



**EFFECTIVENESS ADMINISTRATION OF SOME NATURAL SUBSTANCES ON THE COAGULATION OF RUBBER (*Hevea brasiliensis*)**

**EFEKTIVITAS PEMBERIAN BEBERAPA BAHAN ALAMI TERHADAP KOAGULASI LATEKS KARET (*Hevea brasiliensis*)**

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**Abstract**

Coagulation is one of the processes of bringing together rubber grains contained in latex liquid so that a lump is formed. This study aims to determine the effectiveness of freezing rubber from natural materials such as star fruit, lime, and noni, palm sap. This research was carried out in Punkie Village, Kaway XVI Sub-district, Aceh Barat District from August 2023 until completion. The experimental design used is a non-factorial Completely Randomized Design (CRD) consisting of 5 treatments and 4 replications, namely: K (control), MKD (noni), JNP (lime), NAN (palm sap), BMW (star fruit ). The study results show that the administration of some natural substances has a very significant effect on the coagulation of rubber; the most effective natural substance to coagulate rubber is noni.

**Keywords :** *Freezing, Lime, Noni, Palm Sap, Star Fruit*

**Abstrak**

Koagulasi yaitu salah satu proses mempertemukan butir-butir karet yang terdapat didalam cairan lateks, sehingga terbentuk suatu gumpalan. Penelitian ini bertujuan untuk mengetahui efektivitas pemberian buah mengkudu, jeruk nipis, nira aren dan belimbing wuluh terhadap koagulasi lateks karet. Penelitian ini dilaksanakan di Gampong Pungkie Kecamatan Kaway XVI Kabupaten Aceh Barat pada bulan Agustus 2023 sampai dengan selesai. Rancangan percobaan yang digunakan yaitu Rancangan Acak Lengkap (RAL) non faktorial yang terdiri dari 5 perlakuan dan 4 ulangan yaitu: K (Kontrol), MKD (Mengkudu), JNP (Jeruk nipis), NAN (Nira aren), BMW (Belimbing wuluh). Hasil penelitian menunjukkan bahwa pemberian beberapa bahan alami berpengaruh sangat nyata terhadap koagulasi lateks karet, bahan alami yang paling efektif mengumpalkan lateks karet adalah mengkudu.

**Kata Kunci :** Belimbing Wuluh, Jeruk Nipis, Koagulasi, Mengkudu, Nira Aren

**INTRODUCTION**

Natural rubber (*Hevea brasiliensis*) is widely used on an industrial scale, including for the benefit of society (Sari and Rahayu, 2013). Rubber plants are plantation crops that have high



economic value, and are one of the main sources of natural rubber (latex) and the country's foreign exchange earner. Indonesia is one of the second largest natural rubber producers in the world with a production of 3.2 million tons after Thailand (Setyamidjaja, 2003). According to (Arrizal, 1994 *in Siti et al.*, 2017), around 70% of the world's natural rubber production is absorbed by the tire industry, where currently all well-known tire factories use natural rubber as their raw material. Softness, flexibility and most importantly high elasticity are the advantages of natural rubber that synthetic rubber does not have. Latex is liquid rubber obtained from rubber tree-tapping plantations. Generally milky white and does not clump with or without the addition of stabilizers. This rubber can be obtained by tapping between the cambium and tree bark (Purbaya *et al.*, 2011).

Coagulation is a process of bringing together rubber particles contained in latex liquid to form a lump. This is caused by a decrease in pH (Purnomo *et al.*, 2014). Latex freezing is the freezing stage of rubber, usually to speed up freezing it is done using acids such as sulfuric acid, and formic acid (formic acid), the use of these chemical compounds has many negative effects on nature. Therefore, it is necessary to look for other alternatives to coagulate latex that do not have an impact on the environment (Farida *et al.*, 2009). According to Purbaya *et al.*, (2011), apart from acetic acid and formic acid, other types of acids can thicken latex which makes proteins hydrolyze into amino acids. Some of the natural ingredients consist of noni fruit, lime, palm oil, sap, and starfruit. The use of several natural materials in this research is because they are very abundant and easy to obtain and are more profitable from an economic perspective so they can reduce production costs.

Lime (*Citrus aurantiifolia*) is a type of citrus originating from Southeast Asia and India. Orange plants know no seasons so the availability of oranges is always abundant throughout the year, and can be planted anywhere, both in the highlands and lowlands. Oranges have a sour taste, their juice contains lots of water, vitamin C, iron, potassium, sugar, and citric acid. Highly acidic fruit juices contain citric acid at the level of 7-8% of the pulp weight. The core of the fruit is around 41% of the weight of the ripe fruit and contains many seeds (Sarwono, 2001). Noni (*Morinda citrifolia* L) is a native Indonesian plant that has long been known by the Indonesian people. Its use was introduced more by Javanese people who always used plants or herbal plants to treat various diseases (Djauhariya, 2003).

The compounds contained in noni contain several types of acids, one of which is ascorbic acid which is an extraordinary source of vitamin C, caproic acid, caprylic acid, and capric acid are included in the fatty acid group. Caproic acid and capric acid are what cause the pungent odor of noni fruit (Winarti, 2005). Sugar Palm (*Arenga pinnata Merr*) is one of the most abundant trees after coconut in Indonesia. From palm trees, liquid can be produced by tapping male flowers called Nira. Rubber contains enough sugar to interfere with the growth of microorganisms, it is a very good medium for the growth of microorganisms if the rubber is left for some time so that the sap can undergo a spontaneous fermentation process. With this fermentation process, the sap will experience an increase in acidity which causes a decrease in pH. Natural rubber that comes out of flower bunches will have a pH of 7, so the pH will decrease. The remaining rubber can turn into alcohol and eventually become acetic acid (Dyanti, 2002).



Starfruit (*Averrhoa bilimbi* L) has a lot of nutritional content, is easily decomposed, does not leave residue in the environment, is cheap, and has low toxicity so it is relatively safe and healthy for the environment, but has not been specifically cultivated. Starfruit is a plant whose trees live at an altitude of around 5-500 meters on land. This star fruit plant is very easy to grow and reproduce by grafting stems or by planting seeds. Star fruit that is around 3-4 years old begins to produce 1,500 fruits per tree (Dewi *et al.*, 2009).

### RESEARCH METHODS

This research was carried out in August 2019 until completion at Pungkie Gampong, Kaway XVI Sub-district, Aceh Barat District. The tools used in this research were a small basin, camera, measuring cup, pH meter, small bucket, label paper, knife, filter, stirring rod, scales, and writing utensils. The materials used in this research were liquid latex pH 6.4, sugar palm sap pH 3.9, noni pH 3.8, lime pH 2.5, starfruit pH 2.0, and sufficient water.

This research was conducted using a non-factorial Completely Randomized Design (CRD) consisting of 5 treatments and 4 replications, resulting in 20 experimental units. With latex 100 ml each, noni extract 50 ml, lime extract 50 ml, starfruit extract 50 ml, palm sap 50 ml.

- K = Control (No treatment)
- MKD = Noni
- JNP = Lime
- NAN = Sugar palm sap
- BMW = Starfruit

#### Latex Collection

The liquid latex was tapped and collected from the garden belonging to Syarifuddin Karim, whose address is Pugkie village, Kaway XVI sub-district, West Aceh district. The liquid latex that had been tapped was put into a container.

#### Making Coagulant Materials

Making a natural coagulant includes 100 ml of noni fruit, 100 ml of lime, 100 ml of starfruit, and 100 ml of palm oil juice. The materials used are washed first with water until clean. Apart from sap, each fruit is squeezed until the juice comes out, then filtered to separate the water from the dregs and applied to liquid rubber. For coconut sap, use acidic sap with a pH of 3.9 then mix it with liquid rubber.

#### Application of Coagulant Materials

The natural ingredients of noni, lime, palm sap, and starfruit, 50 ml each, are mixed into a container containing 100 ml of Latex and then stirred until evenly distributed.



**Observation**

Observations were made by observing the clumping time of each latex, the smell of the latex after clumping, the weight of the initial latex, and the weight of the resulting latex.

a. Coagulation Time

Latex clumping is observed by looking at the latex that has coagulated, indicated by the rubber easily releasing from the freezing container and the latex no longer sticking to the skin.

b. Smell of Latex

The smell of latex is observed after the latex has completely coagulated using the sense of smell.

c. Initial L atex A weight

This initial latex weight observation was carried out by weighing the liquid latex that had not been added with other ingredients.

d. Final L atex A weight

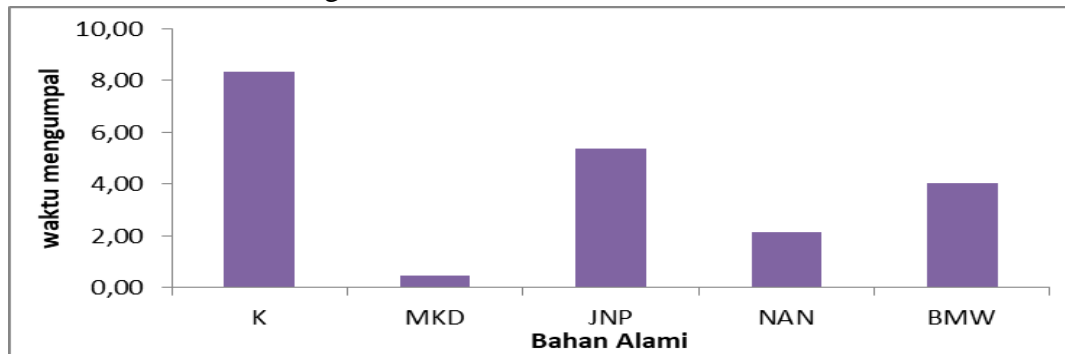
The final latex observation was carried out by weighing the completely coagulated latex with a scale and then entering it into the formula:

$$= \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100\%$$

**RESULTS AND DISCUSSION**

**a. Coagulation Time**

The results of the variance analysis showed that the effectiveness of providing several natural ingredients on the coagulation of rubber latex had a very significant effect on the clumping of rubber latex. The average clotting time after administering several natural ingredients can be shown in Figure 1 below:



**Figure 1.** Average clotting time after administration of several natural ingredients

In Figure 1, it can be seen that the administration of noni extract coagulates the rubber latex the fastest, namely 46 minutes after application, while palm sap coagulates the rubber latex for 2 hours 16 minutes, treatment with the administration of starfruit extract coagulates the rubber latex for 4 hours 5 minutes, followed by Lime can coagulate rubber latex for 5 hours 35 minutes.



Meanwhile, rubber latex without treatment coagulated by itself within 8 hours and 32 minutes. Based on observation results from various types of natural freezing ingredients, the one that influences the freezing speed is noni. This is because noni contains many acids, including acetic, benzoic acid, and ascorbic acid and noni fruit contains acetic acid which can lower the pH of the latex (Rizka *et al.* , 2013).

a. Latex Smell

From the results of observations carried out after 24 hours and the condition of all the latex had completely clotted, using the sense of smell to determine the smell of latex can be seen in the table below.

**Table 1.** Latex Aroma due to the Application of Natural Coagulants

<b>Treatment</b>	<b>Latex Smell</b>
Control	Bad odor
Noni	Pungent acid
Lime	Sour smell
Palm sap	Sour smell
Starfruit	Latex smell

Source: data processed in 2019

In the table above, it can be seen that treatment with noni fruit extract produces a strong sour odor, while lime produces a sour odor. This is similar to palm sap which has a sour smell, latex treated with starfruit produces a fresh sour smell, while untreated latex produces a rotten smell. From the aroma produced, it can be concluded that treatment with noni extract will produce a rotten smell, while treatment with lime will produce a fresh latex smell. The recommended freezer does not cause a bad smell. Apart from causing air pollution, the smell of rubber can also affect the subsequent rubber processing process, especially for finished rubber goods that do not require undesirable odors (Siti *et al.*, 2017).

b. The initial weight of latex

The results of observations on the initial and final weight of rubber latex can be seen in the Table 2 below:

**Table 2.** The Initial Weight of Rubber Rubber Latex

<b>No</b>	<b>Treatment</b>	<b>Initial latex weight (gr)</b>	<b>Liquid latex</b>
1	Control	100 gr	100 ml
2	Noni	100 gr	100 ml
3	Lime	100 gr	100 ml
4	Palm sap	100 gr	100 ml
5	Starfruit	100 gr	100 ml

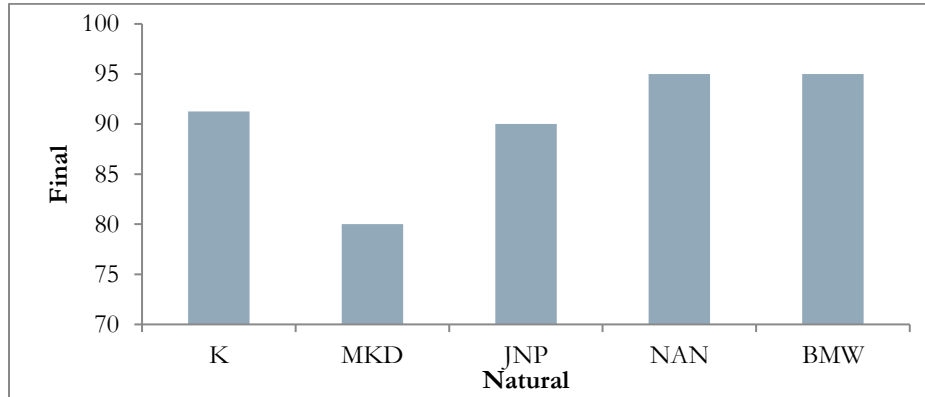
Source: data processed in 2019

In Table 2 above it can be seen that the initial latex weight was 100 ml before each treatment was 100 gr.



c. Final Weight of Latex

The results of the variance analysis showed that the addition of several natural ingredients to the coagulation of rubber latex had a very significant effect on the final weight of rubber latex. The average final strength after administration of several natural ingredients can be seen in Figure 2 below.



**Figure 2.** Average Final Results after Application of several Natural Ingredients

From the results of the observations above in the final weight analysis, it can be seen that noni produces frozen rubber weighing 80 grams with a percentage of 99.20%, then lime with a final latex weight of 90 grams with a percentage of 99.10%, which is different from the treatment of Palm Sap and star Fruit Wuluh. Both produce a weight of 95 grams with a percentage of 99.05%, while the weight of latex without treatment produces a latex weight of 91.25 grams with a percentage of 99.09%. This happened because weight loss was visible from each treatment. In the opinion of (Purbaya *et al.*, 2011), this is caused by the water content contained in the lump shrinking over time so that the weight of the latex also decreases as a result of which the water coming out of the latex lump increases.



**Figure 3.** Natural Ingredients that have been Extracted

**CONCLUSION**

Noni, Lime, Palm Sap, and Star Fruit can be used to coagulate rubber latex to replace formic acid or vinegar which is usually used by rubber farmers. 50 ml of Noni Fruit with 100 ml of latex coagulated the rubber latex the fastest, namely 46 minutes. 50 ml starfruit extract with 100 ml liquid latex produces a fresh latex smell.



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