



Utilization of Aloe Vera Extract as A Natural Coagulant and its Effect on The Characteristics of IRR 118 Clone Rubber

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Abstract

Rubber is one of the plantation products as a foreign exchange earner for the country. In the processing process, coagulants are needed to accelerate coagulation. Aloe vera is a plant that contains organic acid compounds such as salicylic acid, ascorbic acid, and aspartic acid. The content of organic acids in AV is expected to accelerate the coagulation process. Therefore, this study aimed to determine the effect of using natural coagulant AV extract on the characteristics of rubber clone IRR 118. Natural coagulant AV extract with centrifugation and without centrifugation and the chemical coagulant of formic acid 3% as comparison are used as the variations of the coagulants. Centrifugation of natural coagulant AV extract is carried out at a speed of 3000 rpm for 1 hour. The characterization of rubber analyzed was DRC (Dry Rubber Content), Po (Initial Plasticity), PRI (Plasticity Retention Index), ash content, volatile matter, mooney viscosity, dirt content, and nitrogen content. The results showed that the percentage of DRC, Po, PRI, and Mooney Viscosity was highest in AV natural coagulants without centrifugation was highest, at 28%, 36%, 80%, and 80%, respectively. Meanwhile, the lowest percentage of ash, dirt, and nitrogen content by AV centrifugation were 0.38%, 0.014%, and 0.36%, respectively. Because it complies with SNI 06-1903-2017SIR 20 and can be used as a natural coagulant, AV as natural coagulant with and without centrifugation can be used as a coagulant for the latex coagulation process.

Keywords: Clone IRR 118, natural coagulants, centrifugation, aloe vera, latex coagulation

1. Introduction

Rubber plantations in Indonesia in 2020 covered an area of 3,726,506 Ha with a production of 3,037,348 tons (BPSD, 2022). Rubber is one of the plantation products that bring in the country's foreign exchange. In the rubber processing process, latex coagulation is carried out, namely by adding coagulants to speed up the process. The coagulants that are commonly used are chemical coagulants of formic acid. The formic acid as a coagulant is not environmentally friendly and unsafe for workers (Achmad et al., 2022). To replace formic acid as a coagulant, one of them is with a natural coagulant, namely aloe vera (AV). Aloe vera contains organic acids, namely salicylic acid and ascorbic acid which can speed up the coagulation process (Rusanti, 2017).

Natural rubber is composed of straight and long monomer chains with repeated isoprene groups through polymerization reactions forming poly (isoprene) (Nasution, 2016). There are several advantages of natural

rubber over synthetic rubber, including good elasticity, cheaper price, more resistant to heat, resistant to cracking and has better plasticity and flexibility (Rahman and Ilma, 2017). Rubber productivity is influenced by many things, one of which is the type of rubber clone used. Seeds and types of clones have an important role in rubber productivity, namely 60% and the other 40% are influenced by the environment and the processing process of rubber plants (Rochmah and Ramdani, 2020). The IRR 118 clone resulted from a cross between the LCB 1320 clone and the FX 2784 clone (Daslin, 2014).

Latex is a cytoplasmic fluid obtained from the tapping process of rubber plants. Latex is taken from the outer shell layer of the rubber plant with a yellowish-white color. The content contained in latex includes rubber components and non-rubber components. The composition of fresh latex is 25-40% rubber and 60-75% is a non-rubber component (Astrid et al., 2014). Non-rubber components contained in latex are water, proteins, phospholipids or fatty acids, carbohydrates, and sugars.

compositions of fresh latex and centrifuged latex are presented in Table 1. (Hardiyanty et.al, 2013).

Table 1. Latex Composition

Composition	Fresh Latex
Rubber	35%
Carbohydrates	2%
Protein	1,5%
Lipid	1,5%
Inorganic compounds	1,5%
Water	58,5%

The event of the change from the liquid phase to a solid is called coagulation. Coagulation of latex is performed by adding coagulating agents or coagulants (Hatina and Febriana, 2019). Coagulation can occur because the H^+ ions from the addition of acid will neutralize the OH^- ions in the latex causing a decrease in the pH of the latex to the isoelectric point. A decrease in the pH of latex causes the protein particles in the rubber to lose their charge and the rubber polymer will bind to each other so that the latex is coagulated (Ali et al., 2010). The number of H^+ ions is influenced by the pH value and acid content in the coagulants used. When the latex has been coagulated it will produce coagulum and serum (Rusiardy, 2022).

Aloe vera (AV) is a plant that is widely used as a raw material in the cosmetic, pharmaceutical, and other industries (Puspitasari and Novitasari, 2021). Aloe vera contains vitamins C, A, B, B2, B3, B12, E, and folic acid. The acidic compounds contained in aloe vera are salicylic acid 3%, ascorbic acid 0.02%, and aspartic acid 1.5%. The content of these organic acids is expected to help the coagulation process run faster (Rusanti, 2017).

Centrifugation is a separation based on the size and density of particles using centrifugal force. Centrifugation is generally widely used in the processes of macromolecular separation and subtly cell breakdown. Particles that have a greater density will be easier to precipitate than particles with a small density (Juni, 2021)

Recently, the use of aloe vera as a coagulant has never been done by researchers before. Aloe vera extract has a pH of 3.5 – 5 which can be used as a natural latex coagulant. In addition, the availability of aloe vera is very large and easy to obtain, namely as much as 4,396 tons in Indonesia and especially in Lampung as much as 150.7 tons in 2022 (BPSD. 2022). The large availability of aloe

vera is because it can grow well in various soil conditions.

In this study, aloe vera was extracted and then centrifuged to remove or precipitate impurities. It is feared that this dirt will increase the dirt content in the rubber and produce a bad rubber color. This study aims to determine the effect of using centrifuged of natural coagulant aloe vera extract on the characteristics of clone IRR 118 rubber. The characteristics of the rubber produced were expected to comply with SNI 06-1903-2017 for SIR 20. Comparison rubber characteristics were carried out between aloe vera extract with centrifugation (AV CF) and aloe vera extract without centrifugation (AV WCF) and also chemical coagulant of formic acid with a concentration of 3%. Formic acid is commonly used as a chemical coagulant in PT Perkebunan Nusantara VII.

2. Methodology

2.1. Materials

The materials used in this study were latex from rubber clones of IRR 118, aloe vera, formic acid, turpentine, peptiser, sulfuric acid, boric acid, methyl blue, methyl red, NaOH, and selenium. These chemicals were purchased from Merck, Germany.

The latex used in this study from rubber plants type IRR 118 clones is a cross between LCB 1320 clones and FX 2784 clones. The tapping system on the IRR 118 clone rubber plant is $\frac{1}{2}$ S-BO-1/D4 which means that the tapping process is carried out at $\frac{1}{2}$ of the lower spiral of the stem on the east side and tapped every 4 days. Latex sampling was conducted in PT Perkebunan Nusantara VII Sub-Division Way Beulu & Sub-Division Rejosari-Pematang Kiwah, **Province of Lampung**, Indonesia.

2.2. Trial procedure

This study was conducted to determine the effect of natural coagulants of aloe vera (AV) on the characteristics of IRR 118 clone rubber using variations, namely aloe vera extract without centrifugation and centrifuged natural coagulant extract. The volume of coagulants used in this study was 50 mL with a latex volume of 100 mL for the natural coagulant variation of aloe centrifugation, without centrifugation and 3% formic acid as a comparison. The characteristic analysis carried out in this study was DRC, Po, PRI, ash content, dirt content, volatile matter, nitrogen content and mooney viscosity ($ML_{(1+4)}$) for latex samples coagulated without the addition

of coagulants, centrifuged aloe vera coagulants (AV CF), without centrifugation (AV WCF), and 3% formic acid (FA) as chemical coagulant.

2.3. Natural coagulant preparations

Fresh aloe vera weighed as much as 1 kg and then cleaned using water. Afterward, the skin was peeled off by using a knife to pick up the flesh. Aloe vera flesh is mashed using a blender, separated from the pulp by filtering, and obtained as much as 650 mL of extract from 1 kg aloe vera. In addition, the aloe vera extract variations were collected from both centrifuged (at a speed of 3000 rpm for 1 hour) and non-centrifuged extracts. 280 mL of the centrifuged extract and 300 mL of the extract without centrifugation were obtained. The pH of each of these extracts will be determined, and they will all be prepared for use as a natural coagulant during the latex coagulation process.

2.4. Sampling of latex

Tapping was carried out on the rubber tree clone of IRR 118 to obtain latex. Tapping is done from 6 a.m. and latex will be accommodated into the bowl. 2 L of latex from 20 rubber trees was then poured into a sample bottle to be coagulated with the addition of natural coagulants in the laboratory.

2.5. Latex coagulation

100 mL of latex is added after an empty glass beaker has been weighed to determine the weight of the initial latex. Then, also added were 50 mL of natural aloe vera coagulants. After each addition of 10 mL of aloe vera's natural coagulants, a pH measurement will be made. Until the sample is entirely coagulated, stirring with a stirring rod is done to aid the coagulation process. Note the necessary coagulation time and latex pH at each addition of 10 mL of aloe natural coagulants. The same procedure was performed on the natural coagulant of aloe vera without centrifugation and centrifugation and the chemical coagulant of 3% formic acid as a comparison.

2.6. Characterization of rubber

A rolling mill will be used to grind the coagulum produced by latex coagulation by adding various natural coagulant extracts from aloe vera and then drying for an hour in an oven at 130°C. Weighing the dried rubber will be done. To calculate the dry rubber content value or a percentage of DRC, the

weight of the coagulum will be compared against the weight of the dry rubber.

For the initial plasticity (Po) and Plasticity Retention Index (PRI) analysis, 20 g samples of dry rubber were ground in a rolling mill and molded with a wallace punch tool. Three sample pieces are used for each Po and PRI analysis. The sample pieces will be put on a plastimeter disc after being wrapped with cigarette paper. Then the plastimeter disk is closed, and the lower disk travels upward and presses against the upper disk. The acquisition of the Po value of the measurement result is recorded after the second beat has finished. The micrometer's designation at the moment it stopped moving is the number that was recorded. The preliminary plasticity analysis (Po) was done three times. For PRI value analyses, such as Po value assessment, the other three sample pieces were re-dried in an oven at 130°C for 30 minutes. After three runs of the experiment were completed, the acquisition of Pa values was recorded. Po and Pa values are compared to produce PRI percentages.

Furthermore, dry rubber was cut up into small pieces for ash content analysis and weighed up to 10 g. A 100 °C will be applied to the sample for 30 minutes in an electrical bunsen burner. The sample should next be heated in a muffle furnace for 2 hours at 550°C to the point when the rubber turns to ash. The crucible cruciferous is removed from the muffle furnace and placed in the desiccator to cool to room temperature for 30 minutes. Weighed the weight of the crucible filled with ashes and recorded the result. The information was gathered in sample weight, empty crucible weight, and ash-filled crucible weight utilized to calculate ash content. 3 experiments were carried out for ash content analysis on rubber samples.

Using a 10 g sample of dry rubber that has been cut into smaller pieces to facilitate melting it simpler, analyze the dirt content. A 325-mesh sieve is weighed after 30 minutes of baking at 100°C. The dried rubber is added to a 500 mL Erlenmeyer, 250 mL of turpentine solvent, and 2 mL of peptizer and shaken vigorously until completely combined. Erlenmeyer spent two hours in an infrared heater set at 140°C. The material will be thoroughly dissolved before being filtered through a 325-mesh sieve. A filter will be heated to 110°C and packed with dirt for one hour. After drying in the oven, it will be placed in the desiccator for 30 minutes to reach room temperature. The weight of a sieve containing

dirt is measured and recorded. To determine the number of impurities in the sample, information on the weight of the sample, the weight of the sieve when it was empty, and the weight of the sieve when it was full of impurities were gathered. As many as 3 trials were used to analyze dirt levels.

Cut dry rubber into small pieces and weigh 10 g for the volatile matter analysis. For 30 minutes, the crucible was heated to 100°C in the oven while the weight of the empty cup was measured. The sample is then placed in a saucer. The sample-containment cup was weighed and heated in an oven at 100°C for two hours. The sample will then be placed in a saucer and in the desiccator for 30 minutes to bring to room temperature. After the sample has dried, weigh the cup it was in, and record the weight. The level of volatile matter in the sample can be calculated using the information on the sample's weight, the dish it was in before drying, and the dish it was in after drying.

0.2 g of dry rubber was weighed and mixed with 5 mL of concentrated sulfuric acid and 0.6 g of selenium powder into the Kjeldahl flask. Then it is heated with an electrical bunsen burner for 1 hour until the solution turns clear or green in color. The solution will be cooled and diluted with the addition of aqueous by 10 mL. Steam will flow to the distillation device 30 minutes before the tool is used. The sample solution will be put into distillation and rinsed with aqueous 2 times. Then mixed 10 mL of boric acid with 2 drops of indicators (a mixture of methyl red and methyl blue) into the erlenmeyer and placed at the end condensor to hold the distilled vapor to the surface of the boric acid solution. Furthermore, 10 mL of 67% NaOH was added to the distillation tool little by little and rinsed with aqueous. Steam flowed by the distillation device at a temperature of 100°C for 2 hours. The distillate will be accommodated by an erlenmeyer containing a solution of boric acid and an indicator up to its volume of 30 mL. Titration is carried out on distillate using 0.01M sulfuric acid and is stopped until a change in color from green to light purple occurs. To make a solution of blanks carried out the previous steps but in the absence of a rubber sample. The data obtained are the weight of the rubber sample, the volume of sulfuric acid for the titration of the sample solution, and the volume of sulfuric acid for the titration of the blank solution to calculate the nitrogen level in the rubber. 3 experiments were conducted for nitrogen level analysis.

Dry rubber is ground and molded using a special sample mold, adjusting the size and diameter of the rotor by 2 samples. One hour before usage, turn on the mooney viscometer tool. After that, turn up the heater by pressing the control heater. Set the upper and lower temperatures to be stable at 100°C and open the upper stator. The sample printed on the L rotor should be punctured, input into the lower stator, the upper stator closed once more, and the stopwatch turned on. The viscosity value is read on the reference device after the motor has run for one minute up to the fifth minute. Obtained viscosity value and recorded. A repeat of the mooney viscosity ($ML_{(1+4)}$) analysis was carried out in as many as 3 attempts.

3. Results and Discussion

3.1. Effect of Aloe Vera on Latex Coagulation pH

The effect of coagulant volume addition on latex coagulation pH with variations in natural coagulants of aloe vera centrifugation (AV CF) and without centrifugation (AV WCF) and also chemical coagulants of 3% formic acid (FA) can be seen in Figure 1. From the results of the research, it was obtained that the more volume of coagulants used and the smaller the pH of the coagulant, the lower the pH of latex coagulation. Fresh latex before coagulants are added has a pH of 6.5 or in this condition latex has not been coagulated (Ali et al., 2009). The addition of coagulants is carried out slowly, that is, every 10 mL will be recorded pH of coagulation up to the total addition of the coagulant volume of 50 mL.

When added coagulants occur a decrease in the pH of the coagulation from the range of 5.5-6. The lowest coagulation pH was obtained in the natural coagulants of AV WCF and 3% formic acid of 5.5. While the highest coagulation pH in the natural coagulant of AV CF is 6. The lower the pH of the coagulant used, the more H^+ ions are produced to neutralize the OH^- ions in the latex destroying of the protein membrane that envelops the rubber polymer. This explains that the pH and acid content in the coagulant affect the decrease in the pH of latex coagulation so that the latex can reach its instability point or isoelectric and coagulated point (Valentina et al., 2020a and 2020b). The latex coagulation process will produce a coagulum (a fused rubber polymer) and serum. The more volume of coagulants added naturally added, the more protein membranes in the rubber damaged so that the rubber polymers that are fused will be more and more abundant and produce an

increasingly large coagulum (Achmad et al., 2022).

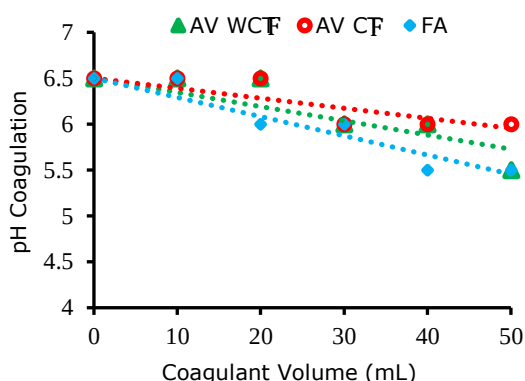


Figure 1. Effect of volume addition of AV CF and AV WCF on the pH of latex coagulation

3.2. Effect of Coagulant pH of Aloe Vera on Latex Coagulation Time

Latex coagulation time is calculated when the coagulant is added until the latex has coagulated or the coagulation time is interrupted. Organic acids contained in aloe vera (AV) coagulants such as salicylic acid, aspartic acid, and ascorbic acid can lower the pH of latex to the isoelectric point and coagulate (Ali et al., 2014). The effect of coagulant pH with variations in natural coagulant extracts of AV CF and AV WCF on latex coagulation time is presented in Figure 2.

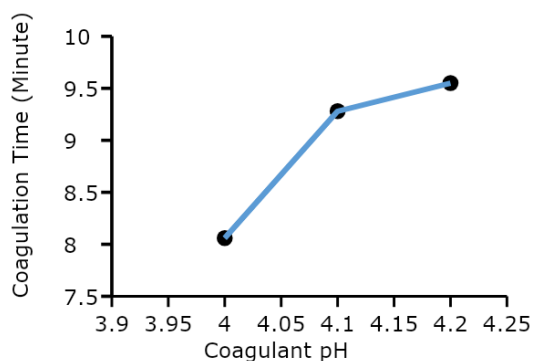


Figure 2. Effect of coagulant pH of AV CF and AV WCF on latex coagulation time

Figure 2. shows that the higher the pH of the coagulant used, the longer the coagulation time will run. The fastest latex coagulation time was obtained in the chemical coagulant of formic acid, which was 8.06 minutes with a pH value of 4 while the longest latex coagulation time in the natural coagulant of AV WCF for 9.55 minutes with a pH of 4.2. The natural coagulants of AV CF have a longer coagulation time than those AV WCF. This is because the pH of the coagulant is higher and

the content of organic acids in the coagulant is precipitated during the centrifugation process, where molecules with a larger size and density will be more easily deposited during the centrifugation process (Koolman and Roehm, 2005).

The smaller of pH of the coagulant used, the more acid content in it and the more H^+ ions will bind to OH^- ions in the latex so that the coagulation time will be faster (Rusiardy, 2022). The coagulation time with the chemical coagulant of formic acid is 3% faster than the time of coagulation with the natural coagulant of aloe vera. In addition, latex samples without the addition of coagulants took 240 minutes (4 hours) to coagulate. This is because there is no additional coagulant in the form of coagulants that have acidic properties that can help speed up the latex coagulation process so that it takes a longer time for the sample to coagulate (Galingging and Sitepu, 2017).

3.3. Effect of Aloe Vera on DRC

DRC (Dry Rubbber Content) states the amount of rubber contained in dry rubber (Sari and Fatkhurahman, 2015). From the results of the study obtained an analysis of the effect of variations in the preparation of AV CF and AV WCF natural coagulants on the acquisition of DRC values presented in Figure 3.

The maximum DRC value in the chemical coagulant of formic acid 3% was obtained in Figure 3, which was 28.88% higher than the AV natural coagulant. The AV CF natural coagulant had the lowest DRC value of 27.36%. The content of organic acids in AV CF coagulants is precipitated during centrifugation because particles with a larger size and density will be easily precipitated during the centrifugation process so that the resulting DRC value is lower. Meanwhile, the content of organic acids in AV WCF natural coagulants is higher, making the DRC value higher (Koolman and Roehm, 2005).

From the results of the study, the DRC value of AV WCF natural coagulant was obtained by 28% whose value was not too much different from the chemical coagulant of formic acid 3% as a comparison. AV natural coagulants that are centrifuged and without centrifugation have DRC values that have met the quality requirements of SNI 06-1903-2017 for SIR 20, namely in the range of 25-40% (Sari and Fatkhurahman, 2015). The use of a type of AV natural coagulant that is centrifuged and without centrifugation also affects the color and volume of the coagulum serum produced

after the coagulation process. Serum resulting from the coagulation process with the addition of AV natural coagulants can be seen in Figure 4.

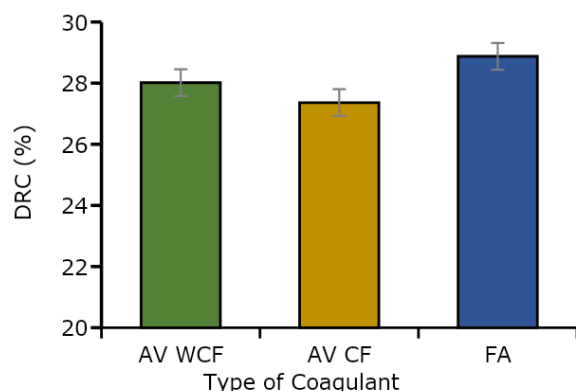


Figure 3. DRC profile of coagulated rubber with AV with (AV CF) and without centrifugation (AV WCF)

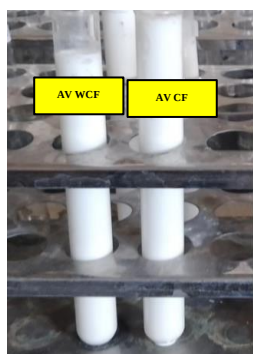


Figure 4. Serum latex with addition of AV with (AV CF) and without centrifugation (AV WCF)

Figure 4 showed the obtained serum latex coagulation results with the addition of AV natural coagulant without centrifugation (AV WCF) and AV natural coagulant with centrifugation (AV CF). For the volume of serum produced, the AV CF natural coagulant produces more serum which is as much as 63 mL while AV WCF produces a serum volume of 57 mL. The chemical coagulant of 3% formic acid produces a serum volume of 59 mL more than the serum produced by AV WCF. It can be seen that the variations in AV natural coagulants that are centrifuged and without centrifugation do not have a significant difference in terms of color, namely producing serum with a white color. The white color of the serum indicates that there are still rubber particles that are not perfectly coagulated, causing a low DRC value. The latex coagulation process that occurs perfectly is shown by the presence of solid rubber clots with clear colored serum (Valentina et al., 2020a).

3.4. Effect of Aloe Vera on Rubber Plasticity

The plasticity value of rubber consists of two types, namely initial plasticity (P_o) and plasticity retention index (PRI). P_o is a rubber plasticity that states the resistance of rubber to oxidation after going through a drying process (Harahap, 2019). Meanwhile, PRI is a characteristic that states the resistance of rubber to degradation at high temperatures (Vachlepi, 2019). The effect of variations in AV natural coagulant preparations on the plasticity value of rubber is presented in Figure 5 and Figure 6.

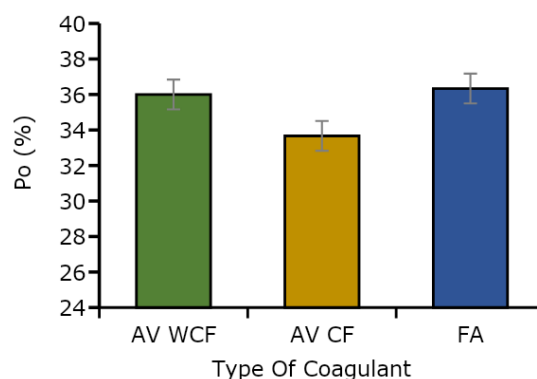


Figure 5. Intial plasticity (P_o) profile of coagulated rubber with AV with (AV CF) and without centrifugation (AV WCF)

The highest P_o value in the chemical coagulant of 3% formic acid at 36.33% whose value is not much different from the P_o value of the natural coagulant AV WCF of 36%. Meanwhile, the lowest P_o value was obtained at 33.67% in natural coagulant AV CF. The greater the value of the P_o produced means the better the quality of the rubber produced. Rubber with a high P_o value means that it has a long molecular chain and is resistant to oxidation (Ali et al., 2009).

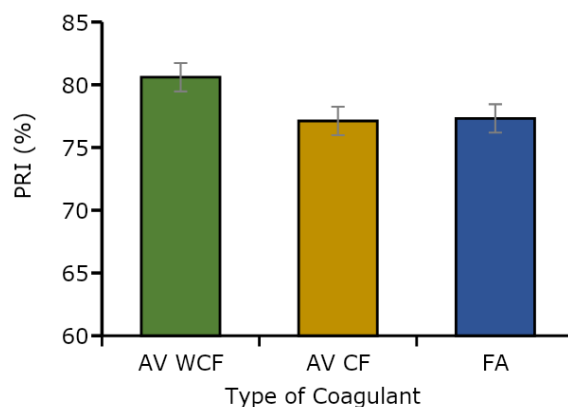


Figure 6. Plasticity retention index (PRI) profile of coagulated rubber with AV with (AV WCF) and without centrifugation (AV CF)

Figure 6 showed the highest PRI value in AV natural coagulants without centrifugation by 80.6%. Meanwhile, the lowest PRI value in AV CF natural coagulant was 77.11%. For chemical coagulants of formic acid 3% produce a PRI value of 77.31% whose value is smaller than the AV WCF natural coagulant and does not differ much from the PRI value of the natural coagulant AV CF.

The organic acids contained in AV are aspartic acid, salicylic acid and ascorbic acid (Rusanti, 2017). The content of organic acids in coagulants acts as an antioxidant that can prevent oxidation so that it affects the Po and PRI values of rubber. The more content of organic acids in the coagulant used, the higher the plasticity value will be (Suwardin and Purbaya, 2015). Natural coagulants of AV CF have lower Po and PRI values because the content of organic acids in the coagulants is precipitated during the centrifugation process. Centrifugation is the process of separating molecules based on their size and density. Molecules with a larger size and density will be more easily precipitated so that the content of organic acids in the natural coagulant AV CF is less and the plasticity value is lower (Koolman and Roehm, 2005). AV WCF and AF CF natural coagulants have Po and PRI values that meet the quality requirements of SNI 06-1903-2017 for SIR 20 which is more than 30% for Po and more than 40% for PRI (Suwardin and Purbaya, 2015).

3.5. Effect of Aloe Vera on Ash Content

Ash content is a characteristic that expresses the content of metal ions in rubber (Ali et al., 2009). The effect of variations in the preparation of natural coagulants AV CF and AV WCF on the percentage of ash content is presented in Figure 7. The highest ash content in av natural coagulants without centrifugation by 0.38% and the lowest in chemical coagulants of formic acid 3% which was 0.29%. The natural coagulants of AV CF have a lower ash content value than AV WCF natural coagulants due to the content of fibers and metal ions that are deposited during the centrifugation process and the sum is less so that the percentage of ash content produced is lower (Juni, 2021).

The ash contained in rubber consists of several metal ions such as Ca, Na, K and Mg. High ash content states the increasing number of metal ions contained which can cause a decrease in rubber plasticity because metal ions are peroxide causing oxidation to occur faster. The natural coagulant AV centrifugation and without centrifugation have met the quality

requirements of SNI 06-1903-2017 for SIR 20 for the resulting ash content of less than 1% (Ali et al., 2009).

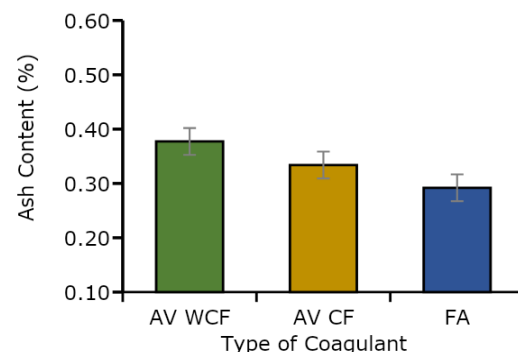


Figure 7. Ash content profile of coagulated rubber with AV with (AV WCF) and without centrifugation (AV CF)

3.6. Effect of Aloe Vera on Dirt Content

Dirt content expresses the content of impurities or contaminants in rubber (Handayani, 2014). The effect of variations in natural coagulant preparations AV CF and AV WCF on the percentage of dirt content was presented in Figure 8.

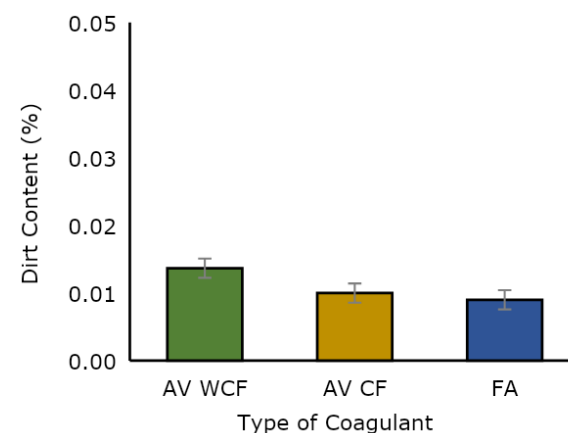


Figure 8. Dirt content profile of coagulated rubber with AV with (AV WCF) and without centrifugation (AV CF)

From Figure 8. obtained the highest dirt content in AV WCF natural coagulants by 0.014% and the lowest impurity content in formic acid coagulants of 3% by 0.009%. The AV CF natural coagulant has a lower dirt content than the AV WCF natural coagulant because the impurities or contaminants present in the coagulant will be precipitated during the centrifugation process so that the value of the impurity level of the resulting impurities is smaller. Contaminants or impurities present in rubber such as sand, leaves, twigs and other impurities from the coagulants used (Santi et al., 2017). The

higher of dirt content in rubber, the elasticity and crack resistance properties of rubber vulcanizers will be reduced (Harahap, 2019). Natural coagulants of AV CF and AV WCF have a percentage of dirt content that have met the requirements of SNI 06-1903-2017 for SIR 20, which is less than 0.16% (Valentina et al., 2020b).

3.7. Effect of Aloe Vera on Volatile Matter

Volatile matter are characteristic of rubber which states the water and serum content that is still contained in dry rubber (Achmadi et al., 2015). The effect of variations in the preparation of AV CF and AV WCF natural coagulants on the percentage of volatile meter substance is presented in Figure 9.

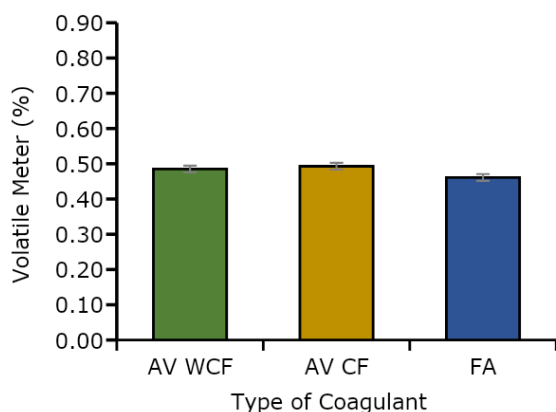


Figure 9. Volatile meter profile of coagulated rubber with AV with (AV WCF) and without centrifugation (AV CF)

The highest volatile matter in AV CF natural coagulant by 0.49% and the lowest in chemical coagulant of formic acid 3% which was 0.46%. The centrifugation process in AV coagulants at a speed of 3000 rpm did not exert a significant influence on the levels of the resulting evaporative substance. This is evidenced by the difference in the percentage of volatile matter in the AV CF and AV WCF natural coagulants very small centrifugation, which is 0.01%. The value of the volatile matter is related to the acquisition of the DRC value in rubber. The high DRC value means that more dry rubber content in the sample, the smaller the value of the evaporating substance. High levels of evaporative substances in dry rubber will cause a foul odor and the growth of mold (Vachlepi and Purbaya, 2018). The natural coagulants of AV CF and AV WCF have met the requirements of SNI 06-1903-2017 for SIR 20 for the resulting volatile meter of less than 0.80% (Suwardin and Purbaya, 2015).

3.8. Effect of Aloe Vera on Nitrogen Content

Nitrogen content are characteristic of rubber which states nitrogen in the form of protein contained in dry rubber. Nitrogen content analysis is carried out in a semi-micro Kjeldahl method. Analysis with this method goes through three stages, namely digestion, distillation and titration (Telaubanua et al., 2013). The effect of variations in the preparation of AV CF and AV WCF natural coagulants on the percentage of nitrogen content is presented in Figure 10.

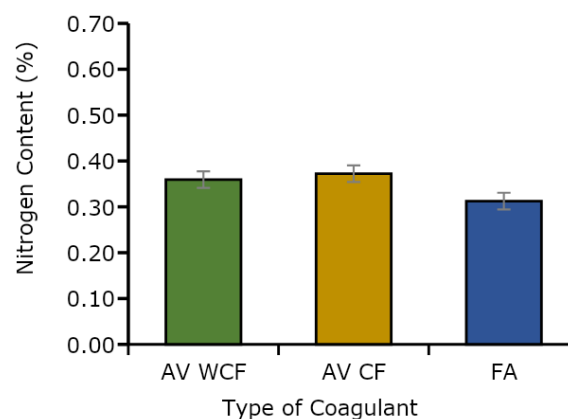


Figure 10. Nitrogen content profile of coagulated rubber with AV with (AV WCF) and without centrifugation (AV CF)

The highest nitrogen content in AV WCF natural coagulants by 0.37% and the lowest in formic acid coagulants by 3% which was 0.31%. Nitrogen levels come from the nitrogen content in latex in the form of proteins which are compounds other than rubber. In addition, protein compounds contained in natural coagulants affect the percentage of nitrogen levels in rubber (Telaubanua et al., 2013). The protein contained in 100 g of AV natural coagulants is 100 mg (Bisu, 2018).

The centrifugation process involves the process of cell lysis to expel intercellular matter such as amino acids in proteins. The centrifugation speed used in this study, which is 3000 rpm, is thought to have not been able to precipitate the entire amino acid content in proteins so that nitrogen levels in natural coagulants of AV CF are higher in value AV WCF (Koolman and Roehm, 2012). The difference in the percentage of nitrogen content in natural coagulants of AV CF and AV WCF is very small at 0.01%. It states that the centrifugation process at a speed of 3000 rpm does not have a significant effect on the value of nitrogen levels in rubber. The natural coagulants of AV CF and AV WCF used have all

met the requirements of SNI 06-1903-2017 for SIR 20 for the resulting nitrogen content of less than 0.60% (Suwardin and Purbaya, 2015).

3.9. Effect of Aloe Vera on Mooney Viscosity

Mooney viscosity ($ML_{(1+4)}$) is a characteristic that states the length of the molecular chain in rubber. Effect of variations in the preparation of AV CF and AV WCF natural coagulants on percentage mooney viscosity presented in Figure 11.

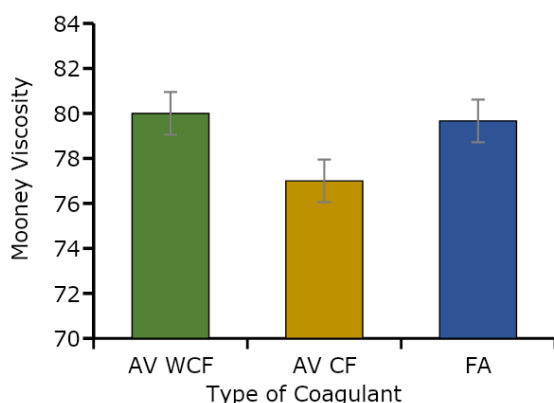


Figure 11. Mooney viscosity profile of coagulated rubber with AV with (AV WCF) and without centrifugation (AV CF)

The highest mooney viscosity value in AV WCF natural coagulants and 3% formic acid coagulants whose values are the same at 80. Meanwhile, the lowest mooney viscosity value in the AV CF natural coagulant was 77. The high value of mooney viscosity states the longer the molecular chain in the rubber so that the elasticity will be better and the rubber is stronger or harder. Mooney viscosity is a quality parameter that determines the rubber products used during the mixing process in the manufacture of compound (Vachlepi and Purbaya, 2018).

4. Conclusion

Based on the research results, it was found that the natural coagulant of aloe vera without centrifugation (AV WCF) and aloe vera with centrifugation had a pH not too much different from formic acid with a concentration of 3%. The centrifuged aloe vera extract did not have a significant effect on the aloe vera extract without centrifuged. The percentage of DRC, Po, PRI, and Mooney Viscosity was highest in AV natural coagulants without centrifugation was highest, at 28%, 36%, 80%, and 80%, respectively. Meanwhile, the lowest

percentage of ash, dirt, and nitrogen content by AV natural coagulant with centrifugation were 0.38%, 0.014%, and 0.36%, respectively. Because it complies with SNI 06-1903-2017 for SIR 20 and can be used as a natural coagulant, AV as natural coagulant with and without centrifugation can be used as a coagulant for the latex coagulation process.

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