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Development of Mahogany Leaf (Swietenia macrophylla) as Source of Green Battery to Help Rehabilitation in Bukit Suligi Educational Forest

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Abstract: **Nowdays, major problem faced by Bukit Suligi Educational Forest is deforestation in which around 70 % FTC (Forest Training Facility) has been burned, and palm oil is illegally planted surrounding the area. From burned area, rehabilitation is the real choice to preserve Bukit Suligi Educational Forest. According to the problem, a study needs to be done to prove that there are trees in the forest that can produce an alternative energy for the community. This is what will change the perception of people who think the value of forest is lower than palm oil plantation. Utilization of mahogany leaf (Swietenia macrophylla) as one of alternative sources that can generate electricity based on the characteristics of mahogany leaf produces a bitter taste in the tongue entirely. This research is done by getting mahogany leaf in Bukit Suligi Educational Forest and making green battery model from mahogany leaf extract in Forestry Vocational School of Pekanbaru. Based on the results, 720 ml green battery model can generate electricity of 3,87 volts. Therefore, mahogany leaf extract is potential for a new alternative electrical energy. From this research, it can be expected that community around the forest will take an initiative to restore degraded forests with mahogany plant.**

Index Terms: **— mahogany leaf, green battery, rehabilitation.**

INTRODUCTION

Indonesia's forest wealth is one of the greatest biodiversity content in the world. Its diversity spreads across Indonesia, especially in Kalimantan and Sumatera. Various types of plants have benefits that can be used as foods, traditional medicine and renewable energy alternative that have not been optimized as a whole.

Mahogany trees are often found in forests and seaside where all parts of this plant has its own benefit and content ranging from roots, stems, fruit and leaves. One of the lesser known pieces of benefit and usefulness is the mahogany leaf, which is often wasted in a useless manner without meaningful utilization that has more value and extraordinary benefits. One of the benefits that should be developed besides the utilization of mahogany leaves as an air pollutant absorber is mahogany leaves can serve as a source of electrical energy in Indonesia. Utilization of extract from mahogany leaves can be used as renewable energy to overcome the increasing electricity demand in Indonesia.

The supply of community electricity based on PLTMH resources can be set in 200 W per house connection (220 V, 1A). The availability of electrical energy from PLN installed capacity, amounting to 72.85% of energy generated from fossil fuels. The main allocation of rural household using generally is for night time lighting, with consideration during the day most people work. New potential local energy sources can be realized into power plants, among others : solar, wind, and microhydro energy. EBT (New and Renewable Energy), especially from local potential, needs to be studied and utilized as primary energy source for electricity generation (Widodo 2012).

Based on the study of chemistry, it can be seen that mahogany leaves which is alkaline with a bitter leaf state along with other supporting solutions such as metal lead (Pb) can be utilized as electrolyte solution on the battery cell. Accumulator with strong electrolyte solution is not environmentally friendly and also dangerous. Therefore, the author is interested in reviewing and applying the utilization of wasted mahogany leaves as an environmentally friendly electrolyte solution to the batteries as well as learning for inland communities which is not yet reached by electricity in order to utilize mahogany leaf extract as engineered from green accumulators.

The purposes of this study are to know the content in mahogany leaves as a source of alternative electrical energy, to know the process of utilization of electrical energy from mahogany leaves to be used as green accumulator, and to know the role of green accumulators in supporting the supply of electricity in Indonesia.

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METHODOLOGY

In carrying out this study, several methods were implemented, those are: literature study by reading books or scientific journals and articles that are related to forest rehabilitation, mahogany plant, and green battery. Primary data retrieval is done by doing an experiment to make green battery model from mahogany leaf extract. This experiment is done by getting mahogany leaf in Bukit Suligi Educational Forest and making green battery model from mahogany leaf extract in Forestry Vocational School of Pekanbaru on December 20th – 26th 2016. After that, primary data will be used as a comparison with literatures (textbooks, journals or other literature sources. The last stage is writing the paper.

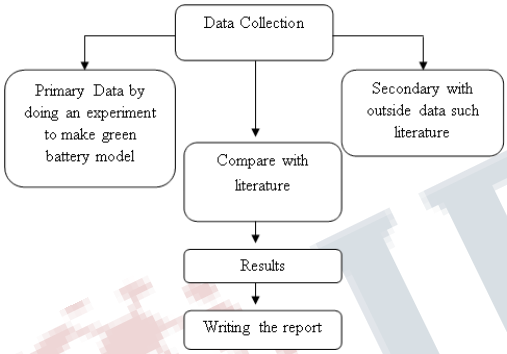

Image 2. Methodology Diagram

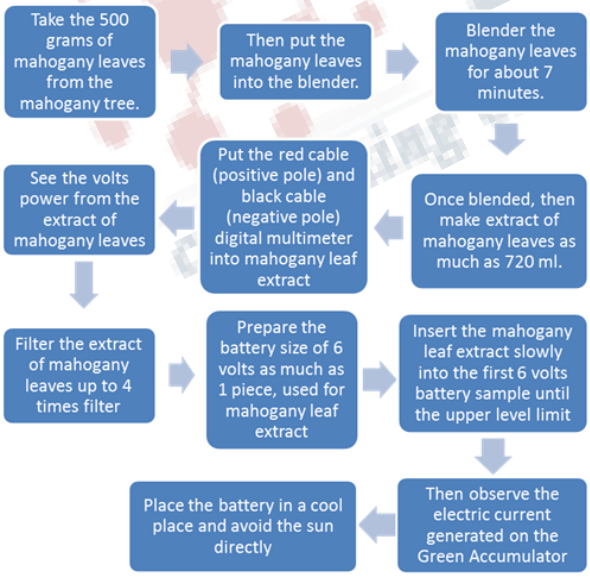

Image 3. Research flowchart

RESULTS AND DISCUSSION

From the research, we tested the electric power generated from mahogany leaf extract of 720 ml by using a multimeter tester tool. Here is the table of research results.

Table 2. Research results

No	Condition of mahogany leaf extract	Electric power
1	Before entering to the accumulator (inside the jar)	1,30 volts
2	Observation after 5 minutes	3,77 volts
3	Observation after 10 minutes	3,80 volts
4	Observation after 15 minutes	3,80 volts
5	Observation after 20 minutes	3,87 volts

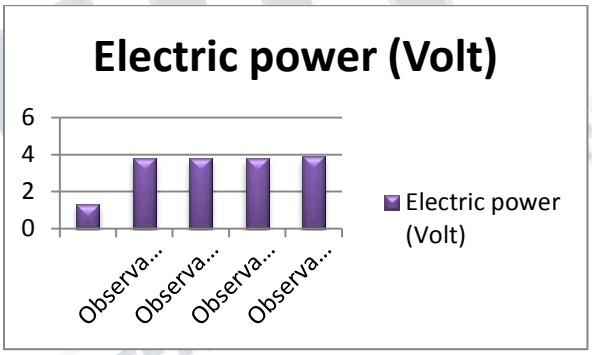

Image 4. Research diagram

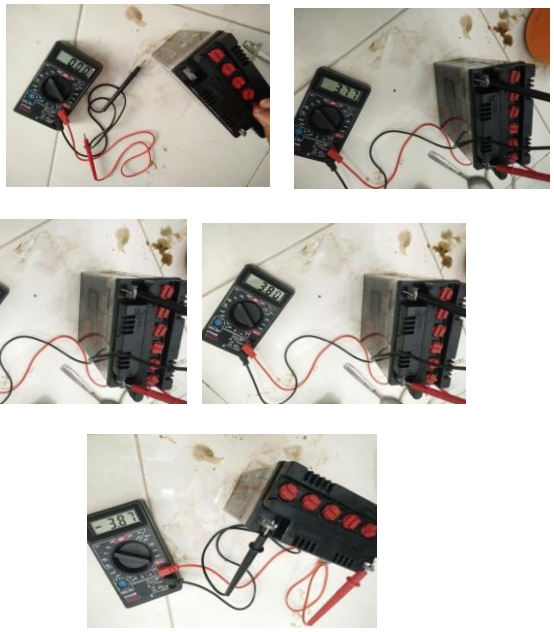

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Image 5. Electricity experiment

Samples of mahogany leaves taken in Bukit Suligi Educational Forest as much as 500 g, then blender it for 7 minutes. This is intended to extract the mahogany leaf soluble in water. This process produces 720 ml of mahogany leaf extract, then test its electrical conductivity using multimeter tester by inserting 720 ml of mahogany leaf extract into the jar. The next step is to insert the copper plate as positive pole and zinc as negative pole, connecting positive pole to red cable on multimeter tester and negative pole with black wire. Read the readable scale and it turns out the readable scale is 1.3 volts or almost equivalent to one large dry battery size of 1.5 volts. This process is done to determine the ability of mahogany leaf extract to deliver electric current without input into the accumulator. The next process is to enter the extract of mahogany leaves into the accumulator, before the first input extract of mahogany leaves filtered as much as 4 times for the leaves of mahogany leaves do not go into the accumulator. After input, electrical conductivity test using multimeter tester showed 3.87 volts in 20 minutes observation.

Table 2. showed that the accumulator contains mahogany leaf extract before it is inserted into the accumulator contained electrical conductivity of 1.3 volts. Once it inserted into the accumulator of 6 volts in 20 minutes observation, then the accumulator electrical conductivity increased to 3.87 volts. This is because when the extract of mahogany leaves has not been inserted into the accumulator or still in the jar, electric power generated only 1.3 volts because it uses only 3 cells while when inserted into a 6 volt accumulator, electric power can reach 3.87 volts or equivalent to two of 1.5 volts dry batteries. This because accumulator has 6 pieces of cells so that the electricity generated can be 2 times when it is not in the input to the accumulator.

The electric current in mahogany leaf extract is caused by mahogany leaves containing lead (Pb) heavy metals which are absorbed by mahogany leaves from vehicle fumes and air pollution resulting from residual combustion. Lead (Pb) has toxic and carcinogenic properties. The lead content (Pb) inside the mahogany leaves is 40.28 ppm and Lead (Pb) is commonly used as the poles on the battery (Sedi 2014).

In a positive polar, accumulator using lead peroxide and negative pole using lead plate, when accumulator is used chemical reactions that cause sediment in negative electrode (reduction) and positive electrode (oxidation). This is the reason why mahogany leaf extract can deliver electric current, caused by lead content (Pb) in the content. This shows that the extract of mahogany leaves is very well used as an accumulator filler and substitute of H_2SO_4 solution. Accumulator containing mahogany leaf extract can conduct electricity well to accumulator with 6 volt capacity.

Therefore, the extract of mahogany leaves can be utilized as a new alternative energy source to be used as accumulator filler solution. From this research, we hope that community is aware of the benefits of mahogany leaves so that they will not do illegal logging which can cause severe forest damage in Bukit Suligi Educational Forest. This chance is also providing a great benefits to forest communities both in the economic aspect and in the aspects of forest conservation in order to support better environmental management and sustainable energy development.

CONCLUSION

From the results of research, we can conclude that mahogany leaf is one of the potential sources from Bukit Suligi Educational Forest and now the number of this species has started to decrease due to illegal logging. Therefore, the utilization of mahogany leaves as an alternative source of electrical energy will make people aware of the benefits of mahogany leaves. The results of study showed that mahogany leaf extract can generate electricity power of 1.3 volts without the input into the battery, while using the battery can generate electrical power up to 3.87 volts. Mahogany leaf extract can be a substitute of H2SO4 solution as a filler solution on wet batteries because it can conduct electricity well. For the recomendation, further research is needed on the ability of electric conductivity on mahogany leaf extract and the factors that influence the conductivity of mahogany leaf extract so that it can produce an optimal energy.

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