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Eco-Friendly Batteries from Rice Husks and Wood Grain

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ABSTRACTS

The purpose of this study was to find out the carbon influence of rice husks and wood grain as electrolyte absorbers on large voltage and battery life. The battery fabrication procedure is as follows: (1) Preparing sixteen used batteries with a 1.5 Volt voltage, (2) Making NaCl solution with percentages of 10, 20, 30, and 40%, (3) Drying rice husks and wood grain until drying, (4) Carbonizing rice husks and wood grain, (5) Smoothing rice husks and carbonated wood grain, (6) Mixing rice husk, wood grain, and electrolyte solution, (7) Remove the contents of the used battery and wash it thoroughly, (8) Insert carbon from rice husks and wood grain. (9) Perform the process of closing the battery with the battery cover, (10) Measuring the battery voltage using an Avometer. This research shows that carbon derived from rice husks and wood grain can generate electrical voltage, but the resulting voltage is still low compared to commercial batteries. In addition, batteries with electrolyte solutions that have a salt percentage of 10% provide the most voltage.

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1. INTRODUCTION

Rice production in Indonesia is very abundant, which is about 67.31 million tons per year and the total potential of rice husks reaches 16 million tons per year (Yuliza, *et al.*, 2013). The total production of saw wood in Indonesia reaches 2.6 million m^3 per year assuming the amount of waste produced is 54.24% of the total production (Jamilatun, *et al.*, 2010). Therefore, the potential of biomass can be utilized as a source of renewable energy.

Currently, research on batteries from various biomass has been conducted. Merbau and matoa sawdust have potential as bio-batteries but the resulting voltage is still low (Ernawati, *et al.*, 2019). Banana skin has a higher voltage value than durian skin (Muhlisin & Muh, 2015). Porous potato biomass as a potassium-ion battery anode produces excellent performance (Cao, *et al.*, 2019). Lithium ion battery anodes derived from green tea leaf biomass exhibit a very capable capacity (Han, *et al.*, 2014). Carbon batteries made from hemp fiber and corn cobs as lithium battery anode material showed excellent and stable capacity (Jiang, *et al.*, 2016). However, research on batteries that use rice husks and wood grain as adsorbent agents of electrolyte solutions does not yet exist.

The purpose of this study was to determine the influence of carbon from rice husks and wood grain as an absorbing agent of electrolyte solution on voltage strength and battery life. The method is to carbonize rice husks and wood grain, smooth them, and mix them with NaCl electrolyte solution. The novelty of this study is (1) The use of rice husk biomass and wood grain as the basic carbon absorbing material of electrolyte solution and (2) The use of four variations of salt and distilled water as electrolyte solutions.

2. METHODS

Figure 1 shows the battery fabrication process performed in this study. The materials used are rice husks, sawdust, distillation water, NaCl, and 1.5 Volt used batteries. The electrolyte solution used is NaCl solution with NaCL percentages of 10, 20, 30, and 40%. In addition, a 1.5 Volt battery with ABC brand is used as a comparison. The carbonization process of rice husks and sawdust is carried out at a temperature of 200°C for 30 minutes. After that the carbonization results are smoothed and mixed with several variations of electrolyte solution. The mixing result is then inserted into a clean battery and then the battery is assembled into a series.

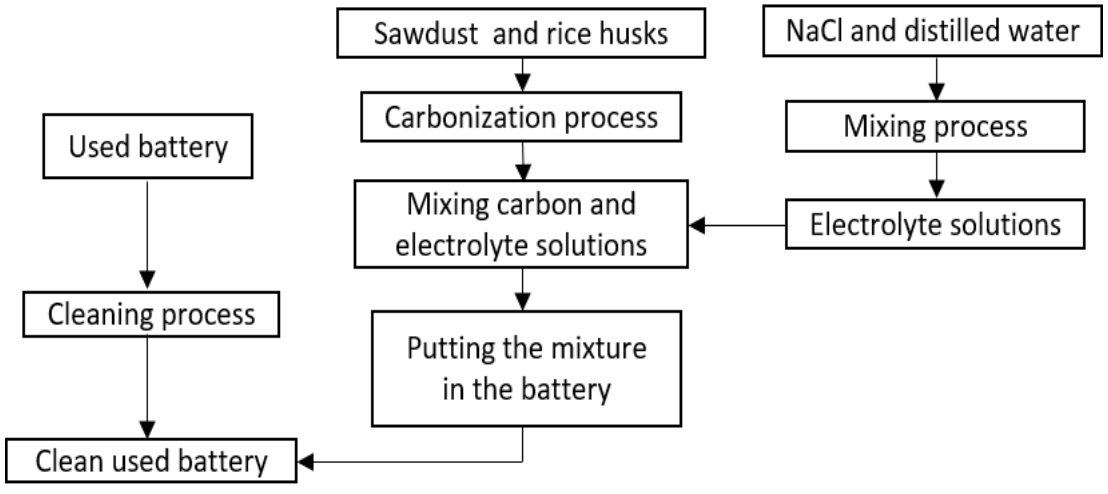

Figure 1 Battery fabrication process.

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3. RESULTS AND DISCUSSION

Figure 2a shows a used battery that has been filled with carbon rice husks and wood grain with variations of various electrolyte solutions. **Figure 2b** shows four batteries that have been compiled in series.

Figure 2. (a) Carbon-charged batteries and (b) Battery series arrangements.

3.1. Voltage test with avometer

Table 1 shows the results of battery voltage test using Avometer. Batteries with carbon from rice husks and sawdust produce an average voltage of 0.79 Volts. When compared to ABC batteries that produce a voltage of 1.5 Volts, this battery still has a lower voltage of 0.71 Volts.

However, batteries with carbon derived from rice husks and sawdust are more environmentally friendly because these batteries do not contain harmful and toxic chemicals. In addition, the use of rice husks and sawdust can increase the selling price of the biomass while also utilizing biomass that is easily found. A battery with an electrolyte solution (10%) produces the highest voltage, which is 0.85 volts.

This shows that the smallest salt concentration produces a larger battery voltage. However, at salt concentrations of 20, 30, and 40%, the relationship between salt concentration and electric voltage is positively correlated. Thus, greater salt concentration can create greater stress. However, overall, the voltage size of each battery is relatively not very different.

Table 1. Battery voltage test results.

NaCl Percentage (%)	Voltage (Volt)
10	0,85
20	0,75
30	0,77
40	0,80
Average	0,79

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4. CONCLUSION

The effect of carbon derived from rice husks and sawdust has been evaluated. Based on this research, batteries with carbon derived from rice husks and sawdust produce less voltage than commercial batteries. However, batteries with carbon derived from rice husks and sawdust are more environmentally friendly because they do not use harmful chemicals. In addition, the use of rice husk biomass and sawdust can increase the selling price of the two biomasses. The smallest percentage of salt in the electrolyte solution actually produces the battery with the largest voltage. This shows that the greater the salt concentration in the electrolyte solution does not produce a greater voltage. However, on the whole, the battery voltage is relatively similar.

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6. AUTHORS' NOTE

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

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