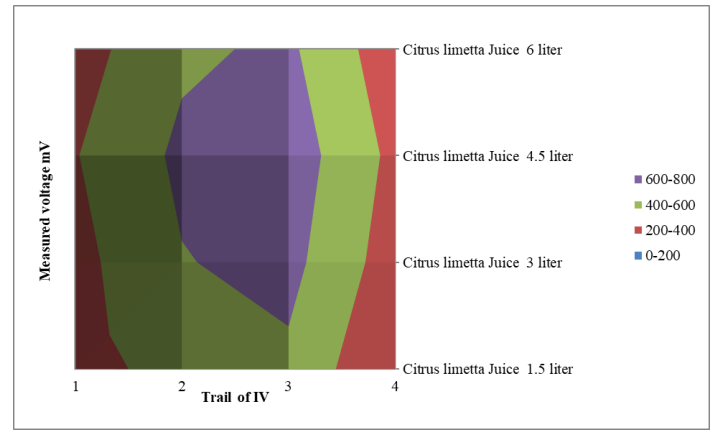
**Figure 5** Average of 24 hours measured voltage in mV for Citrus limetta juice waste used Bio fuel Cell



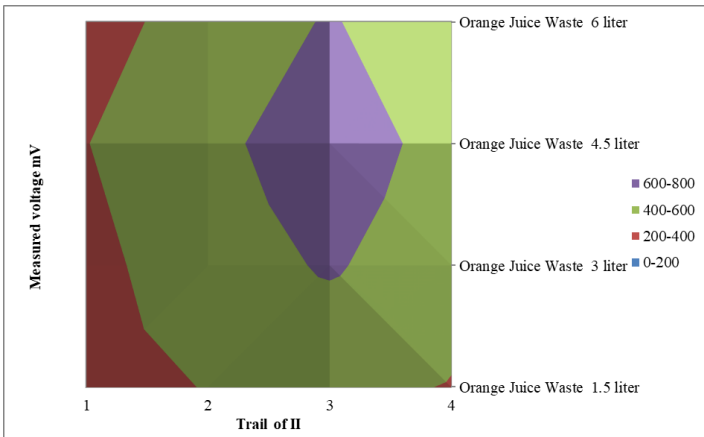
**Figure 6** Average of 24 hours measured voltage in mV for All juice waste used Bio fuel Cell



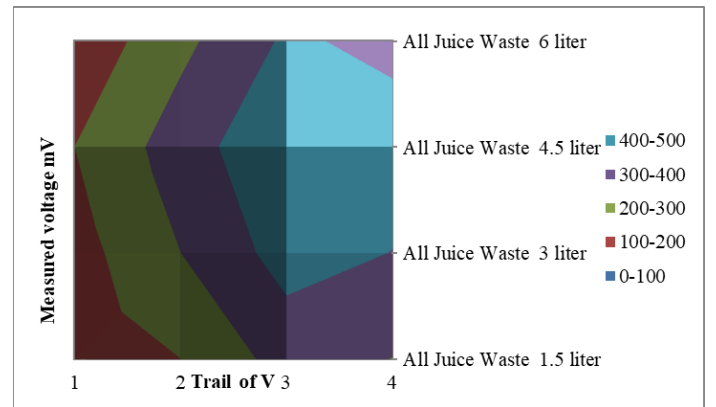
**Figure 7** Contour plot for experimental results of Apple juice waste used Bio fuel Cell



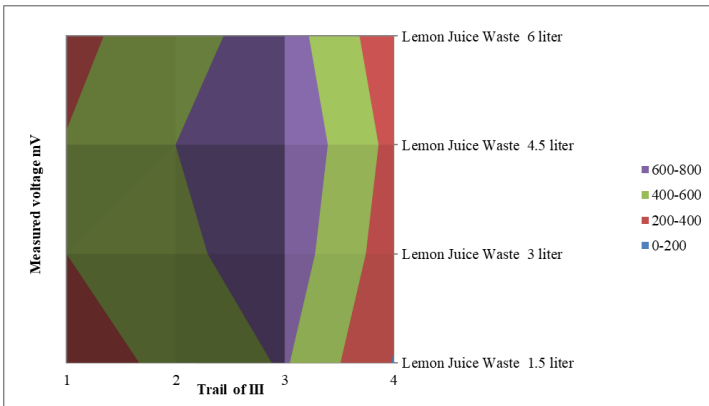
**Figure 10** Contour plot for experimental results of Citrus limetta juice waste used Bio fuel Cell



**Figure 8** Contour plot for experimental results of Orange juice waste used Bio fuel Cell



**Figure 11** Contour plot for experimental results of All juice waste used Bio fuel Cell



**Figure 9** Contour plot for experimental results of Lemon Juice waste used Bio fuel Cell

The Contour plot for experimental results of Apple juice waste used Bio fuel Cell, Orange juice waste used Bio fuel Cell, Lemon juice waste used Bio fuel Cell, Citrus limetta juice waste used Bio fuel Cell and mixing of all juice waste used Bio fuel Cell were clearly mentioned in the figure 7, figure 8, figure 9, figure 10 and figure 11 respectively. The different colors of the plot identified the range of the voltage output in mV. Trail I have the range between 200 to 600 similarly Trail II have the range of 300 to 690 mV, Trail III have the range of 190 to 770 mV Trail IV have the range of 200 to 710 mV and Trail V have the range of 120 to 500 mV.

#### 4. CONCLUSIONS

In this experimental study focused with bio-fuel cell by using various fruits wastes domestic juice shop or hotel were produced the following conclusions.

- ✓ Electricity production by using the wastes of fruits juice used Bio fuel cell can be possible.
- ✓ There are different in electricity production in various wastes of fruits juice used Bio fuel cell.
- ✓ The highest electricity generation can be achieved on Lemon Juice Waste used Bio fuel cell with maximum production 770 mV.

- ✓ The second highest electricity generation can be achieved on Citrus limetta juice waste used Bio fuel Cell with maximum production 710 mV
- ✓ The least electricity generation can be achieved on all juice waste used Bio fuel Cell with production of 120 to 500 mV.
- ✓ Among the individual Trails 4.5 liter of juice waste used Bio fuel Cell produced the greatest results among the four different combination of the electrolyte mixing after that electricity production is decreased.

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