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The effect of water content on increasing grammage in paper made from water hyacinth and cassava peel

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ABSTRACT

Paper is a thin sheet-shaped material containing cellulose from wood. The high demand for paper makes the raw material for paper production increase, which causes forest exploitation. As for this study to determine the effect of mixed variationsin the mixture made from ater hyacinth and cassava peel with the adition of NaOH solution, the characteristics of the paper produced, and the optimal paper quality. Variations in the percentage of water hyacinth and cassava skin raw materials, namely: sample A 30% : 70%, sample B 50% : 50%, and sampel C 70% : 30%. Using the experimental method is done with the soda process. The characterization tests carried out were grammage and water content. The results of the characteristictest obtained grammage values in sample A = 51.6 g/m^2, sample B = 84.0 g/m^2, sample C = 97.0 g/m^2. Test the water content in sample A = 5.7%, sample B = 5.9%, and sample C = 6.1%. Has met the value of SNI 7274-2008 for printing type A paper.

Keywords: Cassava peel; paper; water hyacinth

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INTRODUCTION

In Indonesia, paper usage increases every year, causing the use of wood as a raw material for paper making to also increase [1]. Almost 90% of the raw material for paper making is still dominated by wood, which causes the possibility of forest exploitation. Excessive exploitation of wood can damage the ecosystem and environment [2].

Global paper consumption is currently 394 million tons and is predicted to increase to 490 million tons by 2020. However, domestic paper usage is very high compared to other countries. So it has the potential for high forest damage. In addition, the available wood will be increasingly scarce, and forest damage will be even worse. By substituting other potential materials besides wood, efforts are being made to reduce its use as a raw material for pulp and paper [3].

Seeing the increasing demand for paper, alternative materials are needed to be used as the main raw material for paper making, so that the use of wood in paper making can be reduced. One of them is water hyacinth and cassava skin, which until now have not been widely used. Water hyacinth is usually processed by the community into raw materials for seedlings, mulch, fertilizer, and paper.

LITERATURE REVIEW

Paper

Paper comes from organic materials containing cellulose [4]. Glucose and β-1-4-glucan bonds form a straight chain polysaccharide polymer known as cellulose. Inside the cellulose there are fibers that have high tensile strength, are insoluble in organic solvents and water [5]. The cellulose content in making paper pulp greatly affects the quality of the paper, if the cellulose content is below 40%, the resulting paper is not good.

Water Hyacinth

Water hyacinth (*Eichhornia crassipes*) is a plant that grows in the air floating, has thick

and bubbly leaves [6]. Both vegetatively and generatively, water hyacinth grows very quickly. Water hyacinth is used by researchers as the main ingredient in making paper, because it has a lot of cellulose content, which is the main requirement for making paper.

Cassava Peel

Cassava peel can also be used in making paper because it has cellulose fibers, which is the main requirement in making paper. Cassava (*Manihot esculenta*) is a plant with a fairly high starch content. can be processed into semi-finished products such as tapioca flour or used as a substitute for staple foods. Apart from the tubers, cassava skin dregs can also be used as raw materials for making paper. Some people only use cassava skin as animal feed. The use of cassava in Indonesia is 19.9 million tons per year. Where cassava skin reaches 0.04 – 0.09 million tons per year [7].

Water hyacinth and cassava skin can be used as pulp in making paper. The method of making pulp in general through the stages, pulp making, defibration, washing, filtering, bleaching (bleaching), and printing. Pulping is the process of reducing the size of raw materials containing fibers such as wood or other materials into a mass of fiber. Because the fibers are tightly bound together, long-fiber pulp paper has high tensile strength. Conversely, long fibers are unable to fill small pores, because the pores will be filled with short-fiber pulp [8]. In paper making, it is necessary to add adhesive to obtain good paper quality such as the desired color, fiber quality and texture, as well as the physical quantity of the paper such as good grammage and tensile strength [9, 10].

RESEARCH METHODS

The technique used in the study is an experimental method, carried out with a soda process using 2.5% NaOH solution. In the heating process using 2.5% NaOH to remove lignin in water hyacinth and cassava skin. The three-dimensional polymer network known as lignin functions to glue cellulose fibers together to make them stiff. H_2O is used as a bleach (bleach), Na_2SO_3 is used as a softener of raw materials, Acetic acid is used as a solvent of raw materials.

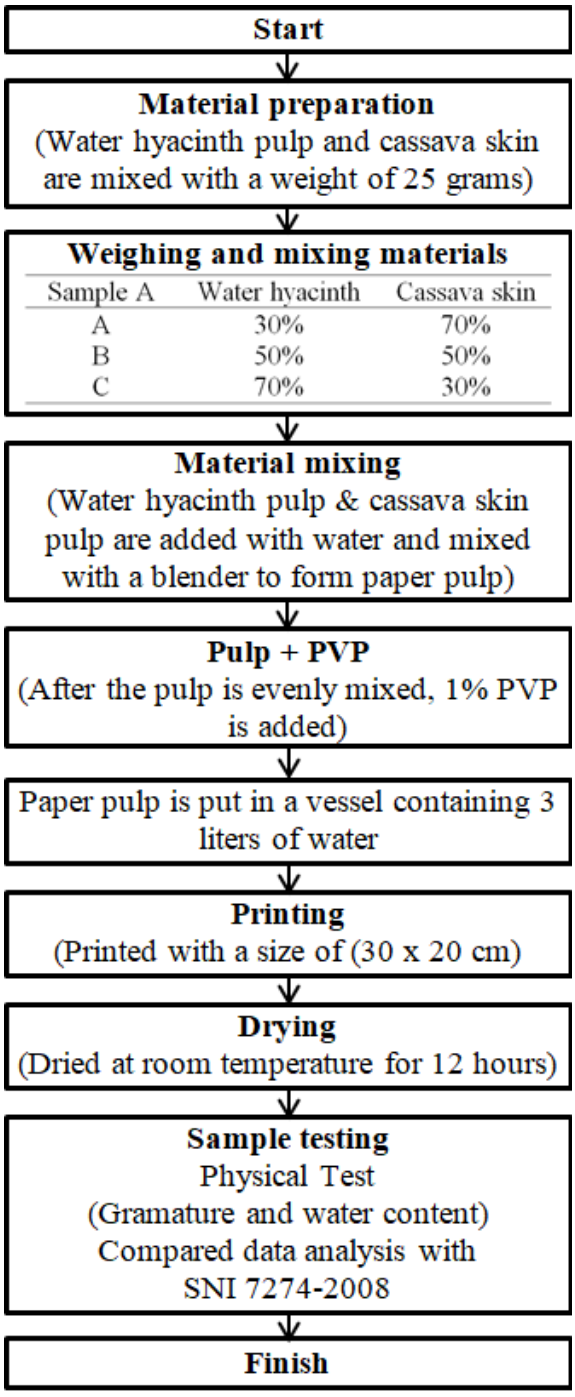

Figure 1. Stages of making and testing paper from water hyacinth and cassava skin raw materials.

The tools used in this study were oven, tripod, magnetic hotplate, analytical balance, stand & clamp, magnetic stirrer, blender, 1000

ml beaker, porcelain cup, stirring rod, thermometer, sieve, plastic, vessel, paper mold, ruler, and scissors. The diagram of this research can be seen in Figure 1.

The raw materials in this study were water hyacinth taken in the Medan Tuntungan area of North Sumatra, cassava skin taken in the Medan Tuntungan area of North Sumatra, 2.5% NaOH, 5.25% H_2O_2, 2% Na_2SO_4, 10% acetic acid, pinovinylpyrrolidone, water, distilled water. In addition, the composition of water hyacinth and cassava skin was varied with different mixtures as in Table 1.

Table 1. Variations in the mixture of raw materials for making paper.

Sample	Water hyacinth	Cassava skin
A	30%	70%
B	50%	50%
C	70%	30%

RESULTS AND DISCUSSION

Grammage

Conducted to determine the mass of paper from a certain unit area. Based on Table 2, the highest paper grammage value in sample C is 97.0 g/m^2, in sample B is 84.0 g/m^2, and sample A is 51.6 g/m^2. As the sample can be seen in Table 2, the paper grammage tends to increase in proportion to the composition of water hyacinth and cassava peel materials and has met SNI standards.

Table 2. Paper grammage measurement.

Sample	Grammage (g/m^2)	SNI 7274-2008 (g/m^2)
A	51.6	
B	84.0	50 – 100
C	97.0	

Based on Figure 2, it shows that grammage increases with the comparison of materials, sample A (30% water hyacinth : 70% cassava peel), B (50% water hyacinth : 50% cassava peel), and sample C (70% water hyacinth : 30% cassava peel). the highest value in sample C. this is influenced by the increasing percentage of water hyacinth. Because water hyacinth has a higher water content and has longer fibers compared to cassava peel.

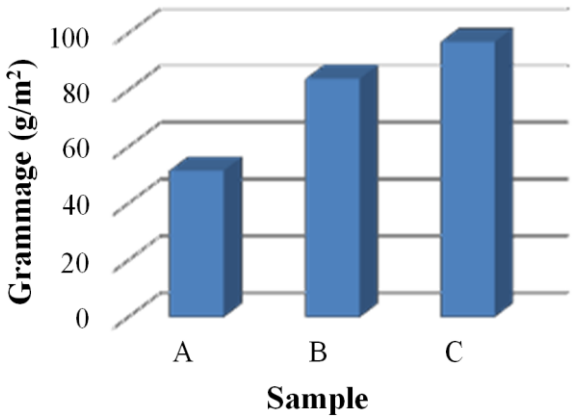

Figure 2. Paper grammage measurement chart.

Water Content

Conducted to determine the water content of a paper. Based on Table 3, the air content value in sample A is 5.7%, in sample B is 5.9%, and in sample C is 6.1% from the three samples above, the lowest air content value is obtained in sample A.

Table 3. Measurement of paper water content.

Sample	Water content (%)	SNI 7274-2008 (%)
A	5.7	
B	5.9	< 6
C	6.1	

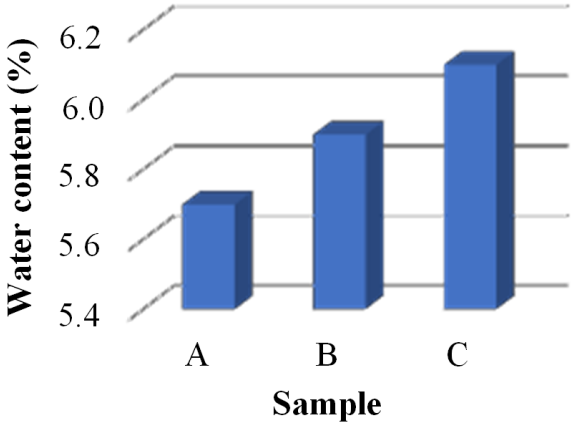

Figure 3. Paper water content measurement.

Based on Figure 3, it shows that the air content increases with the comparison of materials, the sample that shows the most optimal value in sample A, namely the sample

that has the lowest air content. This is due to the increasing percentage of water hyacinth, because the water hyacinth content is more than cassava skin.

CONCLUSION

The conclusion drawn from the results of this study is that the grammage value of sample A is 51.6 g/m^2, sample B is 84.0 g/m^2, and sample C is 97.0 g/m^2. The water content test value of sample A is 5.7%, sample B is 5.9%, and sample C is 6.1%. If the grammage value is high, it will affect the water content value which will also increase because water hyacinth has a higher water content than cassava skin. The grammage and water content values have met the quality requirements of type A printing paper (SNI 7274-2008).

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