Jurnal Reaksi (Journal of Science and Technology)
Jurusan Teknik Kimia Politeknik Negeri Lhokseumawe
Vol. 24 No 01, June 2026 ISSN 1693-248X

FORMULATION OF VIRGIN COCONUT OIL (VCO) AND ALOE VERA *(ALOE VERA l.)* AS A POMADE

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ABSTRACT

Developments in the cosmetics industry, particularly in hair care products, have driven the creation of innovative, natural-based formulations that are safe and environmentally friendly. One of the most popular products is pomade, especially among men. However, many pomades available on the market still contain synthetic ingredients that can cause long-term side effects. This study aims to formulate pomade using natural active ingredients, namely virgin coconut oil (VCO) and aloe vera (*Aloe vera L.*), and to evaluate the effect of varying the volume of these two ingredients on the physical characteristics and total antioxidant content of the product. VCO was used in volume variations of 0; 5; 10; 15; and 20 ml, while aloe vera was used in variations of 0; 2.5; 5; 7.5; and 10 ml. The parameters tested included pH, melting point, ash content, homogeneity, organoleptic properties, and total antioxidants using the DPPH method. The results showed that the addition of VCO and aloe vera affected the physical properties and antioxidant content of the pomade. The best formula was obtained from a combination of 15 ml of VCO and 10 ml of aloe vera, with a pH of 6.5; melting point of 43°C; ash content of 0.08%; and the highest antioxidant content of 1.5350 mg of vitamin C equivalent per gram. Most samples were homogeneous and organoleptically acceptable, except at the highest concentration, which showed heterogeneity. The combination of VCO and aloe vera proved effective in producing a stable pomade.

Keywords: *Aloe vera, Antioxidant, Natural cosmetics, Pomade, Virgin coconut oil*

1. INTRODUCTION

1.1 Background

The cosmetics industry continues to experience significant growth every year. Currently, cosmetics have become a basic necessity for both women and men, contributing to the growth of the cosmetics industry globally, including in Indonesia. This can be seen from the cosmetics production figures in this country, which continue to increase every year. Cosmetics sales also show a positive trend, both for local and imported products. The Ministry of Industry revealed that the cosmetics industry has been designated as one of the priority sectors in the National Industrial Development Master Plan for the period 2015-2035. In 2017, the number of cosmetics companies in Indonesia increased by 153 units (Saputri, 2019).

One type of cosmetic product that has experienced rapid growth is hair care products. According to Dewi (2016), pomade is an oily or waxy substance used to style hair. Using pomade gives hair a smooth and shiny appearance while preventing dryness. The characteristics of pomade make hairstyles look neater, while its moisturizing properties make it popular among individuals with textured hair. Pomade can be divided into two categories: water-based and oil-based.

Pomade is a cosmetic product that is very popular among men and belongs to the category of wax-based creams. The use of pomade offers various benefits, including giving hair a neater appearance and long-lasting shine (Mujiono & Ismedsyah, 2020).

Hair plays a very important role, not only as protection for the head from various threats such as impact, sunlight,

and other external factors, but also as a valuable accessory. Thick, long, black, or healthy, shiny hair that is easy to style can give its owner a unique appeal. Many women and men can attract attention simply through the beauty of their hair (Adnan, 2022).

In this study, pomade made from natural ingredients was formulated using VCO and aloe vera. These two ingredients were chosen based on their benefits for hair health. According to E. S. Putri (2024), VCO consists of organic compounds that are a mixture of esters, glycerol, and fatty acids. Saturated fatty acids are an important component in scalp care, as they function as a moisturizer for the scalp and hair. Meanwhile, according to the Kemenkes (2017), aloe vera (*Aloe vera L.*) is a plant that has long been known in Indonesia as a remedy for various ailments. This plant contains amino acids, vitamins, folic acid, and flavonoids, which have benefits as a hair conditioner.

Based on research conducted by Yahya et al. (2024), it can be concluded that pomade with 5% aloe vera content is the most superior formula. Additionally, the results of Adnan (2022) study indicate that pomade with a VCO formulation at a 10% concentration is also the best formula. Therefore, the researchers plan to conduct a study combining both natural ingredients, with the aim of determining the optimal concentration for the formulation in the production of blended pomade.

2. RESEARCH METHODS

Research methodology

2.1 Research Place

This research was conducted at the Process Unit Laboratory, Basic Chemistry Laboratory, and Analysis Laboratory of the Lhokseumawe State Polytechnic.

2.2 Tools and Materials

2.2.1 Tools used

The equipment used includes a blender, sieve, knife, No. 40 mesh, aloe vera gel container, hotplate, magnetic stirrer, analytical balance, glass beaker, measuring cup, dropper pipette, spatula, stirring rod, thermometer, litmus paper, pomade container, furnace, capillary tube, melting point, petri dish, desiccator, tissue, measuring flask, cuvette, and spectrophotometer UV-Vis.

2.2.2 Materials used

The materials used in this study included VCO, aloe vera, beeswax, petroleum jelly, lanolin, span 80, nipagin, essential oils, glycerin, ascorbic acid, methanol, distilled water, and 2,2-diphenyl-1-picrylhydrazy (DPPH).

2.3 Experimental Treatment Design

2.3.1 Fixed Variables

- Beeswax : 10 gr
- Vaseline : 40 gr
- Lanolin : 9 gr
- Span 80 : 8 ml
- Nipagin : 0,1 gr
- Essential oil : 0,5 ml
- Glycerin ad to : 100 gr

2.3.2 Independent Variables

- VCO levels: 0 ml, 5 ml, 10 ml, 15 ml, and 20 ml.
- Aloe vera: 0.5 ml, 2.5 ml, 5 ml, 7.5 ml, and 10 ml.

2.3.3 Dependent Variable

1. pH Test
2. Ash content Test
3. Melting point Test
4. Homogeneity Test
5. Organoleptic Test (texture, aroma, color)
6. Total antioxidant Test

2.4 Experimental and Testing Procedures

2.4.1 Making aloe vera gel

1. Peel the aloe vera skin until you get about 500 grams of aloe vera flesh.
2. Blend the aloe vera flesh using a blender.Cut the red guava into several pieces.
3. After blending, strain using a sieve, then pour into an empty container and store in the refrigerator.

2.4.2 Making Pomade

1. Weigh the beeswax, vaseline, and lanolin according to the specified variables, then put them in a 250 ml measuring cup.
2. Heat the mixture on a hotplate at 50°C until all ingredients melt and form a homogeneous solution while stirring.
3. Once the ingredients have melted, add nipagin and essential oil to the mixture while continuing to stir until evenly mixed.
4. Add glycerin until the total volume reaches 100 grams and stir until evenly mixed.
5. Add span 80, VCO (according to the independent variable), and aloe vera gel (according to the independent variable) to the mixture.
6. Gently stir all ingredients until they are homogeneously mixed.
7. Pour the homogeneous mixture into a container and let it harden.
8. Repeat the pomade-making process for the next variable using the same procedure.
9. After all steps are completed, conduct testing according to the specified parameters.

3. RESULTS AND DISCUSSION

3.1 Research Results

Table 3.1 Data from Test Results and Observation Analysis

VCO (ml)	Aloe Vera (ml)	pH	Melting Point (℃)	Homogeinity
0	0	7,5	47	Homogeneus
	2,5	7,0	47	Homogeneus
	5	7,0	46	Homogeneus
	7,5	7,0	46	Homogeneus
	10	6,5	45	Homogeneus
5	0	7,0	46	Homogeneus
	2,5	7,0	46	Homogeneus
	5	6,5	45	Homogeneus
	7,5	6,5	45	Homogeneus
	10	6,5	44	Homogeneus
10	0	7,0	45	Homogeneus
	2,5	7,0	45	Homogeneus
	5	6,5	44	Homogeneus
	7,5	6,5	44	Homogeneus
	10	6,5	43	Homogeneus
15	0	6,5	44	Homogeneus
	2,5	6,5	44	Homogeneus
	5	6,5	43	Homogeneus
	7,5	6,5	43	Homogeneus
	10	6,5	43	Homogeneus
20	0	6,5	44	Homogeneus
	2,5	6,0	43	Homogeneus
	5	6,0	43	Homogeneus
	7,5	6,0	42	Non-homogeneus
	10	5,5	42	Non-homogeneus

Table 3.2 Data from Test Results and Observation Analysis

VCO (ml)	Aloe Vera (ml)	Organolepic (%)	Ash Content (%)	Total Antioxidant (mg VCE/g)
0	0	4,1		
	2,5	4,1		
	5	4,2		
	7,5	4,2		
	10	4,3		
5	0	4,2		
	2,5	4,3		
	5	4,3		
	7,5	4,4		
	10	4,5		
10	0	4.4		
	2,5	4.5		
	5	4.6		
	7,5	4.6		
	10	4.6		
15	0	4.7	0,04	1,2969
	2,5	4.7	0,06	1,3879
	5	4.8	0,06	1,4116
	7,5	4.8	0,08	1,4271
	10	4.9	0,08	1,5350
20	0	4.6		
	2,5	4.5		
	5	4.4		
	7,5	4.3		
	10	4,2		

3.2 Discussion

A study was conducted on the production of pomade with varying volumes of virgin coconut oil (VCO) and aloe vera, with the aim of analyzing the characteristics of the pomade product. This study included several tests, including pH testing, melting point testing, homogeneity testing, and organoleptic testing involving 25 panelists. Additionally, ash content testing and total antioxidant testing were conducted on the pomade.

3.2.1 pH Testing

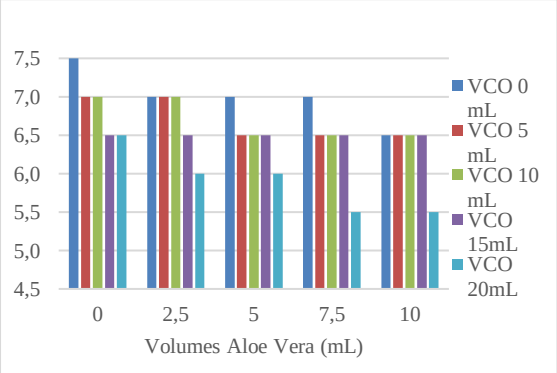

Figure 3.1 Diagram showing the effect of VCO volume and aloe vera volume on pH

According to SNI 06-2578-1992, pomade must have a neutral pH, although no specific number is mentioned. Therefore, additional references from BPOM and related cosmetic literature are used, which state that the ideal neutral pH for the scalp is in the range of 4.5 to 6.5. This pH range is considered safe and in line with the natural condition of the human scalp.

Based on the analysis shown in the diagram, the pH range of the pomade produced in this study ranged from 5.5 to 7.5. Thus, there were values that did not meet SNI standards, particularly at VCO concentrations of 0 mL and aloe vera concentrations of 0 mL. Pomade with a VCO content of 15 mL showed the optimal pH in this study.

According to Adriani et al. (2024), cosmetic products such as pomade should have a pH close to that of the skin to maintain the physiological balance of the scalp. In this study, the highest measured pH was 7.5, while the lowest was 5.5. Only a few formulations had a pH above 6.5, which is close to neutral, but still within the tolerance limits set by the BPOM and SNI 06-2578-1992.

3.2.2 Melting Point Testing

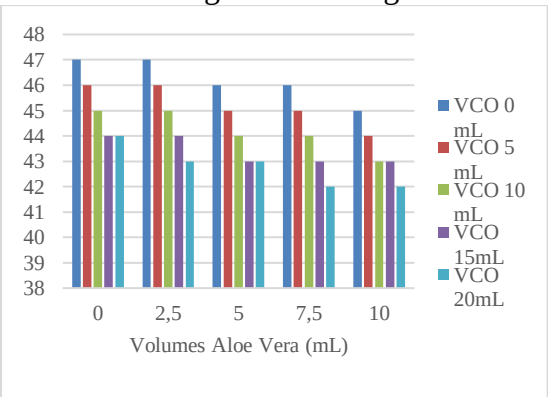

Figure 3.2 Diagram showing the effect of VCO volume and aloe vera volume on melting point

The melting point is the temperature at which a solid substance begins to melt and change into a liquid state. Pomade falls into the category of semi-solid preparations, so it is important to have the right melting point so that it does not melt easily when used at room temperature or when exposed to body heat. According to SNI 06-2578-1992, the melting point criteria must fall within the range of 38°C to 48°C.

The melting point test on semi-solid pomade showed that the highest temperature recorded was 47°C, produced by pomade with a VCO volume of 0 mL and the addition of 0 and 2.5 mL of aloe vera. Conversely, the lowest temperature measured was 42°C, originating from pomade with a VCO volume of 20 mL and the addition of 7.5 and 10 mL of aloe vera.

In this study, the melting point test results of the pomade formulations showed a temperature range that still meets the established standards. It can be

seen that the higher the concentration of VCO and aloe vera, the lower the melting point of the resulting pomade. The melting point values obtained indicate that the proportions of ingredients such as beeswax, petroleum jelly, and vegetable oil are balanced, resulting in a physically stable pomade that does not easily melt at room temperature but remains easy to apply to hair.

The addition of VCO, which is rich in medium-chain fatty acids such as lauric acid and capric acid, along with aloe vera, which has a high water content, causes the mixture to become softer and lowers the melting point of the formulation. This finding aligns with research by Widyana et al. (2021), which states that the addition of liquid components or vegetable oils in a semi-solid system lowers the formulation's melting point, as the molecular interactions between the ingredients become weaker.

3.2.3 Homogeinity Testing

Table 3.3 Showing the effect of VCO volume and aloe vera volume on product homogeneity.

Sample Code	Result
1	Homogeneus
2	Homogeneus
3	Homogeneus
4	Homogeneus
5	Homogeneus
6	Homogeneus
7	Homogeneus
8	Homogeneus
9	Homogeneus
10	Homogeneus
11	Homogeneus
12	Homogeneus
13	Homogeneus
14	Homogeneus
15	Homogeneus
16	Homogeneus
17	Homogeneus
18	Homogeneus
19	Homogeneus
20	Homogeneus
21	Homogeneus
22	Homogeneus
23	Homogeneus
24	Non-homogeneus
25	Non-homogeneus

Based on observations of all samples, most showed a homogeneous appearance. However, there were two samples, namely samples 24 and 25, which appeared to be non-homogeneous. These two samples showed phase separation, marked by the presence of lumps in the pomade. The observed non-homogeneity in samples 24 and 25 is suspected to be caused by high concentrations of VCO and aloe vera, which exceed the limits required for stable mixing of the ingredients. Excessive oil content can prevent the mixture from blending well with solid ingredients such as wax, leading to separation after cooling.

According to Maulana et al. (2023), an excess of liquid ingredients can cause the mixture to become unstable and separate during cooling. Additionally, the temperature during the mixing process also affects the final result. Mujiono & Ismedsyah (2020) explain that mixing at too low a temperature can cause the ingredients to thicken quickly before they are evenly mixed. Therefore, it is important to control the mixing temperature and the proportion of liquid ingredients to ensure the pomade remains homogeneous and does not easily break down.

3.2.4 Organoleptic Testing

The organoleptic test conducted in this study was a liking test or hedonic test. Hedonic testing is one method for assessing product acceptance, which involves evaluating a person's level of liking for a product. In this study, organoleptic testing was carried out using the hedonic method, which included visual observation of the finished pomade product, including aspects of texture, aroma, and color. A total of 25 pomade samples were provided and tested by 25 panelists.

There were five evaluation criteria used by the panelists in assessing the produced pomade. To determine the most preferred product, we summed the scores given by the panelists, ranging from very dislike (1), dislike (2), neutral (3), like (4), to very like (5). The final score was obtained by summing the five highest scores and dividing them by the number of panelists and the number of samples tested.

3.2.4.1 Organoleptic On Texture

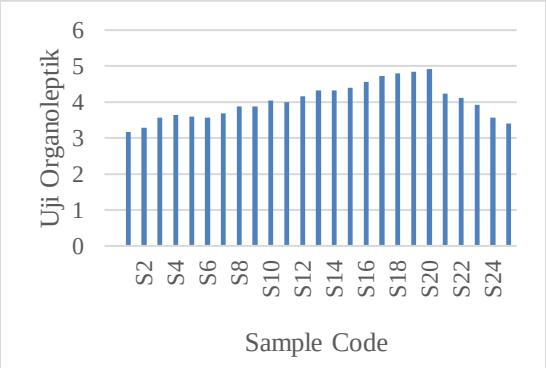

Figure 3.3 Diagram of the effect of VCO volume and aloe vera volume variations on organoleptic texture

Texture is one of the characteristics related to hardness. Texture reflects the properties of a surface that can be felt through touch or seen visually. The pomades produced in this study showed several variations in texture, which were caused by differences in the use of VCO and aloe vera.

Based on the organoleptic test results for texture, almost all panelists showed a preference for the texture of the pomade, with the highest score reaching 4.92. This indicates that increasing the amount of VCO contributes to an increase in panelists' preference for the texture of the pomade. The more VCO added, the better the texture of the pomade produced. Conversely, the organoleptic test results showed that a decrease in the amount of VCO led to a decrease in preference, as the pomade became softer and more runny.

According to Prasetyo et al. (2022), the addition of natural oils such as VCO can enhance the softness and ease of application of semi-solid products like pomade, provided the amount does not exceed the formula's stability limit. The findings of this study also indicate that a balanced formula between solid and liquid ingredients results in optimal texture.

3.2.4.2 Organoleptic On Aroma

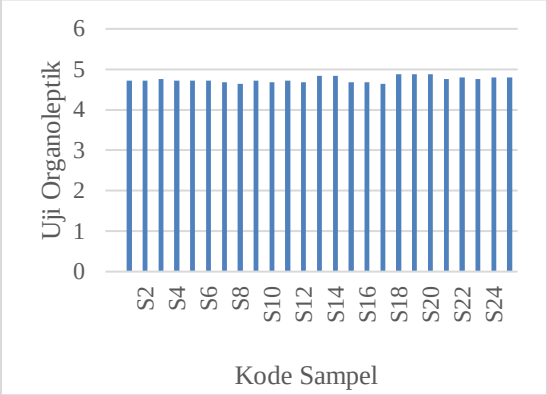

Figure 3.4 Diagram of the effect of VCO volume and aloe vera volume variations on organoleptic aroma

Based on the results of the organoleptic test on aroma, all pomade samples received satisfactory scores. The highest score recorded was 4.88, indicating that the panelists highly appreciated the aroma of the pomade, thanks to the addition of blueberry essential oil as a fragrance ingredient that enhances preference levels.

According to Sarkic et al. (2018), essential oils not only function as natural fragrances but also have calming effects and mild antibacterial properties, making them highly suitable for use in cosmetic products such as pomade. Additionally, a scent that is not too strong can reduce the risk of irritation for users sensitive to synthetic perfumes.

3.2.4.3 Organoleptic On Color

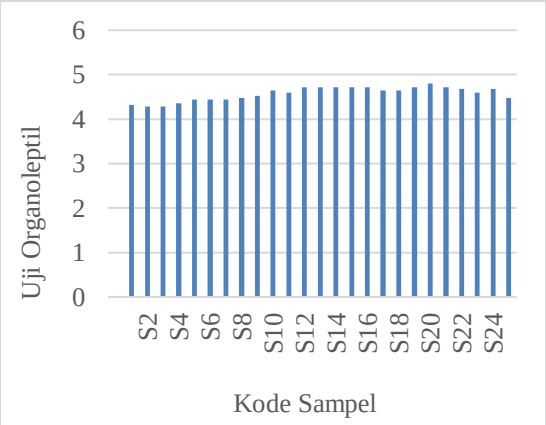

Figure 3.5 Diagram of the effect of VCO volume and aloe vera volume variations on organoleptic color

Based on the results of organoleptic testing for color, it can be concluded that the base color of the pomade is yellowish white. This color is produced from beeswax and lanolin, which do have a pale yellow hue. Therefore, even without the addition of coloring, the pomade still appears yellowish. The highest value obtained from the graph is 4.72. The addition of VCO and aloe vera does not significantly affect the color, as VCO is clear and aloe vera also has a transparent color.

The pomade produced in this study generally has a yellowish-white color. This color originates from base materials such as beeswax and lanolin, which naturally have a pale yellow hue. The addition of VCO and aloe vera did not significantly affect the final color, as both are clear or transparent. This aligns with the statement by Mujiono & Ismedsyah (2020), who noted that the final color of pomade is more influenced by solid base materials such as wax and petroleum jelly than by clear liquid materials like herbal extracts.

3.2.5 Ash Content Testing

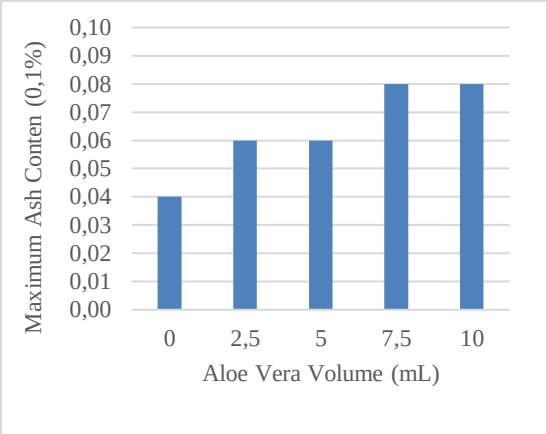

Figure 3.6 Diagram of the effect of VCO 15 ml and aloe vera volume variations on ash content

Ash content analysis is conducted to determine the total minerals or inorganic solids remaining after the combustion of organic materials in pomade. Ash content reflects the amount of inorganic substances (such as metal minerals, chemical residues, or contaminants) left in the product. In cosmetic products such as pomade, high ash content may indicate the presence of contaminants or undesirable insoluble substances. According to the SNI 06-2578-1992 standard, the maximum allowable ash content is 0.1%.

Test results show that the ash content in some pomade samples ranges from 0.04% to 0.08%. This finding indicates that the inorganic substance content in pomade is very low. When compared to the cosmetic quality standards according to SNI 06-2578-1992, the maximum allowable ash content for semi-solid cosmetic products such as pomade is 0.1%. Therefore, the pomade samples with a VCO concentration of 15 mL in this study meet the established standards, as their values are below the maximum limit.

Ash content tends to increase slightly in formulas containing more aloe vera, as aloe vera contains various minerals such as calcium, magnesium, and iron. This aligns with the findings of Krisyanella et al. (2022), who stated that the higher the

mineral content of raw materials, the higher the ash content in the final product.

3.2.6 Total Antioxidant Testing

Antioxidants are compounds that play an important role in fighting free radicals that can damage cells, accelerate the aging process, and cause various health problems, including those related to skin and hair. In this study, VCO and aloe vera were used as active ingredients known to contain natural antioxidants. VCO contains lauric acid, tocopherols, and polyphenols with antioxidant properties, while aloe vera contains phenolic compounds, flavonoids, and vitamin C, which also function as free radical scavengers.

To evaluate the antioxidant potential of these ingredients in the pomade formulation, the total antioxidant content was tested using the DPPH (2,2-diphenyl-1-picrylhydrazyl) method. This method measures the ability of antioxidant compounds to convert purple-colored DPPH radicals into colorless forms, and the results are measured spectrophotometrically at a wavelength of 517 nm. Antioxidant values are expressed in units of milligrams of vitamin C equivalent per gram of sample (mg VCE/g).

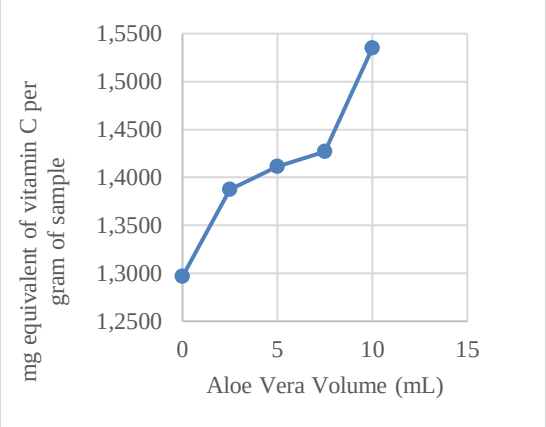

Figure 3.7 Diagram of the effect of VCO 15 ml and aloe vera volume variations on total antoxidant

Based on the data in the graph, it can be seen that the increase in the concentration of aloe vera added is directly proportional to the increase in total antioxidant content in the formulation. The highest level was achieved in the formulation containing 10 mL of aloe vera, which was 1.5350 mg VCE/g, while the formulation without aloe vera (only VCO) produced a level of 1.2969 mg VCE/g.

Overall, the results of this study indicate that the addition of aloe vera up to 10 mL positively contributes to an increase in total antioxidants. The formulation combining 15 ml of VCO and 10 ml of aloe vera is the most optimal in terms of its ability to combat free radicals.

4. CONCLUSION

4.1 Conclusion

Based on the results obtained from this study, the following conclusions can be drawn:

1. Differences in the volume of VCO and aloe vera were found to affect the physical characteristics and stability of the pomade. The combination of these two ingredients determines the final quality of the product, including pH, melting point, homogeneity, ash content, and organoleptic aspects such as color, texture, and aroma. The best formula was obtained from a combination of 15 ml of VCO and 10 ml of aloe vera, resulting in a formulation with a pH of 6.5, safe for the scalp, a melting point of 43 °C, stable at room temperature, ash content of 0.08%, in line with SNI standard limits, and texture, color, and aroma preferred by the panelists. This formula also demonstrated physical stability with a homogeneous appearance without phase separation or clumping, making it the most optimal formula in this study.
2. Increasing the volume of aloe vera in the pomade formulation significantly increased the total antioxidant content. This is due to

the bioactive compounds in aloe vera, such as flavonoids and vitamin C, which function as natural antioxidants. At a combination of 15 ml VCO and 10 ml aloe vera, the highest antioxidant content of 1.5350 mg vitamin C equivalent per gram was obtained, indicating that aloe vera makes a significant contribution to protection against free radicals in this natural pomade product.

4.2 Suggestions

Test the shelf life or stability of the product over a period of 1–3 months at various storage temperatures to evaluate the physical stability and aroma of the pomade during storage.

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