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## Aloe Vera as an Alternative Energy Source

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### ABSTRACTS

Energy is a basic human need. In Indonesia, fuel oil (BBM) is the most widely used energy source in meeting national energy needs. The composition of Indonesia's national energy consumption in 2015, namely BBM: 52.50%; Gas: 19.04%; Coal: 21.52%; Water: 3.73%; Geothermal: 3.01%; and New Energy: 0.2% (Kholiq, 2015). To reduce the use of non-renewable energy, we are trying to find a solution to overcome this problem, namely by using *Aloe vera* as a source of electrical. This research focuses on the type of circuit and the number of sets of electrodes to produce an optimal source of electrical energy. In this research, we are using an experimental method that aims to determine whether *Aloe vera* can be an alternative renewable energy source. The first condition is one leaf, series circuit. The second condition, two leaves with a parallel circuit. The third condition, three-leaf with a parallel circuit. The results of this study are that the more electrodes, the more voltage is generated. By assembling in parallel, the resulting current is greater. From our study, we hope *Aloe vera* has potential as an alternative energy source and it can reduce the use of non-renewable energy.

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## 1. INTRODUCTION

Energy is a basic human need. In Indonesia, fuel oil (BBM) is the most widely used energy source in meeting national energy needs. The composition of Indonesia's national energy consumption in 2015, namely BBM: 52.50%; Gas: 19.04%; Coal: 21.52%; Water: 3.73%; Geothermal: 3.01%; and New Energy: 0.2% (Kholiq, 2015). To reduce the use of non-renewable energy, we are trying to find a solution to overcome this problem, namely by using Aloe vera as a source of electrical energy.

Research related to our research includes optimization using extracting plants, different types of electrodes, open circuit and closed circuit systems (Bhardwaj et al., 2015) optimizing energy sources using Faraday's law (Chong et al., 2019) optimizing energy sources using voltaic cells from various conditions (Choo & Dayou 2013), proving Aloe vera as an energy source (Choo et al., 2014), and the difference in electrodes in different plants (Kholiq, 2015).

We conducted this research to find alternative renewable energy sources and reduce the use of non-renewable energy sources. The method used in this research is an experimental method that aims to determine whether Aloe vera can be an alternative renewable energy source. This research focuses on the type of circuit and the number of sets of electrodes to produce an optimal source of electrical energy.

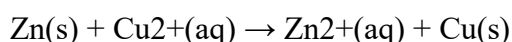
## 2. METHODS

Figure 1 shown the parallel and series circuit electrode. As previously explained, this study uses an experimental method. The tools used are a multimeter, a ruler, a crocodile clip. The materials used are cables, copper pipes, zinc plates, and aloe vera. Zinc-plated and copper piper are used as electrode sets and inserted into the aloe vera leaves at a distance of 1 cm per plate. The area of the zinc plate is 2 x 2,5 cm, and the area of the copper pipe (calculation using the area of the tube covers) is 7.5 cm<sup>2</sup>. The zinc plate and copper pipe are inserts into the aloe vera 2 cm deep. Then, measure the voltage and current generated using a multimeter by connecting the positive terminal to the copper electrode and the negative terminal to the zinc electrode.

1. Independent variables: the number of electrodes sets and the type of circuit.
2. Controlled variables: distance between electrodes, type of electrode, type of aloe vera, area of zinc plate, and area of copper pipe.
3. Dependent variables: voltage, current, and lamp flame.



Overall reaction



## 3. RESULTS AND DISCUSSION

Figure 2 and Figure 3 describe the results of the experimental data. Table 2 describes the measurement of voltage and current with the condition of one leaf chained in series, it is found that the fewer electrodes, the smaller the voltage generated.

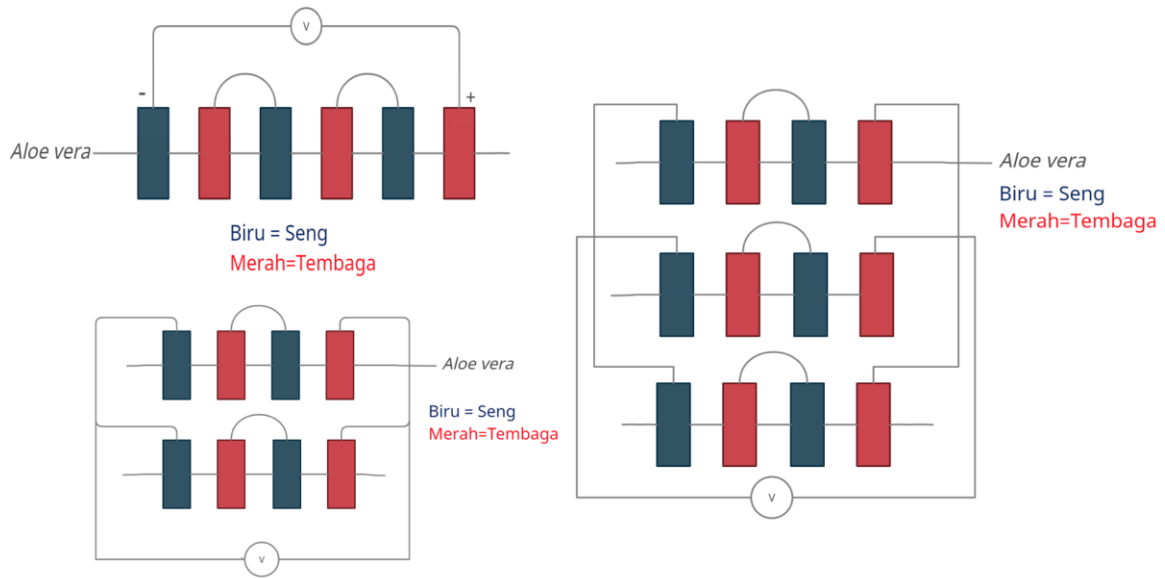


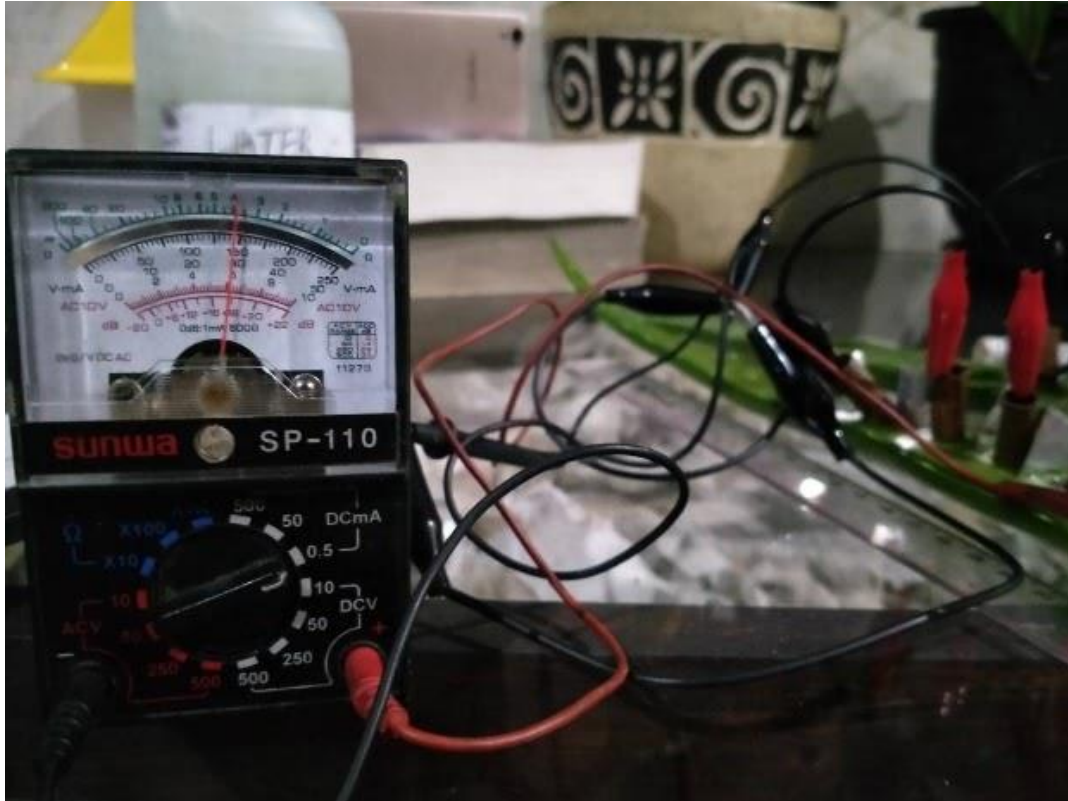
Figure 1. Parallel and series circuit electrode.



Figure 2. One leaf, series.

**Table 2.** Measurement of voltage and current with the condition of one leaf chained in series.

	Dependent variables		
<b>Controlled variables</b>	<b>7 sets electrode</b>	<b>6 sets electrode</b>	<b>5 sets electrode</b>
<b>Coltage (volt)</b>	<b>1,3</b>	<b>1,2</b>	<b>0,9</b>
<b>Current (mA)</b>	<b>0,12</b>	<b>0,12</b>	<b>0,12</b>
<b>Lamp</b>	<b>On</b>	<b>On</b>	<b>On</b>

**Figure 3.** Two leaf, parallel.

**Table 3** describes the measurement of voltage and current with two leaves connected in parallel. It was found that parallel circuits produce a larger current, and adding electrodes will increase the resulting voltage.

In the **Table 4**, it is found that the parallel circuit makes the current bigger, but because the number of electrodes per leaf is small, the resulting voltage is small. From the result of experiments conducted, it was found that aloe vera can be used as a source of electrical energy that shown in **Figure 4**. This is because in the aloe vera leaves there is a lot of water around Aloe vera which consists of a gel that is 99% water with a pH of 4.5.

**Table 3.** Measurement of voltage and current with two leaves connected in parallel.

	Dependent variables	
<b>Controlled variables</b>	<b>1 leaf 3 sets of electrodes and 1 leaf sets of 3 electrodes</b>	<b>1 leaf 3 sets of electrodes and 1 leaf sets of 4 electrodes</b>
<b>Voltage (volt)</b>	<b>0,9</b>	<b>1</b>
<b>Current (mA)</b>	<b>0,21</b>	<b>0,25</b>
<b>Lamp</b>	<b>On</b>	<b>On</b>



**Figure 4.** Three leaf, parallel.

**Table 4.** Measurement of voltage and current with the conditions of three leaves connected in parallel.

	<b>Dependent variables</b>
<b>Controlled variables</b>	First leaf 2 sets of electrodes, second leaf 2 sets of electrodes and third leaf 3 sets of electrodes
<b>Voltage (volt)</b>	1
<b>Current (mA)</b>	0,31
<b>Lamp</b>	Off

#### 4. CONCLUSION

The conclusion obtained from the results of this study is that the more electrodes, the more voltage is generated. By assembling in parallel, the resulting current is greater, but it is recommended that if arranged in parallel, the number of electrodes is added.

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#### 6. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.



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