Antioxidant activity of seaweed (*Eucheuma cottonii*) and coconut (*Cocos nucifera*) masks

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Abstract. The processing of agricultural products is one of the pillars of the development of agro-industry in an area. In LabuhanKertasari Village, the main products from the agricultural sector are seaweed, hybrid maize, and coconut. However, farmers only sell agricultural products in the form of raw materials without processing them first. Processed products certainly have a higher economic value than raw materials. For this reason, this research was conducted to process seaweed and coconut into masks which were then tested for the antioxidant activity of the masks that were processed. The research conducted was a laboratory experimental study where seaweed and coconut were first processed into a powder. The treatment given is processing seaweed into powder with an alkaline process and without an alkaline process. Then, mixing seaweed powder and coconut powder with three ratios, namely seaweed powder: coconut powder (1:1, 2:1, 3:1). The results showed that the antioxidant activity of the masks 1:1, 2:1, 3:1 were 743.9 respectively; 513.69; and 406.23 (with alkaline seaweed powder) and 193.67; 174.09; and 149.10 (with seaweed powder without alkalization). The result showed that a mask with a ratio of 3:1 without the alkalization process is the mask with the highest antioxidant activity value and suitable for the skin.

1. Introduction
Agroindustry is an industry that processes agricultural products into semi-finished or finished products that are ready for use. Agroindustry includes post-harvest handling, food and beverage processing, biopharma, bioenergy, product processing, and agro-tourism [1]. LabuhanKertasari Village is a village in West Sumbawa regency that has coconut and seaweed which are the main agricultural products. But, farmers there have not implemented agroindustry from their agricultural products optimally. Because they tend to sell it in the form of raw materials without being processed. The two materials can be maximally utilized into processed products that are ready to use and very useful, on the other hand, it has higher economic value.

*Eucheumacottonii* a type of seaweed cultivated by farmers. It is one type of red algae that contains polysaccharides, as well as hydro-solid compounds which are important components for organisms and have various functions, including anti-inflammatory, anticoagulant, antibacterial, and antioxidant that
can inhibit virus attacks [2]. The antioxidant is substances that can neutralize free radicals so that atoms are reactive because they don’t have an electron pair can get an electron pair [3]. Free radicals are molecules that are responsible for diseases such as premature aging. There are two kinds of antioxidants, natural and synthetic. Seaweed is one of the natural antioxidants. The result of research by [3] showed that the seaweed pulp of Sargassum sp. And Eucheuma cottonii contain an alkaloid, flavonoid, phenol, and saponin with antioxidant activity (IC$_{50}$) of 145.89 ± 0.42. Likewise with the result of [4] which showed IC$_{50}$ in Eucheumacottonii of 97.522.

Coconut (Cocos nucifera) is a monocot plant that grows in about 90 tropical regions of the world. It’s called the tree of life because of the various benefits it has, including nutritional benefits contained in its meat and water [5]. Several studies have been conducted to identify the active compounds in coconut. Various extracts, fractions, and compounds isolated from coconut fruit parts then analyzed to show different activities, including anti-hypertension, protection against ulcers, anti-inflammatory, antioxidant, anti-fungal, and antiviral [6].

To maximize the implementation of agroindustry in Labuhan Kertasari Village, both resources can be maximally utilized by processing them into superior products. One of them is a face mask. The results of a survey conducted by [7] show that of 45 respondents, 37 of them prefer to use traditional cosmetics. Of the 37 respondents, the most widely used type of cosmetics was face masks, namely 15 people (40.54%). In addition, the results of the researcher's initial survey of 50 respondents consisting of 31 women and 19 men with an age range of 16-60 years showed that 88% of respondents stated that caring for facial skin is important, 74% had treated using face masks, only 34% of respondents know that seaweed and coconut have a good composition for facial skincare, and 94% of respondents have never used a face mask made from seaweed and coconut. This proves that face masks are one of the most commonly used cosmetics.

2. Materials and Methods
2.1. Preparation of seaweed powder
In this procedure, there are 2 treatments given. The first is the preparation of seaweed powder with an alkaline process, and the second is the preparation of seaweed powder without an alkaline process. The steps are as follows.

2.1.1. Preparation of seaweed powder with the alkaline process. 100 grams of dried seaweed is washed and cleaned, the put in 6% KOH which has been heated to 80°C, and then heated to a controlled temperature of 80°C for 2 hours. After that, separated from KOH and washed to neutral pH. Then, oven at 60°C for 24 hours. The final step, mashed and sifted to get the seaweed powder.

2.1.2. Preparation of seaweed powder without alkaline process. 100 grams of dried seaweed is washed thoroughly then simmered in water for 3 hours. After that, it is drained and crushed. And then, oven at 60°C for 24 hours. . The final step, mashed and sifted to get the seaweed powder.

2.2. Preparation of coconut powder
Peeled coconut until flesh remains white, then washed thoroughly. After that, cut it and soak in boiling water for 5 minutes, then remove and drain. Grate then squeeze the coconut milk. And then, oven the coconut dregs at 60°C for 24 hours. The final step, mashed and sifted to get the coconut powder.

2.3. Mixing or processing seaweed powder and coconut powder into masks
Combine seaweed powder and coconut powder in a ratio of 1:1, 2:1, and 3:1. The mixture has a total weight of 12 grams. So, for the sample, I, mix 6 grams of alkaline seaweed powder with 6 grams of coconut powder. Sample II, mix 8 grams of alkaline seaweed powder with 4 grams of coconut powder. Sample III, mix 9 grams of alkaline seaweed powder with 3 grams of coconut powder. Next, for sample IV, mix 6 grams of seaweed powder without alkalization with 6 grams of coconut powder. Sample V, mix 8 grams of seaweed powder without alkalization with 4 grams of coconut powder. Sample VI, mix 9 grams of seaweed powder without alkalization with 3 grams of coconut powder.

2.4. Measurement of the antioxidant activity of three mask formulations
Prepare a blank solution. Then, make sample solutions with concentrations of 50, 100, 150, 200, and 250 ppm. 3 mL of each sample was put into the test tube and 1 mL of 0.004% DPPH solution was added,
shaken, and allowed for 30 minutes. After that, the absorbance of the blank solution and samples were measured using a UV-Vis spectrophotometer at a wavelength of 517 nm. Measuring are performed on the six samples with 5 different concentrations. The final step searched the linear regression equation between concentration and % antioxidant to find IC$_{50}$ value.

2.5. Statistical Analysis

The statistics used in this research are linear regression equations which are carried out with the help of Microsoft Excel applications. Linear regression equations are performed by comparing sample concentrations (50, 100, 150, 200, and 250 ppm) with % antioxidants. The % of antioxidants is obtained through the absorbance data of the difference between the absorbance data of the sample and the absorbance data of the blank solution which is then compared with the absorbance data of the blank and multiplied by 100%. From the linear regression equation, it is determined that the value of Y = 50 (determined value of IC$_{50}$) is then searched for the x value. The x value is the IC$_{50}$ value or the value of its antioxidant activity.

3. Results and Discussion

The results showed that the seaweed powder produced was brownish in color and still had a slight seaweed aroma. The brown color in carrageenan shows the original color of *Eucheumacottoni* seaweed, which is reddish or brownish in color. The results of making seaweed powder through the alkalization process or without the alkalization process showed the same results physically (color, texture, and aroma). The resulting coconut powder is pure white. This is because coconut powder has a high degree of whiteness compared to other powders. After the two ingredients are mixed, the dominant color and aroma come from the seaweed powder, which is brown with a distinctive aroma of seaweed. The results of measuring the antioxidant activity of the six samples are shown in Tables 1 and 2.

| Sample | Sample concentration | Absorbance | % antioxidant | Regression equation | IC$_{50}$ value | Category |
|--------|----------------------|------------|---------------|---------------------|-----------------|----------|
| I      | 10                   | 0.454      | 37.98         | Y = 0.0661x + 38.023 | 743.9           | Very Weak |
|        | 50                   | 0.446      | 39.07         |                     |                 |          |
|        | 100                  | 0.441      | 39.75         |                     |                 |          |
|        | 150                  | 0.437      | 40.3          |                     |                 |          |
|        | 200                  | 0.43       | 41.26         | R$^2$ = 0.9787      |                 |          |
|        | 10                   | 0.452      | 38.25         | Y = 0.0233x + 38.031 | 513.69          | Very Weak |
|        | 50                   | 0.445      | 39.21         |                     |                 |          |
|        | 100                  | 0.436      | 40.44         |                     |                 |          |
|        | 150                  | 0.429      | 41.39         | R$^2$ = 0.9976      |                 |          |
|        | 200                  | 0.419      | 42.76         |                     |                 |          |
|        | 10                   | 0.458      | 37.43         | Y = 0.0316x + 37.168 | 406.23          | Very Weak |
|        | 50                   | 0.448      | 38.8          |                     |                 |          |
|        | 100                  | 0.437      | 40.3          |                     |                 |          |
|        | 150                  | 0.425      | 41.94         | R$^2$ = 0.9996      |                 |          |
|        | 200                  | 0.414      | 43.44         |                     |                 |          |
The results of testing the antioxidant activity of the five samples showed that there were differences in each sample. The antioxidant activity is indicated by the IC$_{50}$ value where this value is inversely proportional to its strength. The higher the IC$_{50}$ value, the smaller the strength of its antioxidant activity, and vice versa [8]. For more details, see Table 3.

Table 3. Category of the strength of antioxidant activity

| No | IC$_{50}$ Value | Category   |
|----|----------------|------------|
| 1  | < 50 ppm       | Very strong|
| 2  | 50 – 100 ppm   | Strong     |
| 3  | 100 – 150 ppm  | Moderate   |
| 4  | 150 – 200 ppm  | Weak       |
| 5  | >200 ppm       | Very Weak  |

The weak antioxidant activity is influenced by the excessive heating process so that during the alkalization process, the antioxidant activity weakens. This is in accordance with what was explained by [8] namely that the difference in the IC$_{50}$ value can be caused by the number of antioxidants contained in the extract. In the time variation of 60 minutes and 75 minutes, the IC$_{50}$ value decreased. This occurs due to antioxidant damage in the extract which is influenced by the length of time the contact between the active substance and the solvent increases due to prolonged heating. The best antioxidant activity was in sample VI which showed moderate category. This is in accordance with the research results of [3] which showed that *Sargassum* sp. and *E. cottonii*, IC$_{50}$ of 145.89 ± 0.42. [4] showed antioxidant activity (IC50) in seaweed *Eucheumaspinosum* at a concentration of 95% ethanol solvent of 97.522.

So, from this research, we can develop an antioxidant mask made from seaweed and coconut which can be used to nourish and maintain healthy skin. Because antioxidants in that masks are able to attenuate the damage caused by UV radiation in the skin by suppressing the production of free radicals triggered by UV rays and protecting cells from oxidative stress [9].
4. Conclusion
Processing agricultural products is essential to be developed because it can develop agro-industry in a region. One of the good products to develop is a beauty product that can be used for both men and women. This research shows that there are differences in the value of antioxidant activity from the six comparisons of mask composition, namely the IC50 value of 743.9 (sample I); 513.69 (sample II); 406.23 (sample III); 193.67 (sample IV); 174.09 (sample V); and 149.10 (sample VI). From the sixth sample, a mask with the lowest antioxidant activity value is a mask with high antioxidant activity. That’s a mask with a ratio of 3:1 where seaweed powder is processed without alkalization.

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