

MANUFACTURING OF TISSUE: THE EFFECT OF MATERIAL AND AMOUNT OF CHITOSAN AND STARCH



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APPROVAL LETTER

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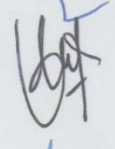

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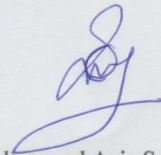
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Abstrak

Tisu umumnya digunakan sebagai kebutuhan pribadi dalam kehidupan. Penggundulan hutan yang disebabkan produksi tisu menjadi masalah besar. Masyarakat peduli dengan solusi untuk menyelamatkan dunia dari *global warming*. Solusi dari masalah ini adalah mencari bahan baku alternative yang mengandung selulosa untuk memproduksi tisu yaitu kulit pisang dan kulit durian yang mengandung selulosa 50-60% untuk durian, dan kulit pisang 60-65%. Empat langkah dalam proses memproduksi tisu. Langkah pertama dilakukan dengan pengeringan untuk mengurangi kadar air dalam bahan. Proses kedua adalah pembuatan pulp dengan senyawa NaOH. Ketiga, proses pemutihan menggunakan H₂O₂. Keempat, jumlah kitosandan pati yangdirancang dengan perbandingan berat 1:1sebanyak 1;1,5;2;2,5;3 gram masing-masing dalam 50 mesh di campurkan dengan 30 gram bahan. Kualitas tisu cocok untuk produksi dalam skala besar. Kondisi optimal berkisar 1,5 hingga 3 gram dimana kualitas memenuhi standart tisu sesuai dengan SNI 0103:2008.

Keywords: kulit pisang, kulit durian, daya regang, tisu, *pulping*, *bleaching*

Abstract

Tissue is commonly used as personal needs in life. Deforestation due to tissue production is big issue. People are concerned with the solution to save the world from the global warming. The solution of this problem can be done by changing wood as raw material to alternative material containing cellulose for producing tissue. This research studied the production of tissue from alternative raw materials are banana peel and durian peel, containing cellulose 60-65% for durian, and 50-60% banana. There were four steps in the process of producing the tissue. The first step was drying pretreatment to decrease the water contain. The second process was chemical pulping with addition of chemical compound NaOH. Third, bleaching process using H₂O₂. Fourth, sheeting with designed amount of chitosan and starch with the ratio 1:1 weight as much as 1, 1.5, 2, 2.5, 3 grams respectively in 50 mesh, mixed in 30 grams of peel. The quality of the tissue was suitable for tissue production in the large scale. The optimum conditions were achieved at the weight range of 1.5- 3 grams where the quality met the standard tissue according SNI 0103:2008.

Keywords: banana peel, durian peel, tensile strength, tissue, *pulping*, *bleaching*

1. INTRODUCTION

Tissue is one of the products produced from pulp production. In Indonesia, the use of tissue is one of the most abundant objects in daily life such as, food paper, toilet paper, facial tissue, etc. The main material of manufacturing tissue material wood. Woods used in pulp production are usually taken from forest. This can cause serious environmental problems. Millions of trees are lost due to continuous logging. Global warming and deforestation are examples.

Oxygen and the animal population in forest will slowly become extinct due to forest logging (WWF, 2017).

Cellulose is the main component of paper tissues production. Cellulose is not only obtained from wood, it can be found from leaf, straw, sawdust, and waste of fruits. The examples of waste of fruits are durian peel and banana peel (Gullichsen, 2000). Peel of durian contains cellulose about 60-65% and lignin approximately 5%. In banana peel, the content of cellulose is about 50-60% and lignin 5-10% (Tibolla H., 2016; Tjahyono, 1998; Sinuhaji, 2014).

The purpose of this research is to investigate some sustainable alternative raw materials at tissue production to shift the wood. As well, to save the forest from deforestation, by changing the materials with those which are friendly environmental, easy find and cheap.

2. METHOD

2.1 Research Variables

The variables studied in the present look included the composition of raw materials. The effect of the material composition on the quality of tissue was investigated.

2.2 Tools and Material

The Experiment used a blender, beaker glass, bucket, drop pipette, filter, hot plate, magnetic stirrer, measuring flask, bulb, sitter glass, volume pipette, thermometer, watch glass, and oven. The material included banana peel, durian peel, NaOH, H₂O₂, chitosan, tapioca, and virgin coconut oil (Noor, A.A., and Purnama H., 2017).

2.3 Procedure

1) Drying

The raw material was cut into small pieces. Then was put under the sunlight with different time for each sample with required time are 60, 90, and 120 minutes each sample.

2) Pulping

Chemical pulping was used in this research by preparing the 30 grams sample and 750 mL NaOH 0.1 N in a beaker glass the mixture was heated on hotplate at temperature 100°C for 90 minutes. The mixture filtered and washed using distilled water to remove NaOH solution and let it completely dry.

3) Bleaching

The brown pulp poured on a beaker glass, and 500 mL of H₂O₂ 2% or NaOCl 2% was added. The mixture was heated on a hotplate at 60°C for 60 minutes. After that, filtering and washing were carried out.

4) Sheeting

The sheeting process used filter of 50 mesh in size. White pulp, chitosan, 300 mL of distilled water, virgin coconut oil and tapioca were put into blender to be blended. After that, the blended mixture was put into bucket filled with water, it was called pulp. The pulp was put on the screen 50 mesh, as thin as possible and let it dry. Finally, a layer of tissue was produced, taken from the screen.

5) Test

The quality of tissue was tested based on the appearance (color), destruction water absorption, and tensile strength. The result were composed with the SNI 0103:2008.

3. RESULT AND DISCUSSION

The appearance of tissue as the effect of variation of composition is shown in figure, table 1, and table 2.



Figure 1. Tissue production from durian peel (top) and banana peel (bottom)

Table 1. Appearance of tissue with variety amount of chitosan and starch

No	Raw Material	Mass of chitosan and starch (g)				
		1	1.5	2	2.5	3
1	Banana peel	Yellowish, clean enough, soft enough, not hollow	Yellowish, clean enough, rough, not hollow	Yellowish, clean enough, soft enough, not hollow	Yellowish, clean enough, soft enough, not hollow	Yellowish, clean enough, soft enough, not hollow
2	Durian peel	White, clean enough, soft, not hollow	White, clean enough, soft, not hollow	White, clean enough, soft, not hollow	White, clean enough, soft, not hollow	White, clean enough, soft, not hollow

Table 2. Color faded of tissue with variety amount of chitosan and starch

No	Raw Material	Mass of chitosan and starch (g)				
		1	1.5	2	2.5	3
1	Banana peel	Not Fade	Not Fade	Not Fade	Not Fade	Not Fade
2	Durian peel	Not Fade	Not Fade	Not Fade	Not Fade	Not Fade

It can be seen that producing tissue from different composition of raw materials different appearance of results. The more chitosan and starch that from added the higher compactness of tissue. Is the color of tissue from durian peel is whiter than banana peel because banana peel contains many plant saps. The color of both materials is not faded because there is no addition of dyes. The data of destruction test shows in this figure below:

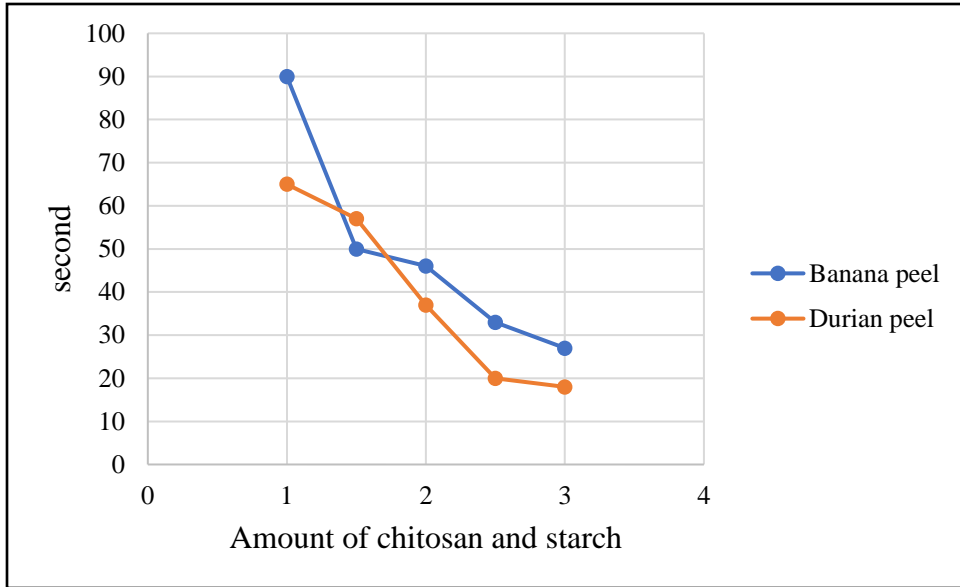


Figure 2. Destruction test of tissue

Figure 2 shown that the time destruction of tissue decreases as the increasing of amount of chitosan and starch the since ratio of white pulp and addition of material gets closer. The cellulose fibers contained in the mixture should be higher than the amount of chitosan and starch because the starch as compact material is easily dissolved in water. The performance of tissue in water absorption shows in this figure below:

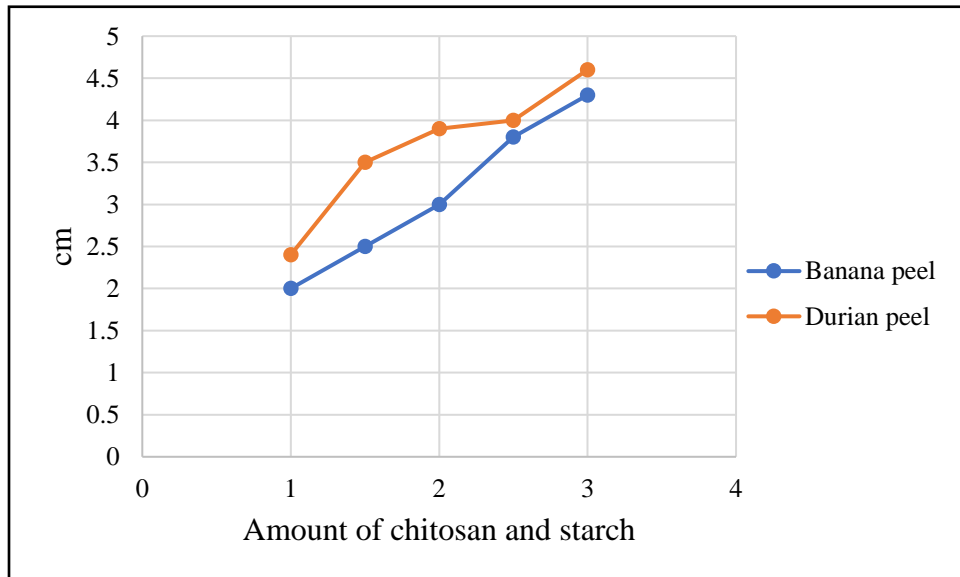


Figure 3. Absorption test of tissue

It can be seen that the water absorption increased by increasing the amount of chitosan and starch. This makes sense since chitosan is a hydrophilic polymer that has good interaction with water. Durian peel has higher absorption than banana because durian peel contains higher cellulose fiber. The quality of producing tissue based on the tensile strength shows in this figure below:

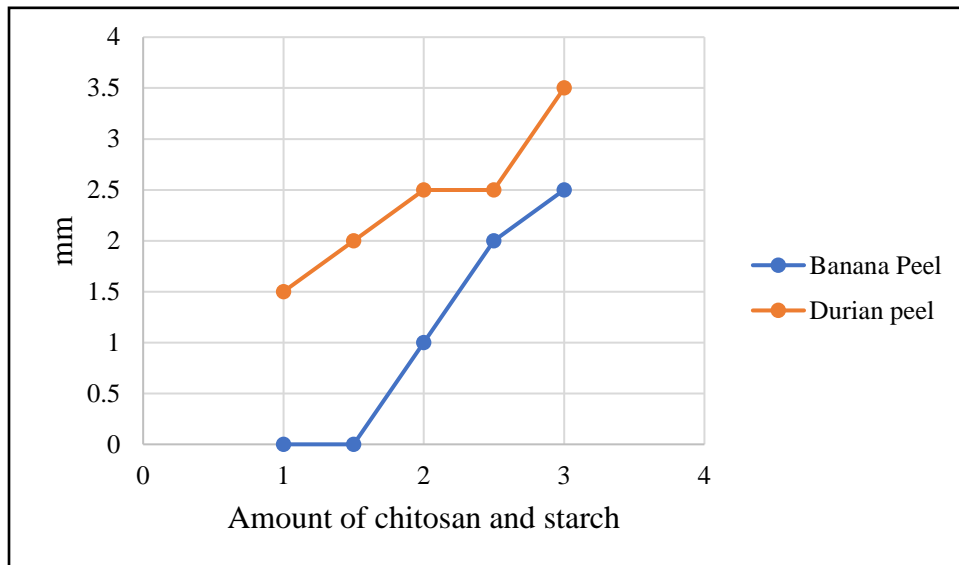


Figure 4. Tensile strength of tissue

The tensile strength also increases by increasing the amount of chitosan and starch. Chitosan and starch make the fiber getting closer, and the filler material makes the strength of tissue more compact.

4. CONCLUSION

Durian peel and banana peel as alternative organic raw material that substitute wood are sustainable in tissue production. The amount weight of chitosan and starch that reach optimum condition at 1.5-3 grams to produce the tissue according SNI 0103:2008. The Durian peel produces better quality of tissue than banana peel due to the higher content of cellulose in durian peel.

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