

The Effect of a Combination of Rubber Wood and Palm Shells as a Source of Fuel in the Fumigation Process Ribbed Smoked Sheet (RSS)

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Abstract

Natural rubber is one of the ingredients result that there are many rubber plantation in Indonesia, products of natural rubber product manufactured by company nationwide Rubber Company is lateks dark, ribbed smoked sheet and crumb rubber one of products manufactured by the factory rubber factory in Indonesia is ribbed smoked sheet. ribbed smoked sheet is one kind of processed products derived from latex or latex have a brisiliensis rubber plants are processed in mechanical and chemical engineering using a drying room with smoke, almost all factories do fumigation only using rubber wood as fuel, the researchers are looking for alternative fuel using palm shells are pretty much and easily accessible in the palm oil mill. The purpose of this study was to determine the effects of fuel combination of rubber wood and palm shells as a fuel source fumigation ribbed smoked sheet this study uses fuel of rubber wood and palm shells by using a laboratory scale fumigation, the first combination used 100% rubber woods, the second combination used 50% rubber woods and 50% palm shells the third combination used 100% palm shells. Ribbed smoked sheet which is observed according to the ribbed smoked sheet Indonesian national standard (SNI) the result of the study indicated that wood rubber fuel produce the best ribbed smoked sheet than palm shells and the combination of palm shells and rubber wood.

Keyword: Ribbed Smoked Sheet (RSS); Rubber; Wood; Palm Shells, Indonesian National Standard (SNI)

Introduction

Natural rubber is one of the materials produced by rubber plantations that is widely available in Indonesia. Natural rubber products produced by national companies are concentrated latex, ribbed smoked sheet, and crumb rubber, Ribbed Smoked Sheet (RSS) is one type of processed product that comes from the latex or sap of the have brasiliensis rubber plant which is processed mechanically and chemically by drying using a smokehouse. Rubber products are usually used or processed into several products, including: RSS I, RSS II, RSS III, crumb rubber, lump and latex. The main product of rubber trees is latex which can be sold or traded in the community in the form of fresh latex, slabs, or smoke sheets/wind sheets. Furthermore, these products will be used as raw materials for crumb rubber factories, which produce various raw materials for various downstream industries such as tires, balls, shoes,

rubber, gloves, swimsuits, rubber bands, rubber toys, and various other downstream products. (Arif, 2009).

Ribbed Smoked Sheet (RSS) is a type of conventional rubber which is included in the second largest product being developed in Indonesia after crumb rubber or SIR (Standard Indonesian Rubber). RSS products in the form of sheets receive a good curing process. This RSS processing uses garden latex as raw material. Garden latex is processed into desired rubber products by adding various chemicals. The quality of RSS rubber consists of various qualities starting from the best, namely X RSS, RSS 1, RSS 2, RSS 3, and cutting (Oktavia et al, 2014). Ribbed Smoked Sheet I (RSS I) Natural rubber in sheet form is the oldest and most popular type. This sheet is also the simplest and easiest form to produce on a small scale, smallholder rubber in most countries is processed and marketed as sheet rubber. These two types of sheet rubber are produced for the commercial market: Ribbed Smoked Sheet (RSS) and Air Dried Sheet (ADS). Of the two, RSS is the most popular due to its mechanical properties and high tensile strength (Rodgers, 2016). Almost all factories carry out fumigation using only rubber wood as fuel, so researchers are looking for an alternative using fumigation using palm oil shell fuel. Which is quite plentiful and easy to get in palm oil factories. The aim of this research is to determine the effect of the combination of rubber wood fuel and palm oil shells as a fuel source for smoking Ribbed Smoked Sheet. This research uses rubber wood and palm oil shells as fuel using a laboratory scale smoking device

Literature Review

Rubber is a product of the process of clumping rubber plant sap (latex). Normal rubber trees are tapped in the 5th year. The product from clumping latex is then processed to produce rubber sheets (sheets), lumps (boxes) or crumb rubber which is the raw material for the rubber industry. Rubber exports from Indonesia are in various forms, namely in the form of industrial raw materials (sheet, crumb rubber, SIR) and derivative products such as tires, components, and so on (Arif, 2009). Rubber products are usually used or processed into several products, including are: RSS I, RSS II, RSS III, crumb rubber, lump, and latex. The main product of rubber trees is latex which can be sold or traded in the community in the form of fresh latex, slabs, or smoke sheets/wind sheets. Furthermore, these products will be used as raw materials for crumb rubber factories, which produce various raw materials for various downstream industries such as tires, balls, shoes, rubber, gloves, swimsuits, rubber bands, rubber toys, and various other downstream products. (Arif, 2009).

Apart from that, there is a small content of non-rubber products in the form of protein, carbohydrates, lipids and inorganic salts. This non-rubber product is separated by acid coagulation, washed with water, then processed into sheets. Increasing rubber elasticity and rubber strength is obtained by a vulcanization process generally in the presence of sulfur, accelerators and other compounding materials, producing a three-dimensional network (Bokobza, 2018). Ribbed Smoked Sheet (RSS) is a type of conventional rubber which is included in the second largest product currently in use. developed in Indonesia after crumb rubber or SIR (Standard Indonesian Rubber). RSS products in the form of sheets receive a good curing process.

This RSS processing uses garden latex as raw material. Garden latex is processed into desired rubber products with the addition of various chemicals. The quality of RSS rubber consists of various qualities starting from the best, namely X RSS, RSS 1, RSS 2, RSS 3, and cutting (Oktavia et al, 2014). Ribbed Smoked Sheet I (RSS I) Natural rubber in sheet form is the oldest and most popular type. This sheet is also the simplest and easiest form to produce on a small scale, smallholder rubber in most countries is processed and marketed as sheet rubber.

These two types of sheet rubber are produced for the commercial market: Ribbed Smoked Sheet (RSS) and Air Dried Sheet (ADS). Of the two, RSS is the most popular due to its mechanical properties and high tensile strength (Rodgers, 2016). RSS rubber made from whole garden latex is coagulated deliberately and classified by visual evaluation. To establish an acceptable value for commercial purposes, all garden latex used to produce RSS is first diluted to 15% solids and then coagulated for approximately 16 hours with dilute formic acid.

The coagulated material is then ground, the water is removed, and the material is coated with a rough surface to facilitate drying. The sheets are then hung on poles to dry in the smokehouse for 2-4 days (Rodgers, 2016). Only intentionally coagulated rubber latex that is processed into rubber sheets, properly dried, and smoked can be used to make RSS. A number of restrictions also apply to RSS quality. Wet, bleached, poorly maintained rubber and original rubber as well as rubber that is not completely dry visually at the time of the purchaser's inspection are unacceptable (except undercured rubber specified for RSS 5). Meanwhile, skimmed rubber made from skimmed latex cannot be used in whole or in part into sheets as required in the specified specifications (Rodgers, 2016). The most important process for making RSS is smoking because it is the stage where phenol compounds are given to the rubber to preserve the RSS. So far, the RSS rubber factory has always used rubber wood as burning fuel, therefore the researchers want to use and mix it with other fuels by using palm oil shell fuel, where palm oil shell fuel is classified as a fuel that is easy to obtain because of its abundance. palm oil factory that produces palm shells.

Research Method

This research was carried out from June to November 2023 at the Process Laboratory and Quality Laboratory of the Plantation Product Processing Technology (TPHP) Study Program, College of Agricultural Agribusiness Plantation Science (STIPAP)/ITSI. This research is experimental-laboratory in nature. Research conducted on a laboratory scale by creating a Laboratory scale RSS.

Research Object

The research objects are RSS I, RSS 2, RSS 3 laboratory scale

Tools and Materials

The tools used in this research are as follows:

- | | |
|-------------------|------------------------|
| 1. Smoking Box | 8. Measuring Flask. |
| 2. Measuring cup | 9. Bucket |
| 3. strainer | 10. Spatula |
| 4. Grinding Ampia | 11. Deres Knife |
| 5. Bamboo | 12. Thermometer |
| 6. Oven | 13. Analytical Balance |
| 7. Beaker Glass | 14. Aluminum tray |

The materials used in this research are as follows:

1. Concentrated Latex
4. Water

2. Formic Acid 5% 5. Palm oil shells

3. Rubber wood

5. Data Collection

The Data Sources Used in This Research Are :

1. Primary data

Data obtained through experiments in the laboratory by making laboratory scale Ribbed Smoked Sheet (RSS), namely RSS 1 RSS 2 and RSS 3 according to the Indonesian National Standard (SNI).

2. Secondary data

Secondary data was obtained through library references and research previously related to this research.

Research Design

Research Variables

• Fixed variable:

- a. 2 liters of fresh latex per treatment
- b. Self-Designed Smoke Chamber Research Tool

• Non-fixed variable:

Combination of Rubber Wood and Palm Oil Shell Fuel Types with a Combination of Treatments:

Treatment 1 = 100% Rubber Wood

Treatment 2 = 50% Rubber Wood and 50% Palm Oil Shells

Treatment 3 = 100% Palm Oil Shells

2. RSS 1, RSS 2 and RSS 3 Standard Quality Parameters (SNI)

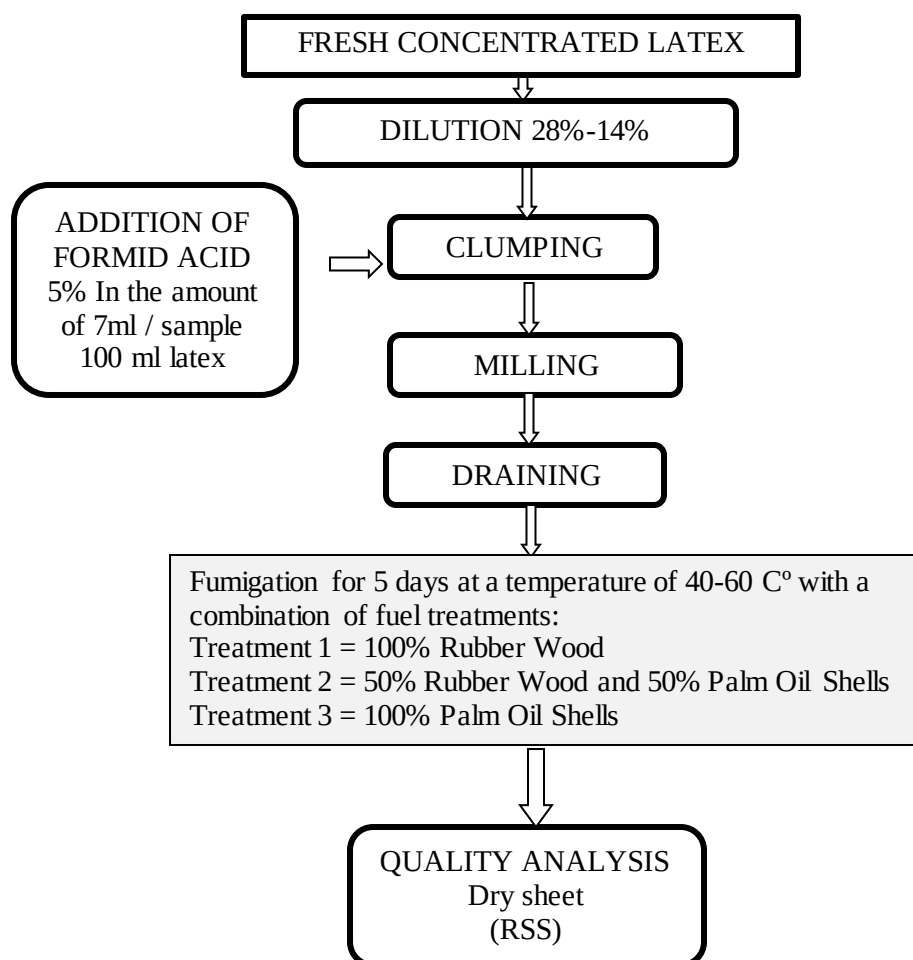


Figure 1. Flow diagram of research procedures

DISCUSSION RESULTS

This research uses conventional methods, namely by looking with the eyes and identifying the RSS based on:

- Bubble
- Fungus
- Sheet color
- Maturity level
- Sheet surface

The RSS sample grouping is based on the Standard Ribbed Smoked Sheet (SNI) according to the RSS 1, RSS 2, RSS 3 and cutting groups.

Results of Analysis of Conventional Ribbed Smoked Sheet Treatment 1

Treatment 1 was fumigated for 5 days using 100% rubber wood as fuel. The procedure carried out before treatment 1 was to make a coagulant in the laboratory which began with latex

dilution where each latex sample was first measured and then diluted 13-15% DRC. In the chemistry laboratory with the dilution formula $N1.V1 = N2.V2$ $V2 = (28, 100)/14 = 200\text{ml}$

The initial DRC was 28%, then dilution was carried out by adding 100 ml of latex and 100 ml of water into a glass beaker to get 14% latex, then adding 5% N formed acid as much as 7/100 ml of latex to speed up coagulation, after becoming a coagulum the latex was ground and drained. For 2-4 hours to reduce the water content, setting the temperature in the smoke room for 5 days according to the procedures of the ribbed smoked sheet processing factory, namely:

- The first day the smoke is carried out with a smoke room temperature of 40-45 C°
- On the second day, smoking is carried out with a smoke room temperature of 45-50 C°
- On the third day, smoking is carried out with a smoke room temperature of 50-55 C°
- On the fourth day, fumigation is carried out with a smoke room temperature of 55-60 C°
- On the fifth day, fumigation is carried out at a temperature of 60 C°

The results of conventional analysis can be seen in the following table:

Table 1. Results of Analysis of Conventional Ribbed Smoked Sheet Treatment 1

Sample	Bubble	Mushroom	Color	Maturity Level RSS	Surface RSS	Group RSS
1	0%	blank	dark chocolate	Ripe	Fine	RSS 2
2	0%	blank	dark chocolate	Ripe	Fine	RSS 2
3	5%	blank	dark chocolate	Ripe	Rough	RSS 2
4	10%	blank	dark chocolate	Ripe	Rougher	RSS 3
5	0%	blank	dark chocolate	Ripe	Fine	RSS 2
6	0%	blank	dark chocolate	Ripe	Fine	RSS 2
7	0%	blank	dark chocolate	Ripe	Fine	RSS 2
8	0%	blank	dark chocolate	Ripe	Fine	RSS 2
9	0%	blank	dark chocolate	Ripe	Fine	RSS 3

Source: Data processed in 2023

Based on table 1, it is known that there are no 9 samples in treatment 1 which are included in the RSS 1 group, there are 8 samples in RSS 2 and 1 sample in RSS 3. The test results show that treatment 1 has more RSS 2 because the sheet color is not too bright so the researcher placed RSS 2 in group, this was in accordance with SNI standards and placed 1 sample in RSS 3 group because the bubbles had exceeded SNI standards.

Results of Analysis of Conventional Ribbed Smoked Sheet Treatment 2

Treatment 2 was carried out by fumigation for 5 days using 50% rubber wood and 50% palm oil shells. The procedure carried out before treatment 2 was to make a coagulant in the laboratory which began with latex dilution where each Latex sample was first measured then DRC dilution was carried out. 13-15% in the chemistry laboratory with the dilution formula $N1.V1 = N2.V2$

$$V2 = (28, 100)/14 = 200\text{ml}$$

The initial DRC was 28%, then dilution was carried out by adding 100 ml of latex and 100 ml of water into a glass beaker to get 14% latex, then adding 5% N formed acid as much as 7/100 ml of latex to speed up coagulation, after becoming a coagulum the latex was ground and drained. For 2-4 hours to reduce the water content, then fumigation is carried out for 5 days. The fuel used on the first and second days is 100% rubber wood and fumigation on the third day uses a mixture of rubber wood and palm oil shells, then on the fourth day and fifth, 100% palm oil shell, setting the temperature in the smoke room for 5 days, namely:

- The first day, smoking was carried out with a smoke room temperature of 40-45 C°
- On the second day, smoking is carried out with a smoke room temperature of 45-50 C°
- On the third day, smoking is carried out with a smoke room temperature of 50-55 C°
- On the fourth day, fumigation is carried out with a smoke room temperature of 55-60 C°
- On the fifth day, fumigation is carried out at a temperature of 60 C°

The results of conventional analysis can be seen in the following table:

Table 2. Results of Analysis of Conventional Ribbed Smoked Sheet Treatment 2

Sample	Bubble	Mushroom	color	Maturity level sheet	Surface sheet	Group RSS
1	5%	Blank	Dark Chocolate	Rape	Roughr	RSS 2
2	20%	Blank	Dark Chocolate	Rape	Roughr	Cutting
3	10%	Blank	Dark Chocolate	Rape	Roughr	RSS 3
4	0 %	Blank	Dark Chocolate	Rape	Fine	RSS2
5	10%	Blank	Dark Chocolate	Rape	Roughr	RSS3
6	50%	Blank	Dark Chocolate	Rape	Roughr	Cutting
7	10%	Blank	Dark Chocolate	Rape	Roughr	RSS3
8	10%	Blank	Dark Chocolate	Rape	Roughr	RSS3
9	0 %	Blank	Dark Chocolate	Rape	Fine	RSS2

Source: Data processed in 2023

Based on table 2, it is known that there are no 9 samples in treatment 2 which are included in the RSS 1 group, there are 3 samples in RSS 2 and 4 samples in RSS 3 and 2 samples in cutting. The test results show that treatment 2 has more RSS 3 due to color. sheet is not too bright and the bubbles exceed SNI standards and place 3 samples in the RSS 2 group because the bubbles have exceeded SNI standards. and place 2 samples in the cutting group because they do not comply with SNI standards

Results of Analysis of Conventional Ribbed Smoked Sheet Treatment 3

Treatment 3 was fumigated for 5 days using 100% palm oil shell fuel. The procedure carried out before treatment 3 was to make coagulant in the laboratory which began with latex

dilution where each latex sample was first measured then carried out with DRC 13-15 dilution. % in the chemistry laboratory with the dilution formula $N1.V1 = N2.V2$

$$V2 = (28, 100)/14 = 200\text{ml}$$

The initial DRC was 28%, then dilution was carried out by adding 100 ml of latex and 100 ml of water into a beaker glass to get 14% latex, then adding 5% N formid acid as much as 7/100 ml of latex to speed up coagulation, after becoming a coagulum the latex was ground and drained. For 2-4 hours to reduce the water content, setting the temperature in the smoke room for 5 days, namely:

- The first day the smoke is carried out with a smoke room temperature of 40-45 C°
- On the second day, smoking is carried out with a smoke room temperature of 45-50 C°
- On the third day, smoking is carried out with a smoke room temperature of 50-55 C°
- On the fourth day, fumigation is carried out with a smoke room temperature of 55-60 C°
- On the fifth day, fumigation is carried out at a temperature of 60 C°

The results of conventional analysis can be seen in the following table:

Table 3. Results of Analysis of Conventional Ribbed Smoked Sheet Treatment 3

Sample	Bubble	Mushroom	Color	Maturity level sheet	Surface Sheet	Group RSS
1	50%	Blank	Dark Chocolate	Rape	Roughr	Cutting
2	0%	Blank	Dark Chocolate	Rape	Fine	RSS 2
3	5%	Blank	Dark Chocolate	Rape	Fine	RSS 2
4	10%	Blank	Dark Chocolate	Rape	Roughr	RSS 3
5	5%	Blank	Dark Chocolate	Rape	Fine	RSS 2
6	5%	Blank	Dark Chocolate	Rape	Fine	RSS 2
7	5%	Blank	Dark Chocolate	Rape	Fine	RSS 2
8	0%	Blank	Dark Chocolate	Rape	Fine	RSS 2
9	0%	Blank	Dark Chocolate	Rape	Fine	RSS 2

Source: Data processed in 2023

Based on table 3, it is known that the number of 9 samples in treatment 3 which is included in the RSS 1 group does not exist, there are 7 samples in RSS 2 and 1 sample in RSS 3, the test results show that treatment 3 has more RSS 2 because the color of the sheet is not too bright so the researcher places in the RSS 2 group and placed 1 sample in the RSS 3 group because the bubbles had exceeded the SNI RSS 2 standard and the researcher placed 1 sample in the cutting group because the bubbles did not exceed the SNI RSS 3 standard.

Based on the results of combining tests on treatments 1, 2 and 3, the following data was obtained:

Table 4. Analysis Results Based on Treatments 1, 2 and 3

Treatment	RSS 1	RSS 2	RSS 3	Cutting
1	0	8	1	0
2	0	3	4	1
3	0	7	1	1

Source: Data processed in 2023

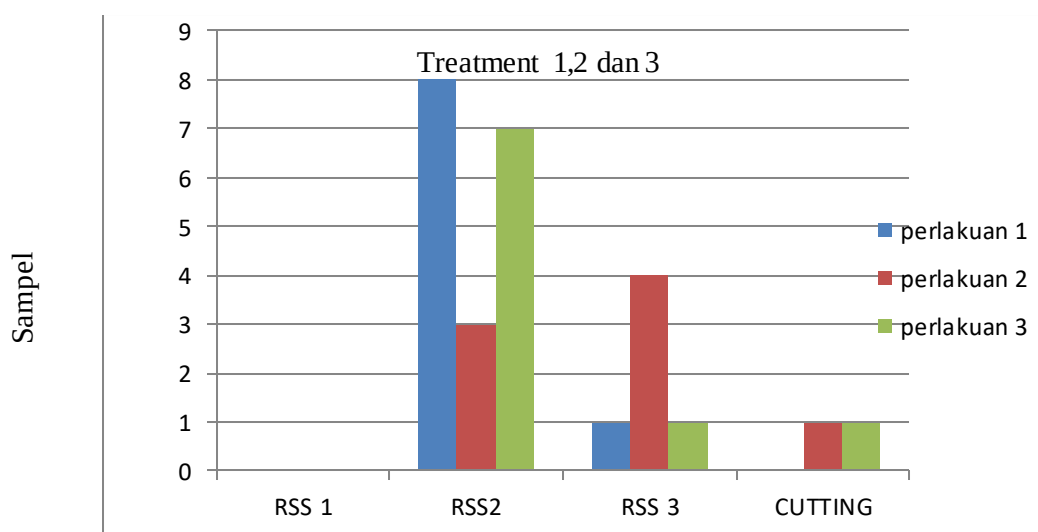


Figure 2. Graph of test results

Figure 2 shows a graph of the test results for treatment 1 with 100% rubber wood fuel which is better because it produces more RSS 2 than treatment 2 and treatment 3, based on the research results from the three treatments. RSS 1 was not obtained because the sheet color was dark brown.

This is caused by direct combustion, namely the combustion chamber directly hits the sheet, so the color change process is obtained from changes in the composition of the fuel for smoking.

The typical coloring of smoked products comes from the interaction between the smoke carbonyl constituents and the amino groups of the product proteins resulting in a product color ranging from golden yellow to dark brown. This coloring is closely related to the technological parameters used during smoking (Girrard, 1992).

The results of the research showed that treatment 3 experienced a darker color change compared to treatments 1 and 2 because treatment 3 used 100% palm oil shell fuel technology where the chemical composition of palm oil shells according to Widiarsi (2008) said that palm oil shells contain a composition of cellulose. (26.27%), hemicellulose (12.61%), and lignin (42.96%) are not as numerous as the chemical composition of rubber wood.

Bubbles on the sheet are caused by imperfect collection of bubbles during the dilution and coagulation process. This is in accordance with the theory which states that there should be no bubbles during dilution and coagulation when stirring the formed acid mixture (Utomo, 2004). There are still bubbles during the dilution and coagulation process because Researchers

were not able to take the maximum because the bubble collection time was relatively short and it was a little difficult to take small bubbles that were not visible to the eye.

CONCLUSIONS

The research conclusions on the influence of the combination of fuel fumigation are as follows:

- a a Treatment 1 (100% rubber wood) is RSS 2 with 8 samples and RSS 3 with 1 sample is the best treatment
- b b Treatment 2 (50% rubber wood and 50% palm oil shell) is RSS 2, there are 3 samples, RSS 3 has 4 samples and cutting has 2 samples, treatment 2 is the test result with the least RSS 2
- c c treatment 3 (100% palm oil shell) is RSS 2 with 7 samples, RSS 3 with 1 sample and cutting 1 sample

Suggestion

The researcher suggests to readers to carry out further research with better tools to produce Ribbed Smoked Sheet which is in accordance with the RSS grade 1 quality group which is in accordance with SNI and to develop other alternative fuels that are easy to obtain besides what the researchers did, making Ribbed smoked sheet that needs to be paid attention to to avoid failure, namely the collection of bubbles when diluting and coagulating should be done perfectly. This will reduce bubbles and is very important for getting maximum results

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