Physicochemical Characteristics and Antioxidant Activity of Solid Soap Enriched With Crude *Eucheuma cottoni* Extract

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Physicochemical Characteristics and Antioxidant Activity of Solid Soap Enriched With Crude *Eucheuma cottoni* Extract

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Abstract: *Eucheuma cottoni* extract is known to have potential as an antioxidant because it has secondary metabolite content in the form of bioactive compounds that can be utilized. The content of bioactive compounds are flavonoids, terpenoids, steroids, coumarins, and alkaloids. Soap is one of the products used to clean the body, with a very varied shape. Soap that people need today not only serves to maintain skin hygiene as well as to maintain healthy skin from free radicals. The purpose of this research is to know the effect of different concentration on the addition of *Eucheuma cottoni* extract to the characteristics and to know the best concentration of the addition *Eucheuma cottoni* extract. For that purpose, *Eucheuma cottoni* seaweed is extracted by maceration method using 60% methanol solvent. *Eucheuma cottoni* extract was added to soap with four various concentrations (0%, 3.5%, 4% and 4.5%). The research method used is Completely Random Design (RAL) experiment, with one factor that is the concentration of *Eucheuma cottoni* extract with three times repetition. Parametric data were analyzed by ANOVA and HSD test, while nonparametric data were analyzed by Kruskal-Wallis test. The results of the addition *Eucheuma cottoni* extract showed that the optimum concentration was 3.5% with antioxidant activity 10.296%, moisture content 8.54%, free fatty acid content 2.59%, pH 9.5, foam stability 84.48%, hardness 1134.42 *gf*, and the best hedonic test. These results have been in accordance with SNI 3532-2016.

1. Introduction

Eucheuma cottoni is a red algae or (Rhodophyta) which has another name *Kappaphycus alvarezii*. The physical characteristics of this seaweed are having cylindrical thallus, with a smooth surface and having catilogeneus. The spines on the thallus are spiky, elongated, rather sparse and stacked by not encircling the thallus. The color of the seaweed can change, not always red, sometimes green, green, or gray. This color change occurs due to environmental factors, which is a process of adaptation to the surrounding environment. The habitat of *E. cottoni* , which is beached by reefs with dead coral reef substrate. Seaweed is attached to the substrate with an adhesive device in the form of a disc. This seaweed can live with a constant flow of water with a small variation in temperature changes [21].

Eucheuma cottoni seaweed is known to produce primary metabolites and secondary metabolites. Primary metabolites are compounds that are produced for their survival which are produced from

primary metabolic processes such as carbohydrates, proteins, and fats, and secondary metabolites have a function as self-defense that is owned by seaweed on the environment. Secondary metabolites produced by seaweed can be used by humans as antifungal, antibacterial and antioxidant [7]. Phenolic compounds are secondary metabolites because they do not directly contribute to photosynthesis, cell division or reproduction. The content of phenolic compounds in *Eucheuma cottoni* such as flavonoids, terpenoids, steroids, coumarin, and alkaloids [36].

Antioxidants are compounds that can prevent the occurrence of oxidation reactions, and prevent damage caused by free radical. Free radicals are compounds that are in a free state having one or more free electrons which are unpaired so that it is easy to attract other molecules which cause free radicals to become more reactive. These free radicals usually attack healthy cells in the body, which cause cell damage to the human body. These free radicals can come from inside (endogenous) and from outside (exogenous). Endogenous free radicals are produced from metabolic processes, respiration, inflammation, and malnutrition, while exogenous free radicals come from environmental pollution, UV rays and cigarette smoke [35].

The skin is the outer part of the body that is often exposed to UV light and environmental pollution. Soap is one of the products used to cleanse the body. Soap is a cleaning agent which made by reacting fatty acids and sodium or potassium bases [37].

The addition of *Eucheuma cottoni* extract to solid soap is intended to improve the physicochemical function and characteristics of solid soap. The soap produced is expected not only to have a clean effect but to have another function to protect the skin from free radicals.

2. Materials and Methods of Research

2.1. *Sample Extraction*

Sample extraction [5]. Fresh *Eucheuma cottoni* was obtained from fishermen at Serang, Banten, aged 43 days then put into dark plastic and stored in styrofoam. The sample is still fresh then washed with distilled water to remove sand and salt impurities, then the sample is cut into pieces ± 1 cm in size. Extraction was carried out by maceration method using 60% methanol solvent. As much as 2 kg of samples were macerated with ~~a~~ 2 L solvent for 3 x 24 hours. The solvent was changed every 24 hours. After then filtering was administered using filter paper, then evaporated with a rotary evaporator at a temperature of 40^0 C. The results obtained were then oven treated at 40^0C to obtain dry results.

2.2. *Yield*

The yield calculation is to determine the comparison between extracts obtained with the extracted material [23]. The material to be extracted is weighed and the extract obtained after evaporation is weighed, then calculate the extract yield (% b / b) according to the yield calculation formula. The yield can be determined by the following formula:

$$\% \text{ Yield} = \frac{\text{weight of extract obtained (g)}}{\text{weight of the extracted material (g)}} \times 100\%$$

2.3. *Phytochemical Screening Test*

Analysis of Flavonoid Compounds [28]; Phenol Compounds [10]; Saponin Compound [10]; Alkaloid Compounds [10]; Steroid and Triterpenoid Compounds [24].

2.4. *Antioxidant Activity*

Antioxidant activity test was made [5]. Measurement of antioxidant activity using DPPH method is 1,1-diphenyl-2-picrylhydrazyl. The DPPH method is the easiest and fastest method. A dried extract *Eucheuma cottoni* as much as 20 mg was weighed and dissolved in 1 ml of methanol then homogeneous. DPPH solution with a concentration of 20 ppm which has been made is added as much as 3 ml into a test tube containing extracts and methanol. The blank solution was made without using a sample of only 1 ml of methanol solution and 3 ml of DPPH. All samples were incubated for 30

minutes in a dark room. The resulting uptake was measured using a Spectrophotometer UV-VIS at a wavelength of 517 nm. DPPH method measurement results show the ability of antioxidant activity in general. The ability to reduce free radicals (inhibition) is calculated using the formula:

$$\% \text{ inhibition} = \frac{\text{abs Blanko - abs sample x 100\%}}{\text{abs blanko}}$$

2.5. *Transparent Soap Formulation*

Transparent soap formulation [30]. The treatment in this research was based on the addition of *Eucheuma cottoni* extract concentration, treatment A (without the addition of extract used as control soap), treatment B (addition of *Eucheuma cottoni* extract 3.5%), treatment C (addition of *Eucheuma cottoni* extract 4.0%) and D treatment (addition of *Eucheuma cottoni* extract 4.5%). Formulation of making transparent solid soap using coconut oil base is presented in Table 1.

Table 1. Transparent Soap Formulation with *Eucheuma cottoni* Extract

Material	A (%)	B (%)	C (%)	D (%)
Coconut Oil	20	20	20	20
NaOH 30%	22	22	22	22
Sugar	11	11	11	11
Gliserin	13	13	13	13
Coco-DEA	3	3	3	3
Etanol 96 %	15	15	15	15
NaCl	0.2	0.2	0.2	0.2
Citric Acid	3	3	3	3
Stearic Acid	8	8	8	8
Aquades	4.5	1	0.5	0
Eucheuma cottoni Extract	0	3.5	4	4.5
Fragrance	0.3	0.3	0.3	0.3

2.6. *Producing Transparent Soap*

The process of making soap uses waterbath [31]. Stearic acid that has been placed in a glass beaker is then heated with waterbath. Add coconut oil, then stir until homogeneous. Then add a 30% NaOH solution. After that, add other supporting ingredients, ethanol 96 %, glycerin, sugar, coco-DEA, NaCl, citric acid and fragrance oil then stir until the mixture is completely mixed. For the addition of extracts, the soap mixture is lowered to ± 40°C. Stir again until the extract is splashed, then pour it into a silicone mold and let it solidify.

2.7. *Solid Soap Testing*

The procedure for testing chemical characteristics of solid soap produced in accordance with [3] regarding the quality requirements of bath soap which includes water content, free fatty acid levels and pH. Testing the physical characteristics of soap includes foam stability using vortex and hardness using a texture analyzer.

In addition, to observe physical and chemical characteristics, transparent solid soap was also carried out by hedonic tests on appearance, aroma, lots of foam, texture, and impression of tightness.

The transparent solid soap produced was also tested for antioxidant activity by measuring the percentage of antioxidant activity produced from the soap.

3. Results and Discussion

3.1. *Yield*

Yield gained after evaporation from *Eucheuma cottoni* extraction is 2.8% (56 grams). A low percentage of yield on *Eucheuma cottoni* seaweed due to the number of active ingredients contained in seaweed is also low. The results of the study from [17], the yield of *Eucheuma cottoni* seaweed extracted with methanol is 0.034% with the weight of 12-gram extract.

The high of yield gained when extraction of active ingredients from a plant material is affected by various factors, such as the type of solvent used when extracting the material. If the material is polar extracted, then the solvent used is also polar. Other factors that may affect are the condition and time of sample storage, the length of time of extraction and the ratio of the number of samples and the solvents used [13].

3.2. *Phytochemical Screening*

This phytochemical screening aims to ascertain the bioactive compounds contained in the extract of *Eucheuma cottoni*. Phytochemical tests include compound tests of phenol, flavonoids, saponins, alkaloids, steroids, and triterpenoids. The results obtained in quantitative and qualitative phytochemical tests are presented in Table 2.

Table 2. Phytochemical Screening Test Solid Soap With *Eucheuma cottoni* Extract

Parameter	Concentration (ppm)
Alkaloid	86.540
Flavonoid	18.289
Fenol	513.75
Saponin	809.000
Steroid	-
Triterpenoid	+

Phytochemical screening analysis of *Eucheuma cottoni* extract was done quantitatively to ascertain the amount contained in the seaweed. The amount of active ingredient that exists in a substance will affect the antioxidant activity. The higher the active ingredient content, then the higher the percentage of inhibition of antioxidant activity. Phenolic compound is one of the contents of seaweed that acts as an antioxidant. This phenol component is a compound which can react with an oxidizing agent. Conforming to [36], phenol compounds are compounds that tend to dissolve in water. Generally, these phenol compounds are bonded with sugars that act as glycosides and exist in a cell of vacuoles.

The content of phenol contained in *Eucheuma cottoni* extract is higher than research [14]. In their research, the total of *Eucheuma cottoni* seaweed phenol extracted with methanol is 1.79 ppm [15]. The selection of solvent during extraction is based on the desired target compound. The polar solvent will dissolve the polar component, while the non-polar solvent will dissolve the non-polar component [18].

Flavonoid compounds contained in *Eucheuma cottoni* extract is 18.289 ppm. Flavonoids are one component of phenolic that has the ability as an antioxidant. According to Janarthanan and Kumar [13], flavonoids are plant chemical compounds found in fruits, seeds, and vegetables. Flavonoids can prevent cell damage from free radicals.

Other compounds that are contained in *Eucheuma cottoni* extract are alkaloids. Alkaloids that are contained in this extract as much as 86.540 ppm. These alkaloids are known to have functioned as antioxidants. Conforming [10], alkaloids are bioactive compounds including more than one nitrogen atom.

The largest bioactive content found in *Eucheuma cottoni* extract is saponin with the amount of 80.9% or 809.000 ppm. The characteristics of saponins, among others, have a bitter taste and can form a stable foam in water. Conforming to [19], saponin when shaken will produce foam. The ability to

lower surface tension is due to saponins having hydrophilic and hydrophobic groups. Saponins usually can be a single sugar series or two sugar series which branch off.

A compound test of bioactive steroids and triterpenoids is done qualitatively, *Eucheuma cottoni* extract has triterpenoid content, but does not contain steroids. Triterpenoid is one of the compounds that have a function as an antioxidant [36]. The existence of triterpenoids is signed by red color after the addition of H_2SO_4. Chemical compounds contained in seaweed widely can be used by industries for food, textiles, and pharmaceuticals. Seaweed produces a wide range of compounds from secondary metabolites.

3.3. *Antioxidant Activity*

The results of antioxidant activity test of soap on *Eucheuma cottoni* extract gained the highest value (10.296 ± 0.54%) at a concentration of 3.5% and lowest value (-3.053 ± 2.63%) at a concentration of 0%. The value of antioxidant activity on control or without the addition of *Eucheuma cottoni* extract is negative, because in the soap with 0% concentration there is no addition of extract. The results of antioxidant activity test presented in Table 3.

Table 3. The Result of Antioxidant Activity Solid Soap with *Eucheuma cottoni* Extract

Treatment	Antioxidant activity (%)
0%	-3.053 ± 2.63^{a}
3.5%	10.296 ± 0.54^{c}
4%	6.369 ± 0.84^{b}
4.5%	4.449 ± 0.45^{b}

Antioxidant concentration addition will influence their antioxidant activity. The higher the concentration added, thus the antioxidant activity will be higher. However, this does not occur in the addition of the extract *Eucheuma cottoni* into the solid soap. The higher concentration of the extract added, then the result declines. Antioxidants at certain concentrations will reach a stable phase [6]. The stability of this antioxidant activity is assumed due to the existence of synergism between antioxidant compounds in the extract, thus the capturing of free radical activity remains stable or turned into prooxidant [9], the antioxidant concentration that is added will affect the rate of oxidation, in addition to the high concentration of antioxidant activity of the phenolic group often vanishes or even the antioxidant becomes prooxidant.

3.4. *Water Content*

The results test of a water content of *Eucheuma cottoni* soap extract gained the highest value of 11.125 ± 0.195% at 0% concentration and the lowest value of 6.167 ± 0.335% at 4.5% concentration. Water content value of soap that is added with *Eucheuma cottoni* extract has a lower value when compared to the control without the addition of the extract. Test results of soap water content can be seen in Table 4.

Declined value of soap water content on *Eucheuma cottoni* is assumed because of the increasing amount of *Eucheuma cottoni* extract added to the soap formulation, thus the less water is added. Water those were added in transparent soap formulations A, B, C, and D were 4.5%, 1%, 0.5% and 0%, respectively. The more amount of water added in the soap formulation, the greater water content in the product. The other factor is total saponin content of *Eucheuma cottoni* extract. Saponin is a complex compound when hydrolyzed will produce glycans (sugar) and aglycons (non-sugar). Sugar has a hygroscopic characteristic or absorbs steam. The more extracts are added the more water is absorbed by the sugar. The value of soap water content of *Eucheuma cottoni* extract by adding 0%, 3.5%, 4%, and 4.5% is in accordance with SNI requirements. Conforming to the [4], the maximum requirement for the quality of soap water content is 15%.

Table 4. The Result of Water Content Solid Soap with *Eucheuma cottoni* Extract

Treatment	Water content (%)
0%	11.125 ± 0.195^{a}
3.5%	8.539 ± 0.192^{b}
4%	7.385 ± 0.409^{c}
4.5%	6.167 ± 0.335^{d}

Measurement of water content has a function of knowing the quality of soap. High soap water content will cause the soap becomes soft. This is because the softer the soap, the soap more easily soluble or shrink when used with water. The water content in the soap will affect the texture of soap and solubility in water when used [20]. Soap with high water content will have a softer texture than a soap with low water content.

3.5. *Free Fatty Acids*

The results of a free fatty acid test on soap of *Eucheuma cottoni* extract gained the highest value (3.752 ± 0.695%) at 0% concentration and the lowest value of 0.592 ± 0.146% at 4.5% concentration of 4.5%. The results of the free fatty acid test can be seen in Table 5.

Table 5. The Result of Free Fatty Acids Solid Soap with *Eucheuma cottoni* Extract

Treatment	Free fatty acid (%)
0%	3.752 ± 0.69^{a}
3.5%	2.595 ± 0.67^{ab}
4%	1.475 ± 0.4^{bc}
4.5%	0.592 ± 0.15^{c}

The value of free fatty acid content on soap of *Eucheuma cottoni* extract along with adding concentration, then the declining is due to the active ingredients contained in *Eucheuma cottoni* extract, which is alkaline. Alkaline is able to bind the free fatty acid component and form the soap. This is in accordance with research of [31], the addition of white tea extract is higher than the smaller the fatty acid content in soap. This is because of the active ingredients such as catechins, flavonoids, alkaloids, and other *alkaline* characteristics that help NaOH to react oil to be soap.

Free fatty acids are fatty acids exist in soap but do not bound to NaOH and triglycerides. The free fatty acids exist in this soap caused by it does not have a saponification reaction. The value of free fatty acids exist in soap of *Eucheuma cottoni* extract at concentration of 0% and 3.5% were higher concentration compared with free fatty acid soap with the addition of tiwai onion beet extract 0.8% to 1.2% [26] and rough extract of *carotenoids Chlorella phyrenoidosa* that ranges from 0.42% to 0.79% [2]. he free fatty acid content of soap with *Eucheuma cottoni* extract which fulfills SNI requirement are 4% and 4.5% concentration. The high free fatty acid content in soap will result in rancid odor easily due to oxidized free fatty acids. According to [4], the maximal requirement of good soap quality is 2.5 %.

3.6. *pH*

The results of the pH test of *Eucheuma cottoni* soap extract gained the highest value (11.612 ± 0.167) at 0% concentration and the lowest value (9.463 ± 0.189) at a concentration of 3.5%. The pH value of the control is the highest pH. The pH test results can be seen in Table 6.

Table 6. The Result of pH Solid Soap with *Eucheuma cottoni* Extract

Treatment	pH
0%	11.612 ± 0.167^{a}
3.5%	9.463 ± 0.189^{b}
4%	10.15 ± 0.11^{c}
4.5%	10.612 ± 0.171^{d}

The pH value of the control is the highest pH. This higher pH value results from an imperfect *hydrolysis* reaction in the *saponification* process [28].

The skin has a pH value that ranges from 5.4 to 5.9. If the skin exposes to soap liquid, then the skin of pH will rise to a base. The skin will have a normal pH again which is 30 minutes after rinsing with water. Soap has an alkaline pH that serves to remove dirt in the form of fat or sweat. The high or alkaline pH value is not good for the skin. Because it can cause dry skin to irritation to the skin that can bring redness. Good pH standard for skin ranges from 9 to 1 [26]. So, therefore, this will not damage the skin and protect the health of consumers.

The addition of *Eucheuma cottoni* extract in the soap gave the higher extract concentration, the pH of the soap was also higher. The value of soap pH of *Eucheuma cottoni* extract is better compared to commercial soap in Kenya [29], white star and jamaa brand which has pH 11.71 and 11.44. The pH increment is due to the saponin content present in the extract. Conforming to Irmayanti *et al.* [12], saponins and polyphenols possess alkaline characters, so their addition in soap will increase the basicity of the soap preparations.

Test of pH in soap is very important to do to find out whether the pH is acid or base. A good pH soap is close to the pH of the skin which is not too acidic and too alkaline. The high pH will damage the skin. pH is one of the chemical parameters that serve to see the level of acidity or alkalinity of soap. Soap with a high pH will cause skin irritation [3].

3.7. *Hardness*

The results of hardness test of *Eucheuma cottoni* soap extract get the lowest value of 686.5 gram force at 0% concentration and the highest value of 1446.293 gram force at 4.5% concentration Hardness test results can be seen in Table 7.

Table 7. The Result of Hardness test Solid Soap with *Eucheuma cottoni Extract*

Treatment	Hardness (*gf*)
0%	686.5^{a}
3.5%	1134.42^{b}
4%	1199.71^{b}
4.5%	1446.29^{c}

The results show that the value hardness of soap is higher with the increase percentage extract Eucheuma cottoni. The increasing of soap hardness is inversely proportional to a soap water content of *Eucheuma cottoni* extract. The increasing of hardness value is due to the higher the extract added to the soap formula, then the added water is less. Softsoap will quickly run out when using with water. One of the factors affecting hardness is water content [11]. If the water content is high, the hardness value of the soap will be low.

The hardness results of soap better when compared with a result of soap of basil leave ethanol extract that is equal to 311.7 gram force [24]. Hardness parameter not shown in standard soap by SNI. This level of hardness is a parameter that affects the resistance of soap. The higher of the hardness value, then the soap gets harder and tends to be more resilient when used. Another factor that affects the level of hardness of soap is the type of saturated fatty acids used in soap making. Saturated fatty acids are fatty acids that have double bonds, usually will harden at room temperature so can increase the hardness of soap. The series of C or carbon in fatty acids affects the hardness of transparent soap.

The influence carbon series is C16 - C18. Green tea extract contains linoleic fatty acid and linolenic fatty acid in small amounts. Therefore, the addition of green tea extract on transparent soap does not affect the hardness [3].

A good soap should have high hygienic power capacity and remain stable when used or not and at different water hardness levels. Soap with *Eucheuma cottoni* extract should have a good enough hardness, to maximize the use of soap and resistance when exposed to water. Another factor that affects hardness is the addition of stearic acid. The use of too little stearic acid will produce soap with a soft texture. This is because stearic acid is a saturated fatty acid that will solidify at room temperature. Fatty acids that do not have double bonds tend to be solid at room temperature [22].

3.8. Foam Stability

The test results of foam stability on soap of *Eucheuma cottoni* extract gained the highest value (93.39 ± 1.47%) at a concentration of 4.5% and the lowest value of 79.63 ± 0.63% at a concentration of 0%. The results show that the higher of the extract added, then the higher of the resulting foam stability. The test results of foam stability can be seen in Table 8.

Table 8. The Result of Foam Stability Solid Soap with *Eucheuma cottoni* Extract

Treatment	Foam Stability (%)
0%	79.63 ± 0.63^{a}
3.5%	84.48 ± 1.22^{b}
4%	89.70 ± 0.5^{c}
4.5%	93.39 ± 1.47^{d}

The results show that the higher the extract added, thus the higher the resulting foam stability. This is because the *Eucheuma cottoni* extract has an active ingredient in the form of saponin which is 80.9%. Saponin is an active ingredient that has a bitter taste and can form a stable foam and soluble in water. Other factors that affect the foam stability of soap are the types of fatty acids in the oils used and the addition of coco-DEA to the soap formulas that have a function to stabilize the foam and soften the soap. Saponin, when shaken, will form a stable foam [19]. The saponin structure causes saponins to be like soaps or detergents, thus saponins are called natural surfactants. Factor that affects the high stability of soap foam is the type of fatty acids used. Lauric acid in coconut oil will produce a soft foam, palmitic acid in palm oil can stabilize foam, oleic acid in corn oil and soybeans, as well as ricinoleic acid in castor oil, can produce a stable and soft foam [16].

The highest foam stability on soap of *Eucheuma cottoni* extract exists in soap with 4.5% concentration. The foam stability is obtained higher than the soap foam stability with tomato extract and white tea extract. The value of foam stability is also in accordance with the criteria because it has a high foam stability. The value of foam stability on a soap with the addition of white tea extract ranged from 72.19% to 81.22% [30]. Soap with the addition of tomato extract has a foam stability of 86.67% to 93.75% [1].

Foam has an important role in soap selection. The percentage of foam stability is not listed in the SNI, as it is not related to a cleansing of the skin. At the time of using, the foam has a role to move the fragrance on a soap to the skin and the level of consumer preference when using soap. The majority of consumers prefer soap with a lot of foam and stable.

3.9. *Hedonic Test*

3.9.1. *Appearance*

The results of *the hedonic* test with *Kruskal-walls* test on *Eucheuma cottoni*, soap extract parameters show *Chi-square* count (3.34) < *Chi-square* table (5.991), the difference of concentration of *Eucheuma cottoni* extract on a soap does not have a significant difference in parameter appearance. The highest result on the appearance parameter of 7.27 is found in soap without the addition of extract.

The lowest result is gained by soap with the addition of *Eucheuma cottoni* extract of 4.5% with a value of 6.73. Here is a table of appearance hedonic test results:

Table 9. The Result of Appearance Test Solid Soap with *Eucheuma cottoni* Extract

Treatment	Appearance
0%	7.27 ± 1.01^{a}
3.5%	7 ± 1.05^{a}
4%	7 ± 1.05^{a}
4.5%	6.73 ± 1.36^{a}

This is because of the appearance of soap with darker than any other soap. The most preferred soap is the control soap because the added extract is brown, thus it will affect the darker soap appearance. Soap features include soap and color forms of soap [34]. This appearance will affect consumer's interest in buying. Soap that has a lighter coloration and clearer appearance will have an effect on panelist favorability compared with soap that has a dark color [25].

3.9.2. *Odor*

The highest result on the odor parameter of 7.53 is found in soap without the addition of extract. The lowest result is obtained by soap with the addition of *Eucheuma cottoni* extract of 4.5% with a value of 6.06 (Table 10).

Table 10. The Result of Odor Solid Soap with *Eucheuma cottoni* Extract

Treatment	Odor
0%	7.53 ± 0.89^{b}
3.5%	6.53 ± 1.00^{a}
4%	6.13 ± 1.00^{a}
4.5%	6.06 ± 1.14^{a}

The odor that exists in this soap comes from the addition of jasmine fragrance and the odor brought by *Eucheuma cottoni* extract. The smell of *Eucheuma cottoni* extract tends to fishy because it has a high salt content. A concentration of 0% has the highest hedonic value of odor because at this concentration there is no addition of extract. Therefore, the odor is only derived from jasmine fragrance only. The odor of soap will affect the level of consumer preference in a product. The odor resulted from the addition of jasmine odor to soap. The odor that is added does not reduce the function of soap but can increase consumer’s attraction [33].

3.9.3. *Foam*

The highest result on the foam parameter of 7.46 is obtained in soap with the addition of *Eucheuma cottoni* extract of 4.5%. The lowest result is gained by soap without the addition of *Eucheuma cottoni* extract with a value of 5.67. The foam hedonic value is higher along with the increasing amount of extracts added. Here is a table of hedonic test results of foam parameters:

Table 11. The Result of Foam Solid Soap with *Eucheuma cottoni* Extract

Treatment	Foam
0%	5.67 ± 1.21^{b}
3.5%	7.07 ± 1.34^{a}
4%	7.2 ± 1.09^{a}
4.5%	7.46 ± 1.0^{a}

The amount of foam produced is affected by the high saponin content in the extract added. Saponins have characteristics like soap, which can produce foams. The majority of consumers like soap with a lot of foam. In fact, many of these foams are not balanced with the hygienic power of soap. Foaming on a soap is influenced by various factors, namely the existence of active ingredients such as surfactants, foam stabilizers, and soap making materials such as the type of oil used [27].

3.9.4. *Tight Impression*

The highest result on the tight impression parameter is 7.27 gained on a soap with the addition of *Eucheuma cottoni* extract of 4.5%. The lowest result is gained by soap without the addition of *Eucheuma cottoni* extract with a value of 6.13. The following is a hedonic test results table of tight impression parameters:

Table 12. The Result of Tight Impression Solid Soap with *Eucheuma cottoni* Extract

Treatment	Tight Impression
0%	6.13 ± 1.45^{a}
3.5%	6.47 ± 0.89^{a}
4%	7.06 ± 0.98^{b}
4.5%	7.27 ± 0.69^{b}

The *hedonic* test of the tight impression is done by trying to wash hands with soap. The intended of tight impression is that there is no slippery feeling left behind after the use of the soap. Soap that has a good tight impression tend to be preferred by consumers compared with soap that has a sense of slippery. The tight impression is the second most important parameter of soap because it can affect consumer's interest in choosing soap [32].

3.9.5. *Texture*

The highest result on the texture parameters of 7.4 is found in soap with the addition of *Eucheuma cottoni* extract of 4.5% and 4%. The lowest result is gained by soap without the addition of *Eucheuma cottoni* extract with a value of 7.13. The following is a table of hedonic test results of texture parameters:

Table 13. The Result of Texture Solid Soap with *Eucheuma cottoni* Extract

Treatment	Texture
0%	7.13 ± 1.17^{a}
3.5%	7.2 ± 0.96^{a}
4%	7.4 ± 0.96^{a}
4.5%	7.4 ± 0.81^{a}

The texture of this soap is influenced by water content, stearic acid content, coco-DEA usage, sugar composition, and oil utilizing. This texture greatly affects the use of soap. Soap with a soft texture will easily run out when used. Increasingly hard soaps will have good resistance to environmental damage and changes [8].

4. Conclusion

The conclusions gained from this research are as follows:

1. The concentration of adding the best roughness extract of *Eucheuma cottoni* on the making process of solid soap is at a concentration of 3.5%. This is seen from the results of the highest antioxidant activity test with a value of 10.296% and followed by the chemical physics test value

with water content of 8.54%, free fatty acid content of 2.59%, pH is 9.5, hardness of 1134.42 gf, stability of foam is 84.48% and with sufficient hedonic value favored by panelists;

2. The addition of *Eucheuma cottoni* extract at a concentration of 3.5% produces *Eucheuma cottoni* soap extract with an antioxidant activity value of 10.296%, the higher of the extract added to the soap can give effect to the physicochemical characteristics of soap.

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