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MORALITY BEFORE KNOWLEDGE

The potentials of jackfruit (*Artocarpus heterophyllus*) skin wastes as a supercapacitor biomaterials

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ABSTRACT

Background: In modern times, the use of electrical energy cannot be separated from everyday life. The consumption of electrical energy in Indonesia itself is increasing along with the increasing number of people who use electrical energy as lighting and electrical equipment to support comfort in everyday life. Indonesia is one of the countries with abundant biological wealth, one of which is jackfruit (Artocarpus heterophyllus) which is very popular for consumption by all groups. Where jackfruit skin has a lot of content that can be utilized. **Methods:** Therefore, researchers are interested in examining "The Potential of Jackfruit Peel Waste as a Supercapacitor Biomaterial". The experimental design used is a complete randomized design (CRD) with two treatments, each treatment is repeated three times, namely: P-1 : Activation of 0.1 M NaCl in solid form. P-2 : Activation of 50% HCl concentration in the form of solids. **Findings:** The highest average voltage indicator produced is in P-1. The highest average for lights on is 0.053. The highest average for lights to stay on when removed is 0.003. The highest average for the length of time the lights stay on when the battery is removed after 10% slow motion is 0.0067 seconds, and the highest average voltage is 0.073 volts. ash is formed more densely so that it produces electricity more stably than the others. **Conclusion:** The minimum voltage that can be used for electrical energy sources is 1.3 volts and the size of the voltage can be influenced by the water content, calcium, sodium, magnesium in the fruit peel and the level of fruit maturity. **Novelty/Originality of This Study:** This study introduces the novel use of jackfruit peel waste as a supercapacitor biomaterial, highlighting its potential as an alternative, sustainable energy source through experimental voltage performance analysis.

KEYWORDS: biommaterials; jackfruit peel waste; supercapacitors.

1. Introduction

Electric current is the electric charge that moves from a high potential to a low potential, through an electrical conductor. Electricity is one of many energies that has an important role in life. Because people nowadays have been made the electrical energy as the basic needs after food, clothing and shelter.

The consumption of electricity in Indonesia has increased along with the increase of the population that uses the electrical energy as lighting and electrical equipment to support comfort in daily life, such as street lights, house lights, fans, televisions, refrigerators, and others. The electrical energy during daily use is obtained from power generator are mostly derived from fossil fuels (Apriani et al., 2013; Muchammadsam et al., 2015). However, the exploitation of the oil resulting in dwindling supply. Fossil fuels are energy sources formation process takes millions of years, making it difficult to obtain fossil energy and renewable.

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With increased consumption of energy resources, it will increase the needs. It is inversely proportional to the evolving technological advances. One of it is nanotechnology. Nanotechnology is the study of particles in the range size of 1-1000 nm (Sofwan, 2013). One form of nanotechnology is nanoparticles (Burke, 2000). Nanoparticles is the name for the metal and polymer particles in the nanometer size scales, which measure between 1-100 nm (Hakim, L. 2008). One application of nanoparticles can be used as a supercapacitor (Suharyadi & Wibowo, 2013; Thangavel et al., 2018)..

Supercapacitor is a technology that evolved from conventional capacitors which supercapacitors have a more modern ability to store energy (Conway, 2013; Fitriana, 2014, Taer et al., 2015). This capacitor utilizing the electrode surface area and thin dielectric material to achieve a capacitance value much greater than conventional capacitors (Andriani et al., 2010; Riyanto, 2014). One of the electrode that commonly used in supercapacitors is nanopore carbon which is an active carbon that having pores in the nanometer scale (Arif et al., 2015; Aziz et al., 2017; Lu et al., 2018; Rosi et al., 2012; Sani, 2012).

The use of supercapacitor is more effective than the battery because superkasitor has a smaller size making it lighter and supercapacitors have a very fast charging capability compared to batteries (Nur, 2014). Besides it, waste of used batteries that careless disposal will pollute groundwater because it contains a variety of harmful metals and can endanger health. And so we need alternative energy sources that are environmentally friendly to be used as a source of biomaterial supercapacitor.

In addition, Indonesia is one country with biological biodiversity richness, one of it is jackfruit *(Artocarpus heterophyllus)* which is a favorite fruit to all circles (Wulandari, 2015). Jackfruit is divided into three parts, there are the skin, pulp and seeds. However, the use of solid skin-shaped jackfruit is rare, causing it becomes waste. Where jackfruit skin has a lot of content that can be utilized. Jackfruit skin texture is hard because there is cellulose. Jackfruit contains cellulose as much as 35-50% (Saha & Saha, 2004). Inside the cellulose, there is carbon, so more and more of cellulose, the more carbon it contains (Kötz & Carlen, 2000; Fajarini et al., 2016). So skin jackfruit have potential for nanoparticles to be applied as a supercapacitor. Therefore, researchers are searching for "The Potentials Of Jackfruit *(Artocarpus heterophyllus)* Skin Wastes As A Supercapacitor Biomaterials"

2. Methods

Research and scientific papers writing was conducted from 11th of November until 25th of December 2016 were held in two places: Senior High School 4 Denpasar Chemistry Laboratory as a place to test the jackfruit skin ash and write the scientific papers and BPPT Denpasar as the place for burning the jackfruit skin wastes.

This type of research is an experimental research. Experimental method is a way of presenting the material lesson in which writers conduct experiments with their own experience to prove something like question or hypothesis. Experimental method is a way of research which the authors conducted an experiment about things, watch the process and write the results of the experiments, and the observation results were submitted and evaluated. The design was completely randomized design with two treatments each treatment into a loop three times, namely: P-1: Activation HCl concentration of 50% and formed powder. P-2: Activation NaCl concentration of 0.1 M in powder form in Table 1.

Table 1. Research methods

Research tools	Research materials
• Beaker	• Jackfruit Skin Ash
• Volumetric Flask	• 0.1 M Nacl
• Balance Ohaus	• Hcl 10%
• Oven	• Aquades
• Glass Cover 9x11 Cm	• Non-Iodized Salt
• Brush	• Wipes

• Funnel • Drop Pipette • Jas Lab • 3 Volt LED Lights • 9 Volt Battery • 196 Mesh Sieve • Spatula • Ceramic Plates • Stationary • Stopwatch • Voltmeter • Filter Paper	Aluminiuim Foil

Jackfruit skin dried into dry evenly. Then jackfruit skin is burned in BPPT with a temperature of 1200 degrees celsius for eight hours with one burning to be ashes. After that, the large skin ash particles jackfruit filtered with a 196 mesh sieve. So that resulting no bigger ash than the filter. Jackfruit skin ash activated by NaCl or HCl. NaCl used for activation with 0.1 M NaCl, where in the ratio of the mass of ash rind jackfruit with NaCl is 1: 5. Activation is done by mixing NaCl with Jackfruit skin ash then stirred for 2 hours at a constant speed using magnetic striter. After stirring, filter the jackfruit skin ash that has mixed with NaCl with filter paper and then jackfruit skin ash that has been activated with NaCl dried for 70 minutes in the oven with temperature 60 degrees Celsius.

Furthermore, for activation with HCl used mass ratio of jackfruit skin ash with HCl was 1: 5. Activation done by mixing the jackfruit skin ash with HCl and then stirred for 2 hours at a constant rate using a magnetic stirrer. After stirring the the jackfruit skin ash with HCl, filter it with filter paper and the jackfruit skin ash that has been activated HCl jackfruit dried for 35 minutes in the oven with a temperature of 60 degrees Celcius. The purpose of ovening is to reduce the moisture content.

Equipment and materials such as aluminuim foil, tissue, 33.3% salt solution, 3 volt LED lights, a 9 volt battery and jackfruit skin ash that has been activated. Then create a salt bridge by stacking a tissue soaked in saline solution 33.3% with aluminum foil and then put the negative pole of the battery in aluminum and the positive pole in gray leather jackfruit. While pole on adjustable LED lights located. LED lights are placed slightly away from the battery. After seeing the lights, measuring voltages using a voltmeter and time using a stopwatch.

Analysis of the data in this study using qualitative analysis and quantitative analysis. Qualitative data is data or information in the form of verbal sentence and not a symbol of numbers or numbers. Where the data obtained will be used to draw conclusions in this study. Then, the quantitative data is data information in the form of number symbols or numbers. Based on these figures symbols, quantitative calculations performed to produce a conclusion generally accepted in the parameter.

3. Results and Discussion

3.1 Potential of jackfruit skin wastes as biomaterials supercapacitor

According to Table 1, it can be seen that the average lamp brightness at P-1 is 0.053, while at P-2 it is 0.0067. The first repetition at P-1 can operate for approximately 0.0003 seconds when the battery is removed, whereas the second and third repetitions do not light up under the same condition. Meanwhile, all repetitions at P-2 fail to light when the battery is removed. Furthermore, the average duration the lamp stays lit after the battery is removed—following slow-motion up to 10%—is 0.0067 seconds at P-1 and zero seconds at P-2. In terms of voltage, the jackfruit skin biomaterial generates 0.073 volts at P-1 and an average of 0.003 volts at P-2.

Table 1. Light activity and voltage from jackfruit skin biomaterial in P-1 and P-2 treatments

Treatment	Treatment number			Amount	Average
	I	II	III		
Observations with indicator light on or not					
P-1	✗	✓	✓	2	0053
P-2	✗	✗	✓	1	0.0067
Amount				3	-
Keep lights on when battery disconnect					
P-1	✓	✗	✗	1	0003
P-2	✗	✗	✗	0	0
Amount				1	-
How long the lights on when the battery disconnected after slow motion up 10% (second)					
P-1	0	0	0.02	1	0.0067
P-2	0	0	0	0	0
Amount				1	-
Generated voltage from biomaterials jackfruit skin ash (volt)					
P-1	0:06	0:08	0:08	3	0073
P-2	✗	0:01	✗	1	0003
Amount				4	-

3.2 Result discussion

Based on the research results table, obtained an average result of each indicator in each treatment which can be seen in Table 2. Based on the above table the highest average tedapat entirely at P-1. The highest average for the light is contained in that 0053. The highest average for the lights remain on when removable 0.003. The highest average for a longer light up the lamp when the battery is removed after slow motion 10% of 0.0067 second, and the average large high voltage of 0073 volts.

Table 2. Average results of each indicator in respective treatment

Treatment	Indicators Research			
	Lighted lamp	Lights Stay Lit When Disconnect	Light On After Battery Removable (second) [1]	Large Voltage Volt
P-1	0053	0003	0.0067	0073
P-2	0.0067	0	0	0003

Information :
[1] = calculation time after slow motion up to 10%.
The yellow color = highest average results.

Indicator lights on the highest and the lights remain on after the battery is disconnected *slow motion* 10% contained in the P-1 and this is because the P-1, the samples are activated with HCl 50% which is a polar compound which is able to conduct electricity. As well as the P-1 and P-2 samples in the form of a more solid in order for the electric current is not interrupted. The voltage generated in the P-1 in particular the second and third replicates a maximum voltage of all experiments. The higher the voltage generated the stronger in the longer conduct electricity so that the supercapacitor is capable of storing energy.

Average indicator large highest voltage generated contained in the P-1, followed by P-2, more dense ash is formed so as to produce electricity more stable than others. According Sucipto (2012), the minimum voltage that can be used for electrical energy source is 1.3 volts and the size of the voltage can be affected by moisture, calcium, sodium, magnesium in the skin of fruit and fruit maturity level. So of the two indicators tested only P-1 (Activation HCl 50% and formed more dense) gives the best results, in one after another by the indicators of P-2 (Activation 0.1 M NaCl and in a form more dense). That means P-1 as a potential supercapacitor material.

4. Conclusion

In this modern era, the usage of electricity can not be separated from daily lifes. Electricity is a load which is consisting of positive and negative charge. The research results show that the P-1 treatment produced the most optimal outcomes compared to P-2. The average light brightness in P-1 was 0.053, while in P-2 it was only 0.0067. In P-1, the lamp could still light up for 0.0003 seconds after the battery was removed, whereas in P-2, it did not light up at all. After a 10% slow-motion condition, the lamp in P-1 stayed lit for 0.0067 seconds, while in P-2 there was no light.

The voltage generated from jackfruit skin biomaterial in P-1 reached 0.073 volts, significantly higher than P-2, which produced only 0.003 volts. P-1 showed better performance due to the activation process using 50% HCl, which enhanced electrical conductivity, and the denser material structure that allowed for more stable current flow. Therefore, P-1 has greater potential as a supercapacitor material compared to P-2.

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