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The Effect of Variations in Cocoa Shell Carbon on the Characteristics of Environmentally Friendly Stamp Ink

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ABSTRACT. Cocoa plants produce cocoa fruit that can be used to make chocolate. There is 75% cocoa shell waste, from 25% cocoa beans. The cellulose content of cocoa shells ranges from 23-54%. This study aims to utilize cocoa shells as carbon for making environmentally friendly stamp ink. The variations of cocoa shell carbon used are 30 grams, 35 grams, 40 grams and 45 grams. The making of stamp ink is done by cocoa shell carbon , then the carbon is ground and vacuumed with a 100 mesh sieve. The carbon powder is added with 15 ml of polyethyelene glycol, 35 ml of alcohol and 50 ml of distilled water in each variation. The characteristic of stamp ink include density, viscosity, drying time, rubbing resistence, pH and color pihment. The best result are in the 30 gram variation with a density value of 1,015 g/cm^3, viscosity of 2,50 poise, drying time of 8 seconds, the ink rubbing resistance does not fade. A ph of 8.5 is alkaline and produces black pigments.

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1. Introduction

The use of cocoa skin is still very limited, cocoa skin water is simply thrown away in the plantation area, causing environmental problems and causing unpleasant odors such as pungent and causing various diseases in good cocoa plants. Cocoa plants are one of the most productive and important plants in Indoneia. There are 75%

cocoa skin waste and the remaining 25% cocoa beans that can be used to make chocolate. Currently, the use of cocoa skin is only used as compost and animal feed. The use of cocoa fruit is still too little. another way to utilize cocoa fruit . this is supported because the content of cocoa skin is cocoa skin cellulose of 23-54% (Budianto, 2016).

Carbon is the of the carbonization process, carbon is porous solid. The carbon element from *Volatile Organic Compound (VOC)* material of the xylene type is one of the main component elements for the black pigments in ink. The perfect black color is the basis for choosing carbon as the main pigments in black ink (Wiguna, 2015). Stamp ink usually contains large amounts of *Volatile Organic Compound (VOC)*. The gradual use of xylene will cause quite serious problems. The sport-term effects of xylene can cause respiratory problems, dizziness, kidneys and central nervous system. This making ink natural ingredients is very safe and evironmentally friendly (Anova, 2017).

2. Research Methods

2.1 Tools and Materials

The materials used in this study were cocoa skin obtained in the Kolam village area, Deli Serdang Regency. The mixed materials used were gum arabic, polyethylene glycol (PEG) and distilled water. The tools used were a 100 mesh sieve, furnance, 200 ml beaker, 100 ml measuring cup, magnetic stirrer, blender, dropper pipette, digital scale, ph meter, pycometer and viscometer. This study was conducted at the PTKI Medan Development Laboratory.

2.2 Research Process

2.2.1 Carbon Production

Cocoa skin is cut into 3 cm squares and then cleaned by washing it with clean water. The clean cocoa skin is then dried in the sun for 7 days to remove its water content. Furthermore, the carbon making process is carried out using a furnance for 2 hours using a temperature of 700 until it becomes carbon. After being cooled in ready to be blended is filtered again using a 100 mesh sieve for maximum results.

2.2.2 Masking Stamp Ink

The process of making stamp ink is done by weighing carbon using a digital scale according to the variations, namely 30 grams, 35 grams, 40 grams and 45 grams. According to research by Rahayu and siti (2021), the density value of the coconut shell carbon concentration with each variation produces, 15% of 1,0979 g/cm³, 20% of 1,1200 g/cm³, 25% of 1,1536 g/cm³, 30% of 1,1912 g/cm³ and 35% of 1,2206 g/cm³. the greater the carbon, the better the ink produced. This study uses the largest and maximum amount of carbon produced. Each variation variation is added with 7 grams of gum arabic. Next, add 15 ml of polyethylene glycol 35 ml of alcohol and 50 ml of distilled water to each variation, stir using a magnetic stirrer at a temperature of 70-80℃, a speed of 700 rpm for 30 minutes until homogeneous, indicated by the absence of lumps or sediment in the ink.

2.2.3 Ink Characteristics Test

a. Density

Density testing is done to determine the density value of an ink. Ink density can affect the level of clumping in the ink. Mathematically it can be writtens.

$$\rho = \frac{m}{v} \quad (1)$$

Where ρ represents the density of the ink (grams/cm³), m represents the mass of the ink and v represent the volume of the ink. Density determination is done by weighing an empty pycnometer that is clean and dry. Then put the ink into the pycometer until the pycometer space is full, then install the pycometer cap and make sure is no empty space or air in the pycometer.

b. Viscosity

Viscosity testing is done to determine the thickness of a liquid. Viscosity determines the speed at which a liquid flows. The viscosity of each liquid varies, depending on the concentration of the dissolved substance in the ink liquid. Viscosity testing is done using a viscometer, a tool used to determining the viscosity of a substance. Viscosity is tested using the Ostwald method, presure is directly proportional to the density of the liquid, so:

$$\frac{\eta_1}{\eta_2} = \frac{\rho_1 t_1}{\rho_2 t_2} \quad (2)$$

Where η_2 represents the viscosity of the ink (poise), η_1 represent the viscosity of water (poise), ρ_2 represent the density of the ink (g/cm³), ρ_1 represents the density of water (g/cm³), t_2 represents the time of the ink (seconds), t_1 represents the time of the water (seconds).

c. Drying Time

Drying time testing is the time when the stamp ink is pressed on the stamp pad and the stamped on paper using a standard stamp. The standard stamp has 3.5 mm and a lowercase height of 2.5 mm. drying time is measured when it is first stamped on paper ends when there is no black color attached to the fingertip.

d. Scratching Resistance

Rubbing resistance testing is the strength or resistance of ink to friction. The experiment was conducted using a fingertip rubbed for 15 minutes. The ink sample was pressed on the stamp pad then stamped on the paper for the first time and repeated four times then allowed to dry for 15 minutes, after which it was tested with a fingertip by rubbing.

e. pH

Ph testing of stamp ink is done a ph meter. It is done by pouring the ink solution into a beaker glass then insertingthe ph meter tip until the value appears.

f. Color pigments

Color pigment testing is done by applying liquid ink to the surface of plain white paper, so that the color pigment produced in each variation can be seen.

3. Results and Discussion

3.1 Density

Density is the ratio between the mass of substance and the volume. Increasing the mass of a substance can cause the density value to incerease as well.

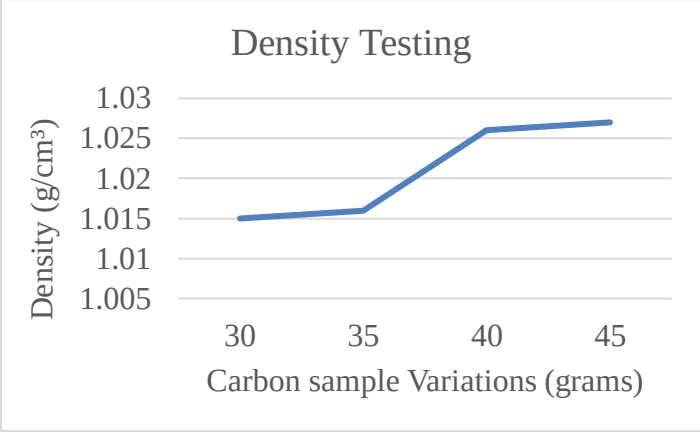

Figure 1. Density Testing on Marker ink

Based on figure 1, it can be seen that the relationship between the concentration of cocoa shell carbon is directly proportional to the density of the ink. The greater the concentration of cocoa shell carbon, the greater the density of the 30 grams sample is 1,015 g/cm³, the 35 grams sample is 1,016 g/cm³, the 40 grams sample

is 1,026 g/cm³, and the 45 grams sample ids 1,027 g/cm³. these results have met SNI 06-1567-1989 concerning stamp ink, which is a minimum of 1,0 g/cm³ (*Rahayu dan Siti, 2021).*

The results of Rahayu and Siti's research (2021), thr density value of the coconut shell carbon concentration with each variation produced, 15% of 1,0979 g/cm³, 20% of 1,1200 g/cm³, 25% of 1,1536 g/cm³, 30% of 1,1912 g/cm³ and 35% of 1,2206 g/cm³. these results have met the SNI for stamp ink. In accordance with this study, the more cocoa shell carbon, the density test will increase and this is in accordance with SNI for stamp ink form cocoa shell carbon with the number 06-1567-1989.

3.2 Viscosity

Viscosity testing on ink to determine the viscosity value of an ink. If the viscosity value is greater, the fluid will be more difficult to flow and complicate the movement of objects in the fluid.

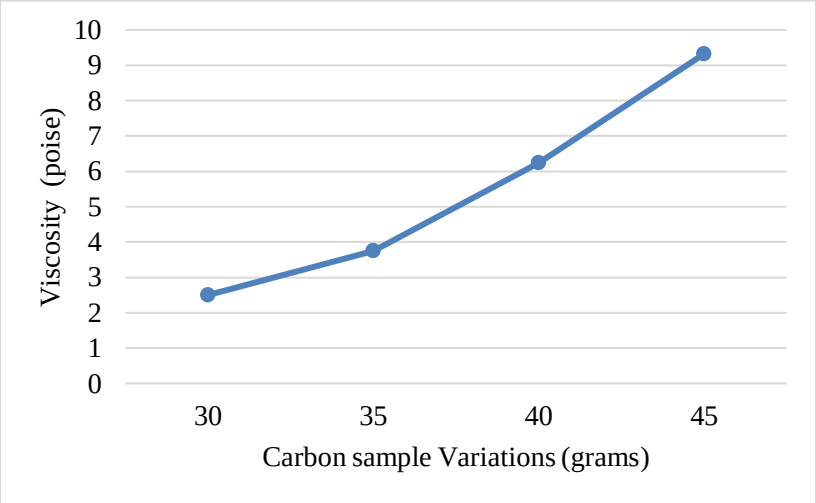

Figure 2. Viscosity testing of marker ink

From figure 2, it can be seen that the viscosity value of the cocoa shell carbon variation is 30 grams of 2.50 poise, 35 grams of 3,74 poise, 40 grams of 6,24 poise and 45 grams of 9,32 poise. This has met the reference of Rahayu dan Siti, (2021) which is 1,12 poise – 2,568 poise. Cocoa shell carbon can affect the results of viscosity testing. Viscosity states the thickness of a liquid. Viscosity is a property of a liquid that is related to the resistance to flow. The greater the viscosity, the more difficult it will be to flow, conversely the smaller viscosity. The easer liquid will be to flow. So the ink must have a viscosity level that is not too thin and not too thick to get the best results.

3.3 Drying Time

The results of the drying time test showed that the 30 grams sample was 8 s, 35 grams was 11,3 s, 40 grams was 11,6 s and 45 grams was 13,6 s, which met SNI 06-1567-1898 on stamp ink, namely a maximum of 40 s.

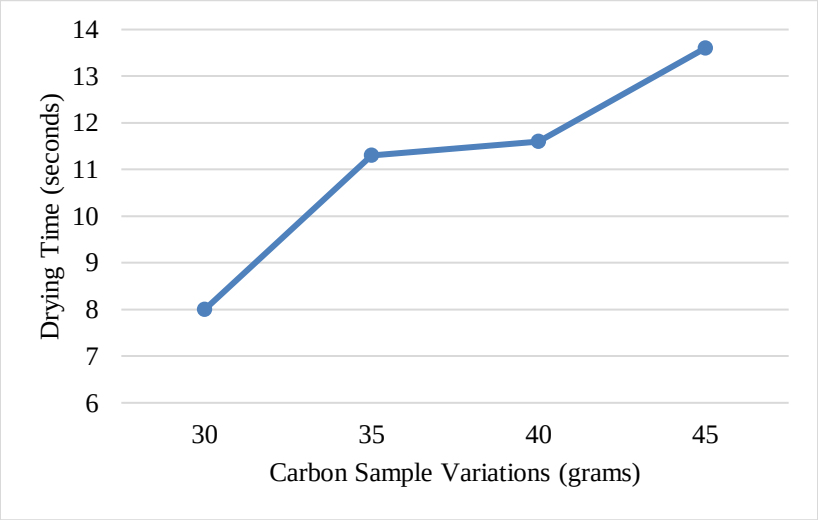

Figure 3. Testing the Drying Time of Marker Ink

Based on figure 3. It is known that the drying time test on stamp ink is the time needed for the ink to dry being applied to the paper. The time needed for the ink to dry is influenced by the size of the viscosity. The smaller the viscosity, the faster the ink dries *(Imani dan Haryanto, 2020).*

3.4 Scratching Resistance

Rubbing resistance testing is the strength or resistance of ink to friction. Based on the results of the rubbing resistance test, it was found that in the 30 grams sample it did not fade, 35 grams did not fade, 40 grams did not face and 45 grams did not fade. This has met SNI nomor 06-1567-1898 on stamp ink, namely it does notfade.

The results of Sulaiman research (2022), in this test using red spinach leaf, a rubbing resistance test was carried out, the results obtained were that the ink did not fade after being stamped on paper for 15 minutes then rubbed using the fingertip. This has met SNI stamp ink number 06-1567-1989 in accordance with my research, in the rubbing resistance test, the stamp ink did not fade.

3.5 pH

Ink pH testing aims to determine the pH level of an ink. Ink has acidic or basic properties. Ink pH testing is done using a pH meter.

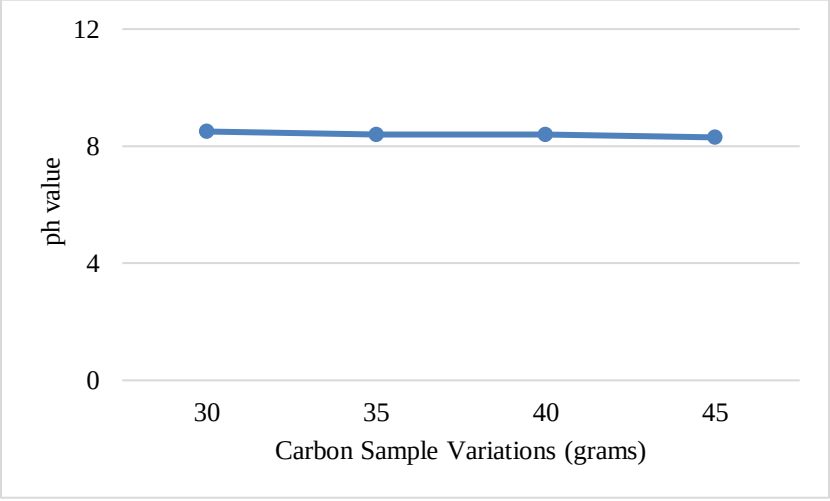

Figure 4. Ink PH Testing

Based on the data from the pH test result of the ink in figure 4, it was found that the pH value for each variation, namely the 30 grams sample was 8,5; the 35 grams sample was 8,6; the 40 grams sample was 8,6 and the 45 grams sample was 8,5. The relationship between cocoa shell carbon is inversely proportional to the pH of the ink. The greater concentration of cocoa shell carbon used, the lower the pH of the ink. Good ink must have a neutral to alkaline pH, because the ink will be corrosive.

3.6 Color Pigments

The higher the carbon content of the cocoa shell, the more pigment particles there are. The density and evenness of the pigment particles can produce a more concentrated black color because the particle carry the color of carbon, which is black (Rahayu dan Siti, 2021). It is known that in 30 grams of ink, the stamp ink results look black, 35 grams of ink produces black stamp ink, 40 grams and 45 grams produce stamp ink with black results.

4. Conclusion

The effect of carbon variations from cocoa shells on the characterization of stamp ink obtained a density value of 1,015 – 1,027 g/cm³, a viscosity value of 2,50 – 9,32 poise, a drying time value of 8 – 13,6 seconds, the results of the rubbing resistance test showed that the did not fade. The pH value produced was 8,5 – 8,3 and pigment results were black.

The variation of cocoa shell carbon that produces the most optimum stamp ink is the 30 grams carbon variation with a density value 1,015 g/cm³, a viscosity value of 2,50 poise, drying time of 8 seconds, rubbing resistance test produces ink that does not fade, a pH value 8,5 which is alkaline and produces black pigment.

Author Involvement

SWS conducted data analysis, wrote the original manuscript and wrote the revised manuscript. M provided the main idea of the research idea. MH provided the main idea of the research idea.

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