Characterization Of Organic Ink From Hydrochar-Based Cellulose Synthesis Of Durian Skin Waste Reinforced By Acasia Substance As Printing Ink Printing

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Abstract. Durian peel waste is one of the solid wastes from durian fruit that has not been processed optimally into something more useful. The purpose of this study was to synthesize durian skin waste through several stages combination method they are mechanical processes, chemical processes, and physical processes. The synthesis of hydrochad from cellulose from durian skin waste that has been produced is then mixed with a variety of alcohol with a concentration of 96% reinforced with acacia gum obtained from gum arabic and then tested for characterization to see the potential of hydrochar as a basic ingredient for making organic ink. The analysis carried out is an analysis of the density and viscosity of organic ink produced from hydrochard cellulose from durian skin waste. The results of the characterization of organic ink from durian skin waste indicate that hydrochard as an organic ink material has the potential to be used as a basic material for making organic ink that is environmentally friendly and biodegradable. Organic ink density analysis shows that the organic ink produced is still appropriate and close to the density standard that has been determined by Indonesian national standards. Furthermore, the viscosity analysis also showed the same results, approaching the determined Indonesian national standard (SNI).

Keywords: ink organic, hydrochard, arabic gum, durian skin waste.

1 Introduction

Ink is a very complex medium, containing solvents, pigments, dyes, resins and lubricants, solubilizer compounds that form polar polymer ions with water-resistant resins, wet element surfactants which lower the surface tension of a liquid, allowing easy diffusion of lower pressure between two fluids. Particulate matter, glow, and other materials serve to color the field or produce an image, text, or a design. In the printing industry, printers are equipment that is often used in the printing process. Thus, it requires large amounts of ink in its operation. Currently ink is Indonesia's prima donna import product which has a million benefits but the level of safety in the use of ink still needs to be considered because almost 90% of the ink comes from carbon black and the rest is iron powder additives and other polymer adhesives [1].

North Sumatra is the largest durian-producing province in Indonesia. North Sumatra's durian production is 579,471 tons per year, while Langkat produces 3,627 tons per year from a land

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area of 850 hectares [2]. However, the durian skin has not been utilized optimally and it is feared that it will become waste that is not utilized. Durian skin contains 50-60% cellulose content whose pores can absorb heat well. So that durian skin has the potential to be used as an organic ink filler. Cellulose ($C_6H_{10}O_5$) is a long chain polymer of carbohydrate polysaccharides from beta glucose. Chemically, cellulose is a polysaccharide compound that is abundant in nature. The characterization of cellulose arises due to the presence of crystalline and amorphous structures as well as the formation of micro-fibiles and fibrils which eventually become cellulose. The nature of cellulose as a polymer is reflected in the average molecular weight, poly dispersion and chain configuration [3].

Gum arabic, also known as gum accasia, is a resin product produced by tapping the gum on the legumes of the same name. Gum Arabic has a molecular weight between 250,000-1,000,000 grams/mol of the compound. Gum Arabic can improve stability with another increase in viscosity. This type of thickener is also heat resistant but it is better if the heating controls the heating time considering that Gum Arabic can be degraded slowly. Gum Arabic is composed of a mixture of heteropolysaccharide compounds consisting of L-aribinose, L-rhamnose, D-galactose, and D-glucuronic acid. The main function of Arabic gum is to improve viscosity, texture and prevent oxidation effects [4] .

Hydrochar is a nano-sized carbon which is often called a carbon nanostructure. Carbon nanostructures are carbon materials with nanoscale crystal structures that can be produced by synthesis, template and activation processes. In general, the carbonation process is carried out in two stages, namely carbonization and activation. Pyrolysis or conventional carbonation is often done to produce carbon. An alternative carbonation that is currently being developed and is environmentally friendly is hydrothermal carbonization (KH). KH was carried out in a closed reactor using water media. In the KH process below the critical point the water with high pressure is generated naturally from the water in the reactor. Activation is carried out to create a high surface area on carbon, either chemical, physical or a combination of both [7].

2 Research Methods

The method used in this research is a research experiment with a combination of the pyrolysis process and the hydrochar activation process followed by testing the physical properties of the organic ink produced. Consists of 4 stages of activities they are cellulosa preparation, hydrochard preparation, Hydrochar-based printer organic ink fabrication, caracterization organik ink.

2.1 Cellulosa preparation from durian waste

Durian peel waste is chopped and ground until the fibers obtained are soft. After that, the fibers were blended and then filtered through a 100 mesh sieve to obtain cellulose fibers. The filter results are then processed by a chemical process by dissolving the cellulose fiber and then filtered again to obtain alpha cellulose.

75 grams of mashed durian skin put into a glass beaker then add 1000 mL of 3.5% HNO_3 and 10 mg $NaNO_2$ then heated at 90 ^{0}C for 2 hours while stirring above hot plate and then filtered and washed the residue until the filtrate is neutral. After The first residue was obtained, 375 ml of 2% NaOH and 375 ml of Na_2SO32% were added. and heated at a temperature of 50 ^{0}C for 1 hour stirred over the next hot plate filtered and washed the residue until the neutral filtrate produced a second residue [8]. Thenthe bleaching process was carried out with 500 ml of 1.75% NaOCl solution then heated at 70oC for 30 minutes stirred on a hot plate. Filtered returned and washed the residue until the filtrate was neutral to obtain a third

residue. Added with 500 ml of 17.5% NaOH on the third residue and then heated at temperature of 80oC for 30 minutes stirred on a hot plate then filtered and washed residue until the filtrate is neutral and a fourth residue is obtained. Added with 250 ml H_2O_2 10% on the fourth residue and heated at 60 ^{0}C for 15 minutes stirred on a hot plate then filtered and washed the residue until the filtrate was neutral Wet cellulose alpha dried in an oven at 60 ^{0}C then stored in a desiccator dry alpha cellulose was obtained [6].

2.2 Hydrochard preparation from durian waste

The alpha cellulose was then obtained by pyrolysis process and then the alpha cellulose was put into an oven at 220 ^{0}C for 4 hours to produce hydrochar. The hydrochar was then washed with distilled water and filtered and then dried in an oven at 120 ^{0}C for 4 hours [9].

2.3 Hydrochar-based printer organic ink fabrication

at this stage the hydrochar that has been produced will be mixed with a solution of Arabic gum with a certain composition to get organic ink that has physical properties in accordance with SNI Standards.

Research variables on the manufacture of waste hydrochar-based printer organic ink Durian peel waste and gum arabic include raw material composition and characterization with a non-factorial Completely Randomized Design (CRD) system [10]. sample data analysis can be seen in table 1 and table 2

Table 1. Variation of Organic Ink Composition With Alcohol 7.5 Ml + arabic gum

Number	Ink sample code	Hydrochard (grams)
1	X-1	3
2	X-2	3.5
3	X-3	4
4	X-4	4.5
5	X-5	5

Table 2. Variation of Organic Ink Composition With Alcohol 10 mL + arabic gum

Number	Ink sample code	Hydrochard (grams)
1	Y-1	3
2	Y-2	3.5
3	Y-3	4
4	Y-4	4.5
5	Y-5	5

3. Result and Discussion

Characterization Of Physical Properties

3.1 Density analysis

Density is defined as the weight per unit volume of ink. Density The ink is affected by the type of raw material and the amount, and is also affected by temperature. Density will affect ink usage during the printing process [11]. The high density is caused by the amount of pigment in the ink. In the process printing, the printer cannot transfer ink with pigment density large, this causes the accumulation of pigment and solid particles in the roller ink or parts of the printing press, causing blockage. This usually occurs in print jobs at high speed tall.

Density is the ratio of the mass of a substance to its volume, so if As the mass of a substance increases, its density also increases. It can also be stated An increase in the concentration of a substance can increase its density [12]. Hydrochar concentration has a linear relationship with the mass of the substance. Density sampel X and Y we can seen in table 3 and table 4.

Table 4. density of Organic Ink Composition With Alcohol 7.5 mL + arabic gum

Number	Ink sample code	Density (cP)
1	X-1	0.244
2	X-2	0.264
3	X-3	0.346
4	X-4	0.583
5	X-5	0.691

Table 5. Density of Organic Ink Composition With Alcohol 10 mL + arabic gum

Number	Ink sample code	Density (cP)
1	Y-1	0.213
2	Y-2	0.224
3	Y-3	0.3 12
4	Y-4	0.415
5	Y-5	0.423

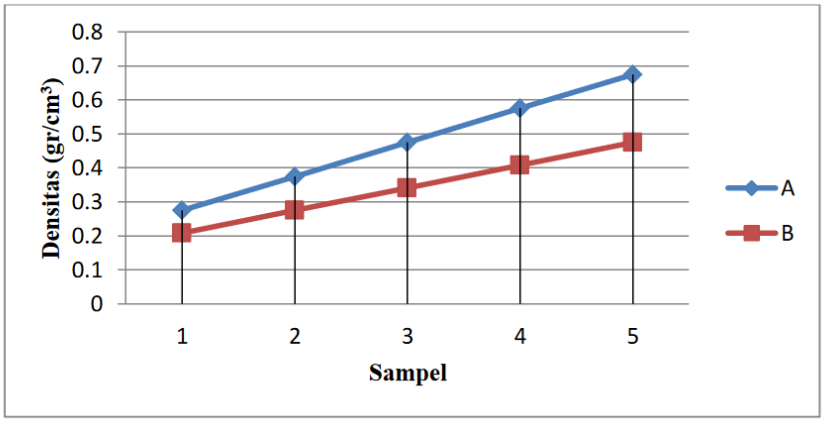

Fig. 1. Grafik density Ink Organic X and Y

3.2 Viskosity analisys

One of the physical properties that affect the printout is size The dilute state of the ink is called viscosity. Viscosity is ink viscosity or a measure of the internal pressure of a liquid against its flow. The high and low viscosity of the ink can affect the printing machine and the results the mold. The ink viscosity level should not be too thick or too runny so that it is not easily clogged or deposited on the printer. Viscosity is the viscosity of printing ink or a measure of the internal viscosity of a liquid to the flow as measured by a viscometer measuring instrument with units of Centipoise (cP). The viscosity of the ink is determined by the binding material (carrier color). By adding solvents or varnishes of varying degrees viscosity, it will affect the printing machine and the printout. Therefore it takes the right

concentration to produce ink with viscosity level that matches the standard ink viscosity [13]. Ink viscosity can be changed by the addition of basic ingredients for making ink, diluents and fastener.

Table 5. viskosity of Organic Ink Composition With Alcohol 7.5 mL + arabic gum

Number	Ink sample code	viskosity (g/cm^3)
1	X-1	5.132
2	X-2	5.245
3	X-3	5.385
4	X-4	5.443
5	X-5	5.564

Table 6. viskosity of Organic Ink Composition With Alcohol 10 mL + arabic gum

Number	Ink sample code	Viskosity (g/cm^3)
1	Y-1	5.108
2	Y-2	5.214
3	Y-3	5.245
4	Y-4	5.536
5	Y-5	5.543

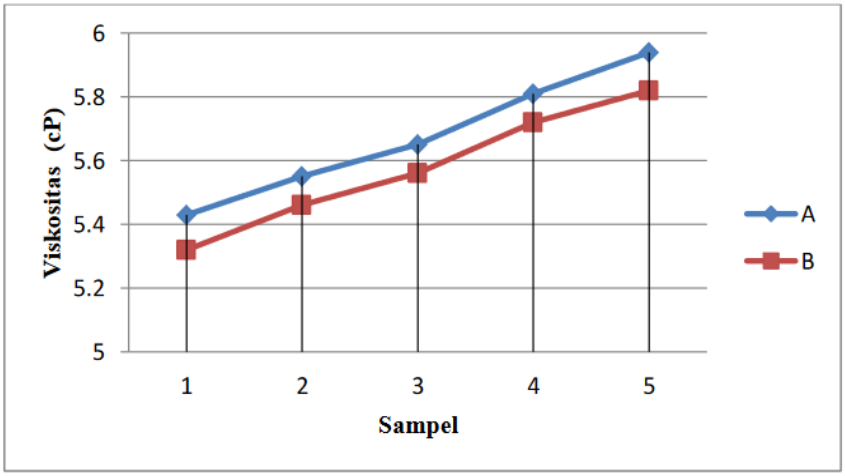

Fig. 2. Grafik viskosity Ink Organic X and Y

4. Conclusion

From the results of the research that has been done, it can be concluded that In the study, Hydrochar-Based Organic Printer Ink was obtained from the Results Durian peel waste that does not experience precipitation is sample X-4 with variations in the composition of 4,5 grams of hydrochar and 7.5 ml of 96% alcohol and 2 gram gum arabic with the addition of 20 ml aquadest and Y-5 with variations composition of 5 grams of hydrochar and 10 ml of 96% alcohol and 2 grams of gum arabic with the addition of 20 ml of distilled water. Among the

samples X-4 and Y-5 which have properties that are close to the value of properties ink according to SNI, namely X-4 has a density value of 0.583gr/cm3, viscosity 5.443 Cp, the surface tension is 18.398 dyne/cm and the light intensity level is -12 lux which is still close to the value of ink properties that meet the National Standard Indonesia (SNI), namely the density value of 0.9-1 g/cm3, viscosity 5.2 Cp.

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