

# Formulation of Seaweed (*Eucheuma cottonii* Doty) Lotion

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**ABSTRACT:** Seaweed (*Eucheuma cottonii* Doty) has potential as an antioxidant because it contains kappa-carrageenan which can counteract free radicals. Formulation of seaweed (*Eucheuma cottonii* Doty) into lotion preparations can minimize the negative effects of sun exposure, because it can reflect solar radiation or work as a physical sunscreen. To give the maximum effect, particle size reduction is carried out, so that the smaller the particle size of the seaweed powder, the surface area increases. This study aims to determine the formulation and evaluate the preparation of lotion from seaweed powder. This research was conducted using an experimental method. The lotion was made with three variations of seaweed powder concentration (*Eucheuma cottonii* Doty), namely 2.5%, 3% and 5%. Tests were carried out before and after accelerated conditions at 50C and 35oC for 12 hours each for 12 cycles with test parameters including organoleptic, homogeneity, pH, spreadability, viscosity and flow type. The results obtained in the organoleptic test showed no change in the three formulas both before and after the accelerated condition. The pH test showed that Formula 2 and Formula 3 still showed that the preparation remained in the skin pH range for sunscreen. In the homogeneity test, all preparations were homogeneous, as well as the spreadability test met the test requirements criteria. Based on the tests carried out, it can be concluded that formulas 2 and 3 have optimum stability.

**KEYWORDS:** *Eucheuma cottonii* Doty, lotion, seaweed powder.

## 1. INTRODUCTION

The skin serves as a barrier against outside effects and is the outermost organ that covers the whole surface of the human body. Skin maintenance and protection are necessary since damage to the skin will affect its health and look. Wrinkles, scales, dryness, and fissures are indicative of the process of skin damage (Pratama and Busman, 2020). The existence of free radicals is one of the reasons of skin damage. One type of reactive chemical that has unpaired electrons is a free radical. Free radicals can develop in the human body as a result of normal cell metabolism, undernutrition, poor food, unhealthy lifestyle choices, cigarette smoke, UV rays, and contaminated environments. In order to reduce or prevent potential skin damage in the presence of antioxidants, this calls for an antidote (Pratama and Busman, 2020).

Exogenous antioxidants are required because although humans have antioxidants in their bodies, the quantity is insufficient to combat excessive levels of free radicals (Hani and Milanda, 2017; Fawwaz et al., 2023). Antioxidants work to diminish free radical compounds by quenching free radicals, chelating metals, lowering levels of enzymes that contribute to the formation of free radicals, and activating internal antioxidant enzymes. This delays, prevents, and eliminates oxidative damage to target molecules (Arnanda and Nuwarda, 2019; Fawwaz et al., 2020).

Lotion is one type of cosmetic preparation. One of the cosmetic products with a higher water content in the emollient class (softener) is lotion. Moisturizers, emulsifiers, fillers, cleansers, active agents, solvents, scents, and preservatives are some of the substances that make up lotion. The purpose of the lotion is to keep skin moist, clean, stop water loss, or preserve active components. Lotion has a number of benefits, including being simple to use or apply, spreading uniformly, working directly on local tissues, and producing the anticipated therapeutic effect more readily (Iskandar et al., 2021)

Seaweed (*Eucheuma cottonii* Doty) is an illustration of a marine plant whose primary component, kappa-carrageenan, possesses antioxidant potential. Carrageenan is a cosmetic ingredient that can be used in lotions, face creams, and anti-aging products (Necas and Bartosikova, 2013; Erungan et al., 2009). Due to its ability to reflect solar radiation or function as a physical sunscreen, seaweed can be used into lotion compositions to reduce the harmful effects of sun exposure. Particle size reduction is used to provide the best results, increasing the surface area of the seaweed powder the smaller the particle size. The intention is for the effect of reflecting sunlight to provide the greatest amount of coverage (Amatullah et al., 2009; SNI, 1996).

Utilize seaweed powder, which is prepared as Lotion, in accordance with this description. In this work, powdered seaweed was used to create a lotion. Lotion preparations were chosen for this formulation because they have a sufficient amount of water, can be applied quickly, have excellent spreading and penetrating power, don't feel greasy, have a cooling effect, and are simple to wash off with water.

## 2. EXPERIMENTAL SECTION

### 2.1. General

A set of maceration tools, a set of rotavapor tools, an analytical balance (Kern ABJ-NM/ABS-N), a pH meter (Ph-107 pocket-sized pH meter), a voltmeter, a water bath (Mettler®), a thermometer, a Brookfield Viscometer Type DV-I Prime, and a climatic chamber (Mettler®) are among the equipment utilized.

Seaweed powder, stearic acid (Merck), triethanolamine (PT. Sumber Rejeki), liquid paraffin (PT. Sumber Rejeki), cetyl alcohol (PT. Sumber Rejeki), glycerin (PT. S. propyleneglycol (PT. Sumber Rejeki), methyl paraben (PT. Sumber Rejeki), propyl paraben (PT. Sumber Rejeki), and distilled water were the ingredients used.

## 2.2. Sample preparation

Seaweed was collected from the Takalar district and thoroughly cleaned under running water to remove all dirt. After which it was sun-dried and drained. After obtaining the dry sample, the particle size is decreased using the cutting process. Cutting the material into smaller pieces, blending it at a specific speed to create very fine particle sizes, then filtering or sifting it to create a uniform particle size are the steps in the process of lowering particle size.

## 2.3. Lotion Formulation

The design formula for seaweed powder lotion can be seen in **Table 1**.

**Table 1.** Formula design for *Eucheuma cottonii* seaweed powder lotion. (doty)

| Ingredients        | Concentrations (% w/v) |           |           |
|--------------------|------------------------|-----------|-----------|
|                    | F1                     | F2        | F3        |
| Seaweed Dispersion | 2,5%                   | 3%        | 5%        |
| Stearic acid       | 3,5%                   | 3,5%      | 3,5%      |
| Cetyl alcohol      | 1,5%                   | 1,5%      | 1,5%      |
| Liquid Paraffin    | 3%                     | 3%        | 3%        |
| Glycerin           | 3%                     | 3%        | 3%        |
| Triethanolamine    | 1%                     | 1%        | 1%        |
| Propyl Paraben     | 0,02%                  | 0,02%     | 0,02%     |
| Methyl Paraben     | 0,18%                  | 0,18%     | 0,18%     |
| Aquades            | Ad 250 mL              | Ad 250 mL | Ad 250 mL |

All of the elements required for the cream formulation were made after producing a physically stable basis, and each ingredient was then weighed individually. Both the oil phase and the aqueous phase of the components are separated. The materials are then heated to 70 °C until all of them melt, including the water and oil phases. When an oil in water base had developed, the water and oil phases were introduced to the hot mortar and slowly mixed together. Following the addition of the seaweed powder samples, mix until homogenous once more. The scent is added at a temperature of 40 °C, after which it is swirled once more for another 25 minutes to achieve homogeneity.

## 2.4. Evaluation of Lotion

### a. Organoleptic assessment

Organoleptic observations included variations in form, tone, and scent that appeared every 30 days or so.

### b. pH measurement

A pH meter is used for this measurement, which is done by submerging the instrument or electrode in the sample being tested, waiting a short while for the number to stabilize on the screen, and then writing down the value that appears. If the pH value during storage is between 4.5-8.08, the conditions are met.

### c. Homogeneity Testing

Lotion is consumed for each formula. The lotion must demonstrate a uniform composition, which means that no solid material can be felt on the glass, after being suitably applied and massaged onto the glass plate (Slamet, 2020).

### d. Spreadability Testing

The device's middle is filled with a 15 cm-diameter glass of lotion, and it is left there for one minute. After 100 g of load had been supplied for 1 minute, three replications of this process were completed, and the diameter of the lotion that spread was then measured (Slamet, 2020).

### e. Viscosity Testing

Utilizing a rotary Brookfield viscometer, the preparation was placed into a glass beaker before being tested for viscosity using rotor No. 6. The preparation is completed with the spindle submerged, after which the tool is turned on and the results are recorded (Pujiastuti and Kristiani, 2019).

#### f. Stability Testing

Stability evaluation was carried out before and after the conditions were applied, namely at 5 °C and 35 °C alternately for 12 hours each for 10 cycles and then organoleptic, pH, homogeneity, spreadability, and viscosity tests were carried out again (Banker and Rhodes, 2002).

### 3. RESULTS

Stability evaluation of seaweed powder as a lotion with varying concentrations of seaweed powder divided into some parameters below:

#### a. Organoleptic Observation

The results of organoleptic examination of seaweed powder lotion can be seen in **Table 2** below:

**Table 2.** Organoleptic Observation of the Lotion Formulas from Seaweed Powder Before and After Forced Conditions

| Formula | Checking Type | Condition      |                |
|---------|---------------|----------------|----------------|
|         |               | Before         | After          |
| F 1     | Odor          | Characteristic | Characteristic |
|         | Color         | Opaque         | Opaque         |
|         | Consistency   | Viscous        | Viscous        |
| F 2     | Odor          | Characteristic | Characteristic |
|         | Color         | Opaque         | Opaque         |
|         | Consistency   | Viscous        | Viscous        |
| F 3     | Odor          | Characteristic | Characteristic |
|         | Color         | Opaque         | Opaque         |
|         | Consistency   | Viscous        | Viscous        |

Information:

F1 = Formula 1 with a concentration of 2.5% seaweed powder

F2 = Formula 2 with a concentration of 3% seaweed powder

F3 = Formula 3 with a concentration of 5% seaweed powder

#### b. pH measurement

pH measurements were carried out to determine the pH propyl of seaweed powder lotion. The results of pH measurements can be seen in **Table 3**.

**Table 3.** Measurement of pH of Seaweed Powder Lotion Before and After Forced Conditions

| Formula | Average pH    |               |
|---------|---------------|---------------|
|         | Before        | After         |
| F1      | 7.592 ± 0.002 | 7.278 ± 0.009 |
| F2      | 7.672 ± 0.01  | 7.351 ± 0.001 |
| F3      | 7.699 ± 0.01  | 7.748 ± 0.002 |

#### c. Homogeneity Testing

The homogeneity test was carried out physically to determine the homogeneity of the seaweed powder lotion. The full results can be seen in **Table 4** below.

**Table 4.** Homogeneity Test Results for Seaweed Powder Before and After Forced Conditions

| Formula | Homogeneity Testing |           |
|---------|---------------------|-----------|
|         | Before              | After     |
| F1      | Homogenic           | Homogenic |
| F2      | Homogenic           | Homogenic |
| F3      | Homogenic           | Homogenic |

#### d. Spreadability Testing

Spreadability test was carried out physically to determine the distribution of seaweed powder lotion (*Eucheuma cottonii*, Doty). The full results can be seen in **Table 5** below.

**Table 5.** Testing of Spreadability of Seaweed Powder Lotion Before and After Forced Conditions.

| Condition | Formula | Average Spreadability (mm) |           |           |           |
|-----------|---------|----------------------------|-----------|-----------|-----------|
|           |         | 0 (g)                      | 50 (g)    | 100 (g)   | 150 (g)   |
| Before    | F 1     | 6.62±0.04                  | 7.17±0.39 | 7.72±0.43 | 8.43±0.43 |
|           | F 2     | 5.67±0.11                  | 6.05±0.28 | 6.5±0.28  | 6.62±0.68 |
|           | F 3     | 5.48±0.33                  | 6.15±0.51 | 6.51±0.41 | 6.98±0.60 |
| After     | F 1     | 4.90±0.90                  | 5.52±1.26 | 5.97±1.44 | 6.37±1.51 |
|           | F 2     | 4.59±0.66                  | 4.93±0.73 | 5.33±0.86 | 5.73±0.94 |
|           | F 3     | 4.95±0.33                  | 5.60±0.05 | 6.03±0.16 | 6.43±0.16 |

#### e. Viscosity Testing

Viscosity testing of seaweed powder lotion preparations can be seen in the following table. The full results can be seen in **Table 6** below.

**Table 6.** Viscosity Testing of Seaweed Powder Lotion Before and After Forced Conditions.

| Condition      | Replications | Viscosity (cP)   |                     |                    |
|----------------|--------------|------------------|---------------------|--------------------|
|                |              | F1               | F2                  | F3                 |
| Before         | 1            | 7620             | 10560               | 12460              |
|                | 2            | 7100             | 10060               | 16980              |
|                | 3            | 7020             | 96760               | 15160              |
| <b>Average</b> |              | 7246.66 ± 325.78 | 39126.66 ± 49912.55 | 14866.66 ± 2274.23 |
| After          | 1            | 9420             | 12160               | 13300              |
|                | 2            | 7880             | 11140               | 19340              |
|                | 3            | 9540             | 10080               | 18420              |
| <b>Average</b> |              | 8946.66 ± 925.70 | 11126.66 ± 1040.06  | 17020.00 ± 3254.28 |

## 4. DISCUSSION

Seaweed powder, which is used as a component in lotion formulations. Because seaweed is high in vitamins and antioxidants, the resulting lotion has more benefits than similar products. Carrageenan, amino acids, protein, minerals, trace elements, sugar, starch, and vitamins A, B, C, E, and K are all present in seaweed. The skin can benefit from using carrageenan as a moisturizer and softener. Nevertheless, vitamin C serves as an antioxidant. Antioxidants work by quenching free radicals, chelating metals, and lowering levels of enzymes that contribute to the formation of free radicals in order to reduce free radical compounds. This helps to prevent premature aging and makes them useful as sunscreen.

Seaweed is also incredibly rich in minerals including iron, magnesium, potassium, and zinc, which can be employed as antioxidants and to dissolve pollutants. Color, preparation stability, and viscosity or thickness all contribute to the appealing look of lotion preparations. Carrageenan serves as an emulsifier, thickening, gelling agent, and stabilizer in cosmetics (Rantika *et al.*, 2020).

Three formulas comprising seaweed powder in varying percentages of 2.5%, 3%, and 5% were created for the manufacture of seaweed powder lotion. Several steps of testing, including the organoleptic test, homogeneity test, pH test, spreadability test, viscosity test, and stability test, were conducted to produce a pharmaceutically stable composition.

Organoleptic observations were carried out to determine whether there were changes in color, odor, and consistency that occurred during storage. Organoleptic examination of the lotion preparations for the three formulas showed that the preparations were physically stable because they did not change color, smell, and consistency, both before and after accelerated storage conditions. This can be seen in **Table 2**.

The results of the pH test can be seen in **Table 3**. Measurement of the pH test of the preparation was carried out before and after the forced conditions. This relates to the stability and safety of the use of the preparation to avoid skin irritation for the wearer. The pH measurement aims to determine the acidity value of a formulation that has been formulated. Based on SNI 16-4399-1996 that the required pH value of skin moisturizing products for lotion ranges from 4.5 to 8.08. If the preparation has a very high or very low pH value it will cause skin irritation. The results of measuring the pH of the lotion preparations showed that the pH values in formula 1, formula 2, and formula 3 before and after the forced conditions met the criteria according to the quality standard of SNI 16-4399-1996. As for the pH of the lotion preparations after the forced conditions decreased in pH, but this decrease was still within the pH range of the preparations that met the criteria. Changes in pH values can be caused by environmental factors, such as temperature, storage and extracts that are less stable in preparations due to oxidation (Rantika *et al.*, 2020).

The results of the homogeneity test can be seen in **Table 4**. In the homogeneity test carried out by observing the sample using a microscope with a magnification of 40 times, the result was that the lotion preparation formula was homogeneous which was indicated by the absence of coarse particles present in the preparation. Variations in the concentration of active ingredients do not affect the homogeneity of the preparation.

Spreadability is the ability of bases and active substances to spread over the surface of the skin to provide a therapeutic effect. Spreadability test was carried out to determine the extent of lotion spread when applied to the skin. Data from the spreadability test results can be seen in **Table 5**. The table shows that the three formulas that have different variations of the active ingredients are given a load of 50 grams, 100 grams and 150 grams. The results show that the heavier the load applied, the wider the spreading power, this can be seen in the three formulas both before and after the forced conditions (Rantika *et al.*, 2020).

The results of the viscosity test can be seen in **Table 6**. Viscosity is a very important property in semisolid preparations, especially lotion preparations, which provides an overview of the resistance of a preparation to flow, both when it is produced, when it is put into packaging, as well as important properties during use. such as consistency, spreadability, and moisture. The viscosity requirements according to SNI 16-43399-1996 are 20 – 500 Poise. The viscosity of the lotion preparation was measured using a Brookfield Viscometer with spindle number 6, and 50 rpm. The test results show that the viscosity for the three lotion formulations falls within the required viscosity range (SNI, 1996).

## 5. CONCLUSION

Seaweed powder can be formulated into lotion preparations. From the results of physical stability testing, formula 2 and formula 3 with active ingredient concentrations of seaweed powder of 3% and 5% show optimal physical stability.

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