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FORMULATION OF BAR SHAMPOO BASED ON *Eucheuma cottonii* SEAWEED EXTRACT WITH VARYING CONCENTRATIONS OF SODIUM COCOYL ISETHIONATE

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ABSTRACT

This study aims to formulate shampoo bars as an environmentally friendly alternative hair care product by utilizing nutrient-rich Eucheuma cottonii seaweed extract and varying the concentration of Sodium Cocoyl Isethionate (SCI) as a natural surfactant that does not irritate the scalp. The E. cottonii extract was obtained through maceration with 96% ethanol and concentrated using a rotary vacuum evaporator. The SCI concentrations used were 30%, 35%, 40%, 45%, and 50%, while the E. cottonii extract concentrations were 2%, 6%, 10%, 14%, and 18%. The physical quality of the shampoo bar was evaluated through acidity (pH) testing, moisture content, foam stability, organoleptic testing (color, aroma, texture), and irritation testing. The results showed that all formulations had a pH of 5.5–6.33, meeting SNI 06-2692-1992 standards. The highest moisture content was recorded at 16.96% in SCI 30% and 18% extract, while the lowest was 5.26% in SCI 50% and 2% extract. Foam stability increased with increasing SCI, with the highest foam stability percentage of 79.22% in SCI 50% and 2% exract. Organoleptic testing showed good acceptance of color and texture, with the aroma of some formulas slightly changing to be less fresh, but generally still acceptable to the panelists. Irritation testing on 25 panelists did not show any serious irritation, indicating the optimal quality of the shampoo bar produced.

Keywords: Eucheuma cottonii, Maceration, Physical Quality, Shampoo bar, Sodium Cocoyl Isethionate

1. INTRODUCTION

1.1 Background

Hair is one of the most important elements of a person's appearance and identity. Hair health not only affects aesthetics, but is also related to an individual's self-confidence. Hair also plays a role in protecting the body from environmental conditions, such as sunlight and cold weather. Healthy hair usually has characteristics such as good thickness, natural black color, shiny appearance, does not tangle easily, and does not experience hair loss (Eryaputri et al., 2023). Unfortunately, various hair problems such as hair loss, dandruff, and dry hair can interfere with hair health. Therefore, the use of hair care products, especially shampoo, is very important to maintain and improve hair condition.

Shampoo is a product formulated primarily to cleanse the hair and scalp of oil, dead skin cells, dandruff, dust, environmental pollution, and other dirt particles (Muhammad et al., 2022). Shampoo comes in various types, such as liquid shampoo (gel) and solid shampoo (bar). Liquid shampoo has long been the primary choice of consumers because it is easy to use and produces abundant foam. Liquid shampoo (gel) generally contains more water, which makes it easier to use but also more susceptible to contamination. On the other hand, shampoo bars have recently regained public attention, along with increasing public awareness of the importance of protecting the environment and health. This trend has emerged because many people are starting to look for alternatives that are more environmentally friendly

and safe for everyday use compared to conventional products. According to a study conducted by a scientific working group at the National Center for Ecological Analysis and Synthesis (NCEAS) at UC Santa Barbara, it was found that approximately 8 million metric tons of plastic end up in the ocean every year (All Things Beauty., 2019).

Shampoo bars are a type of shampoo in solid form, known to be more environmentally friendly due to their ability to reduce dependence on plastic packaging. By using shampoo bars, you can not only keep your hair clean, but also contribute to efforts to reduce plastic waste generated from conventional shampoo products. On the other hand, shampoo bars have a higher concentration of active ingredients and do not require a lot of water in the manufacturing process, making them more durable. Another advantage is that shampoo bars are made from natural ingredients that are free of sulfates and parabens, making them a safer choice for the scalp.

The innovation of making shampoo bars based on Eucheuma cottonii seaweed extract with varying concentrations of sodium cocoyl isethionate (SCI) offers an interesting solution to various hair problems. E. cottonii seaweed extract is rich in carbohydrates, proteins, and small amounts of fat and ash, which are mostly salt compounds such as sodium and calcium. E. cottonii also contains many sources of vitamins such as vitamins A, B1, B2, B6, B12, and vitamin C, as well as minerals such as K, Ca, Na, Fe, and iodine (Syafitri et al., 2022). Nutrients such as iodine and minerals can strengthen hair roots, thereby helping to prevent hair loss and improve scalp health (I et al., 2020).

Sodium Cocoyl Isethionate (SCI) is a surfactant that is increasingly popular in shampoo bar formulations, thanks to its gentle properties and effective cleansing ability. SCI is an anionic surfactant derived from coconut oil, known for its non-irritating properties on the scalp and hair, making it an ideal choice for hair care products, especially for those with sensitive scalps. With these characteristics, SCI can be used in various types of care products without causing harmful side effects. This makes SCI an important component in effective and pleasant-to-use shampoo bar formulations (Anggraini et al., 2024). Based on research conducted by (Anggraini et al., 2024), variations in sodium cocoyl isethionate (SCI) concentrations of 35%, 30%, 25%, and 20% showed the best results, with the 35% SCI variation having the best cleansing effect.

Considering the various advantages described above, this shampoo product will utilize a combination of natural ingredients from E. cottonii seaweed extract with varying concentrations of sodium cocoyl isothionate. Through this research, it is hoped that a product can be produced that is not only effective in caring for hair, but also environmentally friendly and supports sustainability.

2. RESEARCH METHODS

Research methodology

2.1 Research Place

The research on shampoo bars was conducted at the Laboratory of Chemical Engineering and Analytical Chemistry at the Lhokseumawe State Polytechnic.

2.2 Tools and Materials

2.2.1 Tools used

Scissors, spoon, chopper, crusher, digital scale, large glass jar, 40 mesh sieve, basin, rotary evaporator kit, filter, dropper pipette, 100 mL, 500 mL, and 1000 mL, measuring cups, stirring rods, porcelain dishes, test tube racks, test tubes, shampoo bar molds, pH meters, hot plates.

2.2.2 Materials used

The ingredients used in this research include Sodium Cocoyl Isethionate (SCI), Seaweed Extract, Stearic Acid, Cocoa

Butter, Citric Acid, Lemon & Rose Essential Oil, Lexgard, Colorant.

2.3 Experimental Treatment Design

2.3.1 Fixed Variables

- Dried Seaweed : 500 g
- 96% Ethanol : 6 L
- Stearic Acid : 10 g
- Citric Acid : 2 .5 mL
- Cocoa Butter : 2.7 g
- Rose and Lemon Essential Oil : 1 mL
- Lexgard : 1 mL
- Coloring : 0.5 mL

2.3.2 Independent Variables

- Sodium Cocoyl Isethionate (SCI) concentration: 30%, 35%, 40%, 45% and 50%.
- Eucheuma cottonii seaweed extract concentration: 2%, 6%, 10%, 14%, and 18%.

2.3.3 Dependent Variable

1. Acidity Test (pH)
2. Moisture Content Test
3. Foam Stability Test
4. Organoleptic Test
5. Irritation Test

2.4 Experimental and Testing Procedures

2.4.1 Seaweed Extract Production Procedure

1. Seaweed is washed thoroughly to remove any dirt.
2. After that, the seaweed is cut into smaller pieces to make the drying process easier.
3. Next, dry it under the sun.
4. Grind 500 grams of dried Eucheuma cottonii seaweed using a crusher and then a chopper, then sift it with a 40-mesh sieve to obtain a simplisia powder.
5. Put 500 grams of simplisia powder into a jar, then add 2 liters of 96% ethanol. The jar is tightly closed and soaked for 24 hours while stirring occasionally.
6. The jar is stored in a place that is not exposed to direct sunlight at room temperature.
7. After 24 hours, the simplisia is filtered, and the liquid extract obtained is stored in a closed container.
8. The filter residue is remacerated twice, with filtering and the addition of 2 liters of new solvent.
9. All liquid extracts (macerates) obtained over three days are stored in closed containers.
10. The liquid extract obtained is then evaporated to a concentrate using a rotary vacuum evaporator.

2.4.2 Procedure for Making Shampoo Bars

1. All ingredients are prepared and weighed.
2. Stearic acid and cocoa butter are melted in a heat-resistant container while stirring until all ingredients are melted and mixed evenly.
3. Sodium cocoyl isethionate (SCI) and Eucheuma cottonii seaweed extract are added to the mixture.
4. The mixture is left to cool, stirring continuously until evenly mixed.
5. In a separate container, a 10% citric acid solution is made by dissolving it in distilled water.
6. The citric acid solution, rose and lemon essential oils, and lexgard are added to the mixture.
7. The mixture is stirred slowly until all ingredients are evenly mixed.
8. Colorant is added to the mixture.
9. The mixture is poured into a silicone mold.
10. The mixture is left to harden at room temperature for 24-48 hours.
11. The shampoo bar is removed from the mold after hardening.

12. The shampoo bar is stored in a dry place at room temperature (±24°C) to prevent moisture.
13. Testing is conducted on the shampoo bar formula.

3. RESULTS AND DISCUSSION

3.1 Research Results

Table 3.1 Data from Test Results and Observation Analysis

SCI (%)	Ekstrak R. Laut (%)	Hasil Rata-rata Pengujian				
		pH	Kadar Air (%)	Stabilitas Busa (%)	Organoleptik	Iritasi (Panelis)
30	2	5,67	7,95	59,50	3,5	2
	6	5,78	8,64	55,29	3,2	1
	10	5,86	10,22	52,66	3,8	-
	14	5,91	14,23	50,29	4	2
	18	5,93	16,99	49,94	3,6	-
35	2	5,66	6,82	64,47	3,5	3
	6	5,70	7,24	61,79	3,8	3
	10	5,80	9,34	59,52	4	-
	14	5,83	12,93	58,02	4,1	-
	18	6,13	15,92	56,10	4,1	-
40	2	5,65	6,18	68,38	3,6	2
	6	5,65	6,98	65,10	3,6	1
	10	5,69	8,11	64,15	3,9	-
	14	5,71	11,15	62,91	3,9	1
	18	6,07	15,10	60,80	4,2	-
45	2	5,55	5,60	71,91	3,5	1
	6	5,58	6,53	70,06	3,7	-
	10	5,63	7,56	68,40	3,6	-
	14	5,64	9,27	65,78	4,1	-
	18	5,86	13,66	65,33	4,4	1
50	2	5,58	5,26	79,22	4,5	-
	6	5,56	6,00	77,25	3,1	-
	10	5,59	6,31	76,19	3,6	-
	14	5,61	8,44	74,29	4,5	-
	18	5,71	10,83	73,77	4,3	-

3.2 Discussion

Research on the production of shampoo bars from Eucheuma cottonii seaweed extract as a hair and scalp care product. Made using various concentrations of E. cottonii seaweed extract and sodium cocoyl isethionate (SCI). The resulting products were tested for pH, water content, foam stability, organoleptic properties, and skin irritation.

3.2.1 Acidity Level (pH) Testing

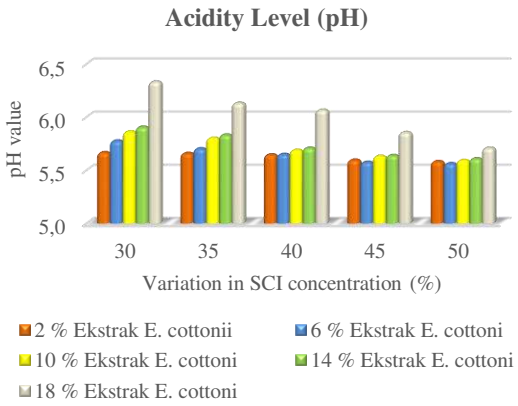

Figure 3.1 Graph of the Effect of Variations in Sodium Cocoyl Isethionate Concentration and E. cottonii Seaweed Extract on pH Values

Based on SNI, the recommended pH range for shampoo bars is between 5–9, while the pH of human scalp is around 5.5 - 6. Therefore, shampoo bars should ideally have a pH close to that of the scalp to ensure they are safe and comfortable to use. pH testing is conducted to determine the acidity or alkalinity level of a preparation, as pH levels that are too high or too low can increase the scalp's absorption capacity and potentially cause irritation.

Based on the test results shown in Figure 4.1, the pH of the shampoo bars produced ranged from 5.5 to 6.33. This range indicates that all samples met the SNI 06-2692-1992 standard. The pH values obtained are also in line with the research by Anasri et al. (2020) on seaweed pulp-based shampoo, which has a pH of 6.14 and is still considered safe according to the shampoo pH standard range of 5–9. In topical preparations, a pH below 5 has the potential to cause skin irritation, while a pH above 9 can cause

the skin to become dry and scaly (Syamsurizal et al., 2019).

The pH value of shampoo bars is influenced by the use of Sodium Cocoyl Isethionate (SCI), because SCI is an anionic surfactant with slightly acidic properties. Therefore, the addition of SCI in the formulation can affect the pH of shampoo bars. The higher the concentration of SCI used, the more the pH of shampoo bars tends to decrease due to the acidic properties of this ingredient. Meanwhile, the addition of seaweed extract can help raise the pH closer to neutral. This is due to the alkaline mineral content in seaweed, which can increase the pH.

In this study, the most optimal pH of the shampoo bar was obtained in a formulation with 50% Sodium Cocoyl Isethionate (SCI) content. The addition of seaweed extract and SCI in the right proportions resulted in a balanced pH.

3.2.2. Moisture Content Testing

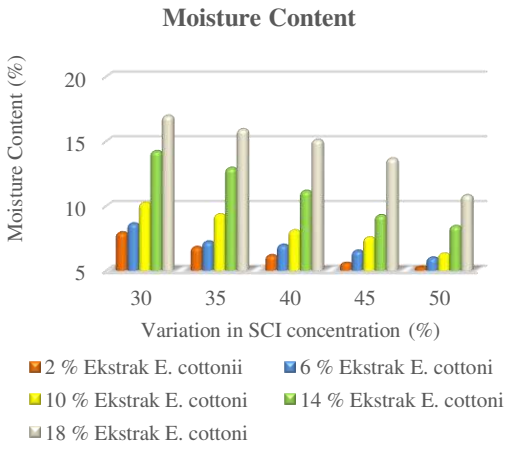

Figure 3.2 Graph showing the effect of varying concentrations of sodium cocoyl isethionate and E. cottonii seaweed extract on moisture content

Water content testing on shampoo bars is conducted to determine the amount of water remaining in the shampoo after drying at 105°C using the gravimetric method, which involves determining the difference in weight of the material before and after the water content has been evaporated. Water content affects the quality of shampoo bars, as too high a water content can make the product soft, prone to shrinkage, and uncomfortable to use. According to SNI 06-3532-1994, the maximum permissible moisture content is 15%.

Based on the test results shown in Figure 4.2, the highest water content in shampoo bars was recorded at 16.96%, obtained from samples with 30% Sodium Cocoyl Isethionate (SCI) and 18% seaweed extract. Meanwhile, the lowest moisture content recorded was 5.26%, found in shampoo with a concentration of 50% Sodium Cocoyl Isethionate (SCI) and 2% seaweed extract. The water content values obtained are also in line with research conducted by Lau et al. (2021) on ethanol extract coffee bean solid soap, which has a water content of 11.95% - 12.77% and still meets the established SNI standard of <15%. The addition of E. cottonii seaweed extract to shampoo bars was proven to increase the water content in the product. This was seen in three samples that exceeded the standard water content limit, namely 16.99%, 15.92%, and 15.10%, respectively. The higher the concentration of seaweed extract used, the higher the water content in the shampoo bar. Conversely, the use of higher SCI concentrations tends to decrease the water content in shampoo bars. These results indicate a relationship between increased SCI concentration and decreased water content, as well as a relationship between seaweed extract concentration and increased water content in shampoo bars.

The decrease in water content due to an increase in SCI concentration occurs because SCI, as a solid surfactant, helps reduce moisture in shampoo bars, resulting in lower water content in the product (Patel et al., 2022). Conversely, the increase in water content with the addition of seaweed extract is caused by the hydrophilic polysaccharide content in seaweed, which is hygroscopic and able to

bind and retain water in shampoo bars (Nurmala Sari et al., 2022). Other factors that can increase the water content in shampoo bars can also be influenced by the water content of other ingredients used.

Water content plays an important role in determining the quality and durability of shampoo bars. Shampoo bars with too high a water content tend to be softer, mushy, and use up faster because their texture becomes less dense and dissolves easily when exposed to water. In addition, high water content also shortens the shelf life of the product because it increases the risk of microbial contamination, such as fungi and bacteria, which can grow faster in products with high moisture content. The texture of shampoo bars also becomes less comfortable when rubbed because it does not provide a solid sensation.

3.2.3. Foam Stability Testing

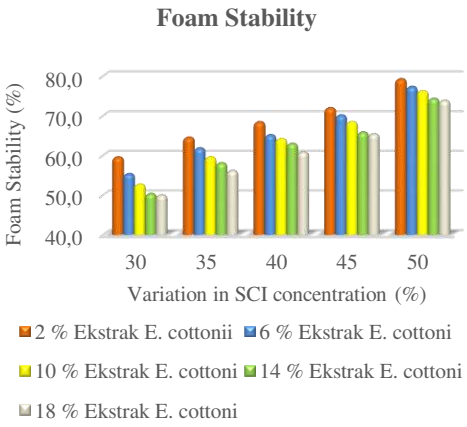

Figure 3.3 The Effect of Variations in Sodium Cocoyl Isethionate Concentration and E. cottonii Seaweed Extract on Foam Stability.

Foam stability testing on shampoo bars is conducted to assess the product's ability to maintain the foam produced over time. This test aims to determine the durability of the foam formed and how long the foam can last before it eventually breaks or disappears. There are no provisions regarding minimum or maximum foam stability limits for shampoo preparations, because foam height cannot be used as an indicator of the product's cleaning ability. Foam stability is more related to aesthetics and consumer preferences, as consumers generally prefer shampoos that produce a lot of foam when used.

Based on Figure 4.3, it can be seen that the foam stability of the shampoo bar increases with the increase in Sodium Cocoyl Isethionate (SCI) concentration in each variation of Eucheuma cottonii seaweed extract concentration used. The formulation with 50% SCI concentration showed the highest foam stability, while at 30% SCI concentration, foam stability tended to be lower. In addition, the higher the addition of seaweed extract, the lower the foam stability at the same SCI concentration. The highest foam stability in shampoo bars was recorded at 79.22%, obtained from samples with 50% Sodium Cocoyl Isethionate (SCI) and 2% seaweed extract. Meanwhile, the lowest foam stability was recorded at 49.94%, which was in shampoo with a Sodium Cocoyl Isethionate (SCI) concentration of 30% and 18% seaweed extract. The foam stability values obtained are also in line with research conducted by Amalia Etika (2020) on anti-dandruff shampoo preparations from grapefruit, which had foam stability of 77.2% - 84%.

The increase in foam stability with increasing SCI concentration is due to the nature of SCI as an anionic surfactant that has the ability to produce and maintain foam well. SCI is able to reduce the surface tension of water, thereby increasing foam formation and maintaining the foam structure so that it does not break quickly (Brilhante., 2018).

On the other hand, the decrease in foam stability in shampoo bars with the addition of high-concentration seaweed extract may be caused by the polysaccharide content in hydrophilic seaweed, which can bind water, thereby increasing the water phase in the foam and causing the foam film layer to become thinner and more prone to

breaking. In addition, the minerals contained in seaweed extract can also interact with SCI and affect foam formation ability (Nurmala Sari et al., 2022).

Thus, the results of this graph show that to produce good foam stability in shampoo bars, an optimal SCI concentration is required with the appropriate addition of seaweed extract concentration, so that the resulting foam is stable but still provides the moisturizing benefits of seaweed extract to the hair and scalp.

3.2.4. Organoleptic Test

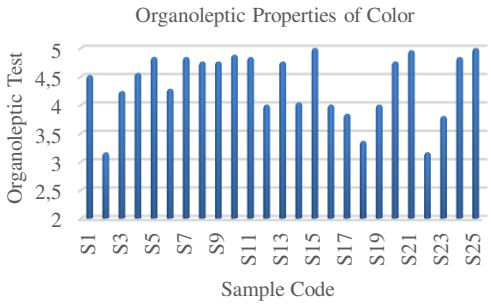

Figure 3.4 Organoleptic Test Results Graph for Color.

The color of the shampoo bar is influenced by the difference in seaweed extract concentration and the addition of yellow dye during the manufacturing process. The higher the concentration of seaweed extract used, the more intense and striking the color of the shampoo bar will appear. This is due to the combination of the natural color of the seaweed extract with the added yellow dye, resulting in a more intense yellow color.

Based on Figure 4.4, the organoleptic test results for shampoo bars show a scale value range of 3.16 to 5. The highest value on the graph is 5, which indicates that the panelists really liked the color of the shampoo bars in samples 5, 10, 15, 20, and 25. This is due to the addition of yellow dye and higher concentrations of extract, resulting in a more intense and fresher-looking yellow color. This color was considered more attractive by the panelists.

Meanwhile, lower preference scores were given to shampoo bars with a pale yellow color that looked less attractive and did not give a fresh impression, making them less preferred by the panelists. The panelists considered this less intense color to be “incomplete” or not visually appealing enough, which affected their level of liking. This is in line with the theory of color perception in cosmetic products, where bright and even colors are usually considered a sign of good product quality. Therefore, the more intense color of the shampoo bar made it more attractive and increased the panelists' liking during the organoleptic test.

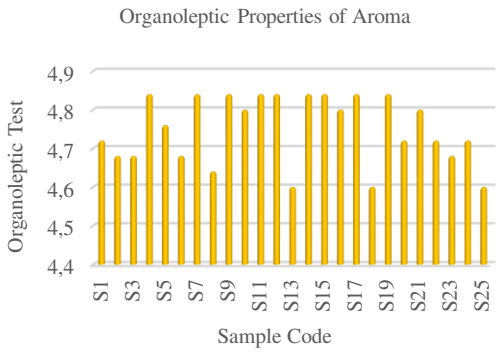

Figure 3.5 Organoleptic Test Results Graph for Aroma.

The aroma of shampoo bars is influenced by the addition of essential oils. In this study, the shampoo bars produced had a distinctive aroma from a combination of lemon and rose essential oils, resulting in a fresh and soft scent. The aroma rating range for shampoo bars was between 4.6 and 4.84. Almost all samples received high scores, with some samples receiving the highest score of 4.84. This shows that the panelists generally really liked the scent produced by the shampoo bars.

However, the scent of the shampoo bars changed to a sour smell due to prolonged storage. The change in scent to a sour smell can be caused by the

oxidation process of the essential oil or fat components used in the shampoo bar formulation, which produces aldehyde compounds and sharp-smelling organic acids. In addition, the high water content in shampoo bars can trigger the growth of certain microorganisms if the storage conditions are not airtight and exposed to moisture. These two factors can accelerate the degradation of active ingredients, causing the desired initial aroma to become stale.

In this study, the change in aroma to sourness did not occur in samples tested immediately after production, but began to be detected after storage for more than 4 weeks. These results indicate that even though the shampoo bar formula meets organoleptic quality standards at the beginning of production, excessive shelf life or improper storage conditions can affect the aroma quality of the product.

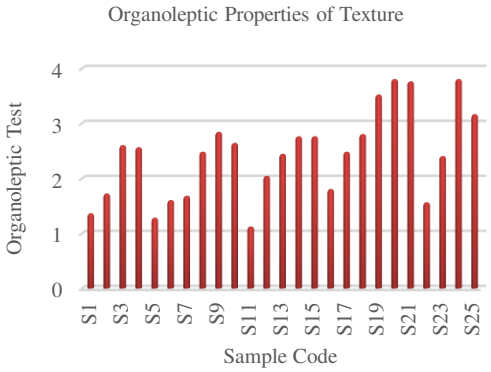

Figure 3.5 Organoleptic Test Results Graph for Texture.

In this study, the shampoo bars produced showed variations in texture influenced by differences in the concentration of Eucheuma cottonii seaweed extract and the addition of Sodium Cocoyl Isethionate (SCI). These variations in composition affected the density of the shampoo bars produced. The texture assessment of the shampoo bars showed a range of values between 1.12 and 3.76. These variations were influenced by differences in the composition of Eucheuma cottonii seaweed extract and Sodium Cocoyl Isethionate (SCI) concentrations used in each sample formula. The sample with the highest organoleptic value for texture, namely 3.76, showed that the panelists really liked the texture of the shampoo bar produced. This texture is generally smoother, denser, and not easily brittle. This is due to the use of a higher concentration of SCI and the addition of seaweed extract in appropriate amounts. SCI plays an important role in forming a denser shampoo bar texture.

Conversely, samples with lower organoleptic values tended to have a softer texture, less density, and were more fragile. This condition was caused by the use of low SCI concentrations and high concentrations of E. cottonii seaweed extract, where low SCI resulted in less dense texture, while high seaweed extract concentrations produced a softer texture.

Overall, these results show that the combination of SCI as a solid surfactant and seaweed extract as an active ingredient greatly affects the final texture of the shampoo bar. A balanced composition produces a shampoo bar with a denser texture that is comfortable to use.

3.2.5. Iritation Test

Table 3.2 Results of Skin Irritation Testing on Seaweed Extract Shampoo Bar E. cottonii.

Konsentrasi SCI (%)	Konsentrasi Esktrak Rumput Laut (%)	Sukarelawan	Iritasi Kulit		
			Kemerahan	Gatal-gatal	Kering
30%	2%	Panelis 1-25	Tidak	Tidak	2 Panelis
	6%	Panelis 1-25	1 Panelis	Tidak	Tidak
	10%	Panelis 1-25	Tidak	Tidak	Tidak
	14%	Panelis 1-25	Tidak	2 Panelis	Tidak
	18%	Panelis 1-25	Tidak	Tidak	Tidak
35%	2%	Panelis 1-25	1 Panelis	Tidak	Tidak
	6%	Panelis 1-25	Tidak	Tidak	Tidak
	10%	Panelis 1-25	Tidak	Tidak	Tidak
	14%	Panelis 1-25	1 Panelis	2 Panelis	Tidak
	18%	Panelis 1-25	Tidak	2 Panelis	Tidak
40%	2%	Panelis 1-25	Tidak	2 Panelis	Tidak

Konsentrasi SCI (%)	Konsentrasi Esktrak Rumput Laut (%)	Sukarelawan	Iritasi Kulit		
			Kemerahan	Gatal-gatal	Kering
	6%	Panelis 1-25	Tidak	1 Panelis	Tidak
	10%	Panelis 1-25	Tidak	Tidak	Tidak
	14%	Panelis 1-25	Tidak	Tidak	1 Panelis
	18%	Panelis 1-25	Tidak	Tidak	Tidak
45%	2%	Panelis 1-25	Tidak	1 Panelis	Tidak
	6%	Panelis 1-25	Tidak	Tidak	Tidak
	10%	Panelis 1-25	Tidak	Tidak	Tidak
	14%	Panelis 1-25	Tidak	Tidak	Tidak
	18%	Panelis 1-25	1 Panelis	Tidak	Tidak
50%	2%	Panelis 1-25	Tidak	Tidak	Tidak
	6%	Panelis 1-25	Tidak	Tidak	Tidak
	10%	Panelis 1-25	Tidak	Tidak	Tidak
	14%	Panelis 1-25	Tidak	Tidak	Tidak
	18%	Panelis 1-25	Tidak	Tidak	Tidak

Skin irritation testing was conducted to ensure the safety of E. cottonii seaweed extract shampoo bars. Testing was conducted on 25 panelists, and no signs of irritation were found after using the shampoo bars. This indicates that E. cottonii seaweed extract shampoo bars are safe to use and do not cause adverse side effects on the skin. Skin irritation testing was conducted to ensure the safety of the E. cottonii seaweed extract-based shampoo bar. Based on the results of testing on 25 panelists, it was found that in general, the shampoo bar did not cause serious irritation. Only a small number of panelists reported mild symptoms such as redness, itching, or dry skin on some samples.

These mild complaints are related to differences in the concentrations of Sodium Cocoyl Isethionate (SCI) and seaweed extract used. In samples with low SCI concentrations (30% - 35%) and high seaweed extract concentrations (14% - 18%), some panelists experienced mild redness or itching. This may be due to the low SCI concentration reducing the cleansing and softening properties of the shampoo bar, causing more of the active ingredients from the seaweed to remain on the skin's surface, triggering discomfort in some individuals. High concentrations of seaweed extract contain polysaccharides, minerals, and other organic compounds that can trigger mild reactions such as redness or itching in some individuals with sensitive skin (Morais et al., 2021).

Conversely, in samples with higher SCI (40% - 50%), irritation tended to decrease. This is because a higher SCI provides better protection for the skin, maintains moisture, and does not cause irritation. Overall, these results show that the balance between SCI concentration and seaweed extract greatly affects the safety of the product on the skin.

4. CONCLUSION

4.1 Conclusion

Based on the results of the research that has been carried out, the following conclusions can be drawn:

1. Variations in the concentration of sodium cocoyl isethionate (SCI) in the range of 30–50% affect the pH, moisture content, and foam stability of shampoo bars, but all parameter values still meet SNI quality standards, so no formulation reduces product quality.
2. Variations in seaweed extract concentration (2–18%) affect the pH, water content, and foam characteristics, but all organoleptic, physical, and chemical test results remain in the good category according to quality standards.

4.2 Suggestions

Based on the conclusions drawn, the recommendation is that longer-term storage stability tests be conducted to determine the physical resistance, aroma, color, and foam performance during the storage period.

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