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IDENTIFYING RESISTIVITY VALUE OF CHARCOAL WOOD AND CHARCOAL SKIN FRUITS: ALTERNATIVE SUBSTITUTE OF RESISTANCE MATERIAL ON RESISTOR

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ABSTRACT

Utilization of waste through innovation and the creation of new works based on technology with newly found knowledge are discussed in this study. This study aims to determine resistivity value of charcoal wood and charcoal skin fruits as an alternative substitute of resistance material on resistor. Skin fruits are used in the form of mango and banana skins. The method used in the form of quantitative methods in the form of experiments. The process of making this resistor begins as a rare faction of the whole material separately into a fine powder and which performs compression in the receptacle which has a surface area (A) = 4.08 x 10^{-4}m^2. The results showed that charcoal woodand charcoal skin fruits have resistance values which respectively amounted to 14.28 x $10^6\Omega$; 5.5 x $10^6\Omega$; 4.7 x $10^6\Omega$. Resistivity of charcoal woods value (0.73 x $10^6\Omega$m) is higher than charcoal of mango skin (0.28 x $10^6\Omega$m) and charcoal of bananacharcoal of banana skin (0.24 x $10^6\Omega$m). This waste can only be created as an alternative substitute resistance of material on resistor with the great size of the resistivity value. This study is expected to be carried out on the use of other waste.

Keywords: Charcoal skin fruits; Charcoalwood; Resistance; Resistivity; Resistor

1. INTRODUCTION

Technological development enlivens the spirit of competition generating innovation and works of stone that are useful in everyday life. This innovation can be the utilization of waste contained in the surroundingenvironment. Wastes that were examined in this study in the form of wood and skin fruits are used as an alternative substitute of resistance material on resistor.

Resistor is a fundamental component of electronics that have resistive/hamper characteristics. Resistors are used to limit or impede the flow of electricity through a series of resistors (Aiyub, 2013; Fidianti, 2014). This is made clear by Susanto (2015), the resistor in a circuit has a function as a flow divider, voltage divider, lowering the voltage, over current safety, inhibiting the flow of electricity, and so on (depending on the design of components of different types of resistor).

Resistors have diverse types, one of which is that resistors carbon film. Resistor carbon film made of carbon materials that consist of a tubular resistive element with a wire or metal lids on both ends (Hariyanto, 2009). It is used in this research. In principle, this resistor material contains carbon as a main element, so it needed a material that has the potentialcontaining similar carbon. In this waste, wood and skin fruits are an option. Riadi (2013) explains that the waste wood is wood parts that are considered to no longer possess economic value in a particular process, at certain times and certain places that may still be used in the process and different times. Type of wood used is lamtoro, while the skin fruits studied form of mango and banana skins. These wastes are found

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and underused well (Astuti, 2013;Nurhadi, 2013). Waste is processed in such a way that forms charcoal.

Charcoal is a black residue containing impure carbon which is formed by removing the water content of the material through heat decomposition process of the material (Lempang, 2014). Charcoal wood, charcoal of mango skins, and charcoal of banana skins in this study were packaged in a specific container to determine the resistivity of the material on charcoal. Thus, once the resistivity is known, we can facilitate and consider for further research to produce a resistor made from charcoalwood, charcoal of mango skins and charcoal banana skins having regard to the standard specification resistance material on resist or to safety when assembled with other electrical components.

This research is expected to increase knowledge in the utilization of waste into product innovation that is economical and environmentally friendly, as well as having additional knowledge about resistivity value of charcoal wood and charcoal skin fruits to use as an alternative substitute of resistance material on resistor.

2. METHODOLOGY/ EXPERIMENT

This research method is quantitative in the form of experiment. Experiment form of making resistors was conducted by utilizing waste wood and skin fruits. The tools and materials used include: scissors, rubber hammer, nails, pipettes, clamps nails, wire rod, bar/ruler, sieve/strainer, aluminum foil adhesive, digital multimeter, spoons, lamtoro wood, mango skins, and banana skins.

In this study, we begin with a heating process of wood, mango skins, and banana skins to dry, solid black, and any type of charcoal. Furthermore, various charcoals is finely ground and filtered so that it leads to finely powdered charcoal. The fine powder is compressed slowly using blunt spikes and rubber mallet into a tube. The tube is made from a pipette with both ends covered with aluminum foil adhesive. Length (l) or high (t) pipette of 0.8 cm and a diameter of 1 cm, so that the surface area (A) of the tube is amounted to 4.08 x 10^{-4}m^2. The calculation is as follows.

$$\begin{aligned} A &= 2\pi r^2 + 2\pi r t \qquad (1) \\ &= 2\left(\tfrac{22}{7}\right)(0.5)^2 + 2\left(\tfrac{22}{7}\right)(0.5)(0.8) \\ &= 1.57 + 2.51 \\ &= 4.08\ \text{cm}^2 \\ &= 4.08 \times 10^{-4}\ \text{m}^2 \end{aligned}$$

The last, giving the wire on each side of the tube. Wire on each side should not be a fused, and the aluminum foil should not exceed big tear wire that is attached to it. Then resistance has measured using a multimeter and a calculation of the resistivity charcoal. To determine the value of resistivity, it is necessary to first know the value of resistance. The relationship between resistance (R), the cross-sectional area (A), length (l), and resistivity material (ρ) shown in the equation:

$$R = \rho \frac{l}{A} \qquad (2)$$

The equation for calculating the value of the resistivity material is as follows:

$$\rho = \frac{RA}{l} \qquad (3)$$

As for the procedure scheme of making resistor from charcoal wood and charcoal skin fruits is as follows.

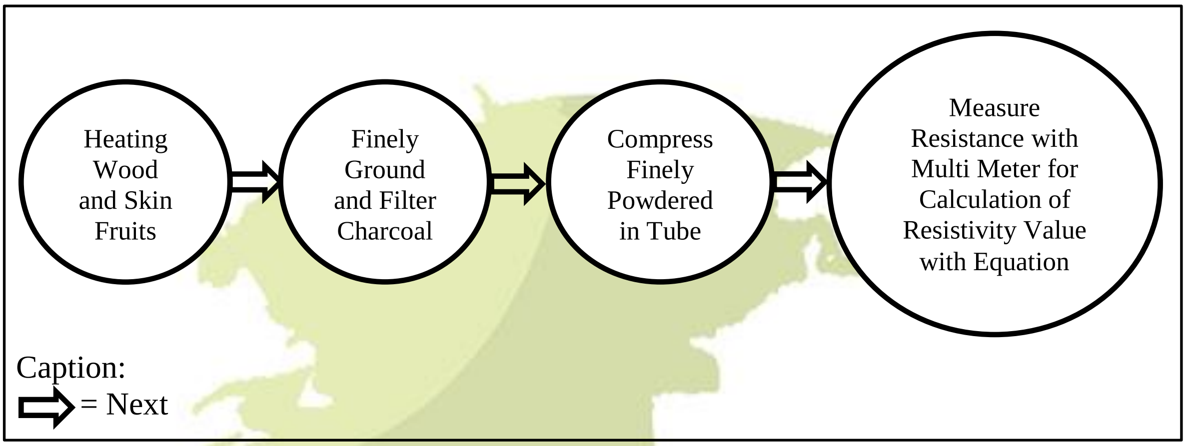

Figure 1 Procedure scheme of making resistor from charcoal wood and charcoal skin fruits

3. RESULTS

In this research material charcoalwood and charcoalskin fruits (charcoal of mango skins and charcoal of banana skins) must be solidly packed very tightly into the container. The density of the material is very important, because the resistance value can only be read when the material is really tight. The amount of container or surface area also determines the value of resistivity material. The container used in this study is a tubular pipette with a height (t) = 0.8 cm and a diameter of 1 cm. By the equation: $A = 2\,\pi r^2 + 2\,\pi rt$, it was found that the surface area was 4.08 x 10^{-4}m^2. The surface area of a cylindrical tube made of materials similar to charcoal wood, charcoal of mango skins, and charcoal of banana skins intended to do the comparison value of resistance and resistivity between the three materials.

It was found that the value of resistance at higher than charcoal wood with charcoal of mango skins, and charcoal of banana skins. The resistance value is determined by using a digital multimeter. Value constraints on charcoalwood, charcoal of mango skins, and charcoal of banana skins can only be read when the player scale digital multimeter showed limit the scale of 20 mega ohm (20 MΩ), so that the values read on-screen digital multimeter also has the same unit that mega ohm (MΩor 10^6Ω). Thus, the third ingredient is charcoal which can be used as an alternative substitute of resistance material in resistor because the resistor has a resistance value which is read on a digital multimeter.

The value of constraints for charcoal wood, charcoal of mango skins and charcoal of banana skins, is presented in Table 1 as follows.

Table 1 Charcoalresistance value

Type Material	Resistance Value (Ω)
CharcoalWood	14,28 x 10^6
Charcoal of mango Skins	5,5 x 10^6
Charcoal of banana Skins	4,7 x 10^6

The chart resistance values of charcoal wood, charcoal of mango skins, and charcoal of banana skins in this study is shown in Figure 2 as follows.

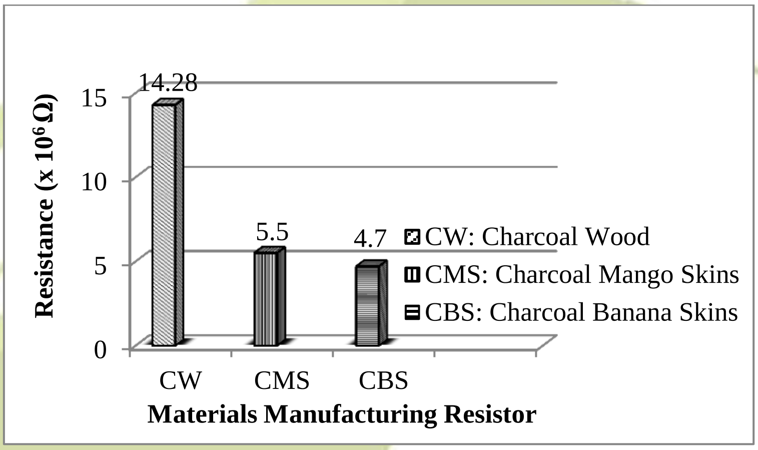

Figure 2 Graphs the resistance value of charcoal wood, Charcoal of mango skins and charcoal of banana skins

After the value is revealed by measuring the resistance value, the value of resistivity material searchable through the calculation of the data is obtained. The calculation is performed by using equation (3). The resistivity value of charcoal wood, charcoal of mango skins and charcoal of banana skins, is shown in Table 2 below.

Table 2 Charcoal resistivity value

Type Charcoal	Resistivity (Ωm)
Charcoal Wood	0,73 x 10^6
Charcoal of mango Skins	0,28 x 10^6
Charcoal of banana Skins	0,24 x 10^6

Calculation of resistivity material on charcoal wood, charcoal of mango skins, and charcoal of banana skins in this study showed that the charcoal wood has a higher resistivity than charcoal of mango skins and charcoal of banana skins. Resistivity comparison of charcoal wood, charcoal of mango skins, and charcoal of banana skins is shown in Figure 3 as follows.

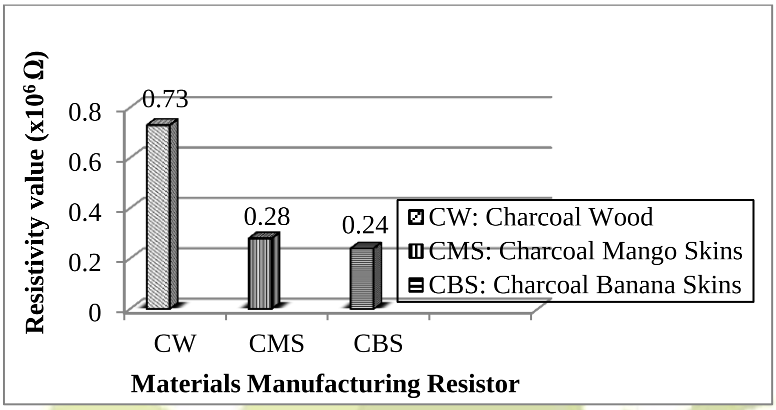

Figure 3 Graph resistivity value of charcoal wood, charcoal Mango skins and charcoal of banana skins

4. DISCUSSION

This study aims to determine the resistivity value of charcoal wood and charcoal skin fruits (charcoal of mango skins and charcoal of banana skins) as alternative substance of resistance material on resistor. The wood used is lamtoro, while the rind studied in this research is the mango and banana skins. The resistor is in the form of types of fixed resistors, carbon film resistors are made of the main causes of carbon. Carbonaceous charcoal nature was indicating the formation of an alternative material used in carbon film resistor by replacing pure carbon material with charcoal.

This study found that charcoal wood, charcoal of mango skins, and charcoal of banana skins have a resistance value that can be measured with a digital multimeter. This shows that the three materials can be used as materials for resistor. However, the value of resistance at these three ingredients can only be measured through a large-scale limit, which has 20 mega ohms (MΩ). This shows that the resistor which is made by using these three ingredients can only be used to produce a resistor with a large resistance value.

On the basis of the resistance value on the measurement results, it was found that the charcoal wood has a higher resistance value than the value of resistance of charcoal of mango and charcoal of banana skins. This is because the process of making charcoal wood consists of dry wood arranged to resemble a pyramid (each timber standing position) so carbonation (Ramdja, et al., 2008) can be evenly distributed and facilitates the propagation of heat. Wood fuel is completely dry, thus producing high quality charcoal (carbonization process is perfect down to the inside of the timber). This is evidenced in rarefaction screening process resulting in powdered black and very dense charcoal as compared with charcoal of mango skins and charcoal of banana skins. Therefore carbonization to experienceis the perfect charcoal, then charcoal containing carbon the charcoal wood, it is higher than charcoal of mango and banana skins.

This research is expected to make a significant contribution in the world of technology through the utilization of waste. Components of the resistor in the form of resistance material which has been put into focus as a core material in the manufacture of carbon film resistor can be changed. The results showed that the resistance of the material can be replaced with the existing waste in the environment, which uses wood waste and skin fruits. Packaging that meets the standards expected in the sequel.

5. CONCLUSION

Charcoal wood and charcoal skin fruits in this study can be used as an alternative substitute resistance material on resistor. Found resistance values with measurements on charcoal wood at 14.28 x $10^6\Omega$, charcoal of mango skins at 5.5 x $10^6\Omega$, and charcoal of bananacharcoal of banana skins at 4.7 x $10^6\Omega$. Cross-sectional area of each of the materials used at 4.08 x $10^{-4}m^2$ and a length of 0.8 cm. Based on calculations using the equations $\rho=\frac{R\,A}{l}$, can be identified that the resistivity for charcoal wood by 0.73 x $10^6\Omega$m, charcoal of mango skins 0.28 x $10^6\Omega$m, and charcoal of bananacharcoal of banana skins0.24 x $10^6\Omega$m. Resistance value and resistivity materials have a proportional relationship. The greater the value of its resistance, the greater the value of resistivity, otherwise the smaller the resistance value is smaller the resistivity.This waste can only be created as an alternative substitute resistance material on resistor with the size of the resistivity value is great.

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7. REFERENCES

Aiyub, S.,(2013), Zero Cross Voltage as a Detection Resistor in Synchronization Pulse Ignition, Electrical Energy Journal, Volume II, Number 1. Available at: http://jurnal.pnl.ac.id/wpcontent/plugins/Flutter/files_flutter/1394591212JurnalEnergiElektrikzerocrossvoltageoke.pdf. [Access on February 8, 2016].

Astuti, A.F., (2013),Utilization of Waste of Mango Skin: Healthy snack rich in benefits. Available at:https://ayukfitriastuti.wordpress.com/2013/10/31/pemanfaatan-limbah-kuman-kulit-mangga-camilan-sehat-kaya-manfaat/. [Access on February 2, 2016].

Fidianti,N.,(2014), Resistor of papers. Available at: https://www.academia.edu/6257997/Makalah_Resistor. [Access on January 30, 2016).

Hariyanto, D., (2009), Determining Studies on the Value of the Resistor Using the Color Selection Model HIS on the 2D Image, Telkomnika, Volume. 7, Number 1, pp. 13 – 22, ISSN: 1693-6930.

Lempang, M.,(2014), Manufacture and Use of Activated Charcoal, Technical Info EBONI, Volume 11, Number 2, pp. 65-80.

Nurhadi,(2013),Utilization of Banana Skin Waste as a Raw Material for Making Papers. Available at: http://uny.ac.id/berita/pemanfaatan-limbah-kulit-pisang-sebagai-bahan-baku-pembuatan-tisu.html/.[Access on February 2, 2016].

Ramdja, A.F., Mirah, H., Jo, H., (2008),Manufacture of Activated Carbon from Coconut Frond, Chemical Engineering Journal, Volume 15, Number 2. Available at: http://jtk.unsri.ac.id/index.php/jtk/article/viewFile/47/48. [Access on February 18, 2016].

Riadi, M., (2013), Wood waste. Available at:http://www.kajianpustaka.com/2013/03/limbah-kayu.html.[Access on February 10, 2016].

Susanto, B., (2015), Definitions of Resistor and Their Complete Functions. Available at: http://www.seputarpengetahuan.com/2015/02/pengertian-resistor-dan-fungsinya-lengkap.html. [Access on February 8,2016].