

Soba Candy Products Formulation with the Addition of the Seaweed *Eucheuma cottonii*

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Abstract

This study aims to determine the formulation of soba candy without seaweed and the formulation of soba candy with the addition of seaweed, the level of preference for the panelists with the addition of seaweed and the quality characteristics of the selected seaweed soba candy. This research activity was carried out in the Laboratory of Testing and Guidance for the Quality of Fishery Products in Gorontalo Province which was divided into two stages. Preliminary research was carried out to determine the basic formulation without seaweed. The main study was to determine the formulation with the addition of seaweed (30%, 40% and 50% by weight of brown sugar) which was analyzed organoleptically using the hedonic test (level of preference) and hedonic quality. The data obtained were analyzed descriptively and to determine the differences between treatments using the Kruskal Wallis method, and to determine the selected / preferred product using the Bayes method. The results showed that the basic formulation (without seaweed) obtained was 100 g brown sugar with 200 ml coconut milk and a formula with additional seaweed that was 40% by weight of brown sugar. Characteristics of the hedonic quality of the selected products obtained in the form of soba candy with the addition of seaweed are soft, less tidy, delicious taste and specific types and specific smells and fresh without additional odor and the results of proximate analysis are 9.94% moisture content, 0.92% ash content, high levels of 4.24% fat, 3.68% protein content and 82.13% carbohydrate content.

Keywords: Seaweed; brown sugar; coconut milk; candy; organoleptic.

I. Introduction

Seaweed is one of the important fishery commodities as a source of foreign exchange. One type of seaweed that is often processed in seaweed extraction and has important economic value is *Eucheuma cottonii*. The existence of seaweed in Gorontalo Province, especially the type of *Eucheuma cottonii*, is quite available because there is already a seaweed cultivation development cluster in several areas of Gorontalo waters.

Eucheuma cottonii is very potential as a carrageenan producer whose role is very important which is widely used in the food, medicine, cosmetic, textile, paint, toothpaste and other industries. In the food industry, *Eucheuma cottonii* has been widely used as a raw material in making *dodol*, pudding, jam,

ice cream, fruit ice, cendol, making noodles and jelly candy.

Along with the times, the diversification of seaweed products continues to be developed to increase the usability of fishery products. One of the efforts to develop these fishery products is the use of seaweed in making soba candy. Candy (confectionery) is a food product that is in great demand by the public. Candy is often referred to as junk food, where seen from its composition, candy has low nutritional value, but not all candy is called junk food. This depends on the ingredients that make up the candy itself.

Like the candy that has been known by the people of Gorontalo, whose manufacture is still simple, namely pahangga (local name) sweets which

are better known by the trade name of soba candy. In terms of ingredients, this candy is only made from brown sugar and coconut milk, so it may have a different nutritional value than candy in general. Nowadays the existence of this candy is starting to disappear with the emergence of modern candies that are more attractive in shape with more varied flavors.

Brown sugar which is used as the basic material for making *soba* candy is brown sugar produced by the people of Gorontalo and its surroundings, namely brown sugar made from palm water. According to Dyanti (2002), palm sugar in terms of color, aroma and taste is different from other sugars because palm sugar tastes sweeter, clearer and fresher. Furthermore, Dyanti (2002) states that brown sugar also contains fiber, calcium, crude protein, vitamins, and compounds that function to inhibit cholesterol absorption in the digestive tract.

Considering that the basic ingredients for making *soba* candy have a fairly good and natural nutritional content, it is deemed necessary to carry out product development to improve the texture, appearance, taste, aroma and color of *soba* candy to make it more attractive by utilizing fishery products, namely *Eucheuma cottonii* seaweed.

II. Research Methods

The research was carried out at the Laboratory of Fisheries Product Quality Development and Testing (LPPMHP) Gorontalo Province and proximate analysis was carried out at the Laboratory of Chemistry and Food Analysis, Department of Public Nutrition, Faculty of Human Ecology, Bogor Agricultural University.

The tools used in this research are gas stove, scissors, plate, frying pan, blender, saucer (separating midrib), sode, scale, baking sheet, measuring cup, knife, oil paper, plastic clip, thermometer, score sheet. The materials used in the research were seaweed, brown sugar, coconut milk, aqua and bread.

The preliminary research aims to determine the basic formula (*soba* candy without seaweed), while the main research is the manufacture of *soba* candy with the addition of *Eucheuma cottonii* seaweed with different treatments, namely 30%, 40% and 50% of

the weight of brown sugar which aims to find selected products based on the level of acceptance or preference of the panelists on the parameters of color, texture, appearance, aroma and taste by using the panelist as a representative of the consumer. The panelists used in this test consisted of 30 students of the Fishery Product Technology Study Program, Department of Fisheries Technology, Faculty of Agricultural Sciences, UNG. This different treatment was carried out based on previous studies on the addition of seaweed in various processed products.

Objective quality of food products can be measured by physical instruments while subjective quality characteristics can only be measured by the five human senses. The subjective nature of food is more commonly called organoleptic or sensory because the assessment uses human sensory organs, sometimes it is also called sensory characteristics because the assessment is based on sensory stimulation of the sense organs (Soekarto, 1985 in Riyadi, 2007).

The test parameters carried out consist of:

1. Organoleptic test based on SNI 01-2346-2006 and SEAFEAST 2006.
2. Bayes test based on Marimin (2004)
3. Chemical tests are based on test results at the Laboratory of Chemistry and Food Analysis, Department of Community Nutrition, Faculty of Human Ecology, Bogor Agricultural University, namely determining the content of water, ash, protein, fat and carbohydrates.

III. Results and Discussion

Soba Candy Formulation without Seaweed

Based on the experimental results presented, it was obtained the characteristic formulation of *soba* candy as presented in Table 1. The formulation of the ratio of the concentration of brown sugar and seaweed was carried out experimentally, considering that there was no patented *soba* candy formula.

Table 1. Characteristics of the Soba Candy Formula

Ratio	Charakteristics of resulted candy
1 : 1	very hard texture that you can't bite into
1 : 2	tough texture with appropriate oil and can be bitten
1 : 5	texture that remains hard with excess oil and can be bitten

Soba Candy Formulation with Seaweed

Soba candy with the addition of *Eucheuma cottonii* seaweed produces candy with a soft texture. Based on SNI 3547-2-2008 there are two kinds of soft candy, namely jelly and non-jelly with different constituent materials. Seaweed soba candy is categorized as non-jelly soft candy.

The average quality value of the organoleptic test results on the assessment parameters (preferred level) of color, texture, appearance, aroma and taste of soba candy with the addition of *Eucheuma cottonii* seaweed is discussed in the following sections.

Color

Color is the factor that most attracts consumers' attention and the fastest gives the impression of being liked or disliked in food commodities. Color is the first element seen by consumers or panelists in assessing a product (Soekarto, 1990 in Sembiring, 2002). The color hedonic test results of the *Eucheuma cottonii* seaweed soba candy were at a value of 6.01 - 7.26 in the range of somewhat favorable to favorable acceptance scale. The formula with a concentration of 30% has the lowest acceptance value, namely 6.01 with a somewhat favorable acceptance scale. Meanwhile, the highest acceptance value of 7.26 with the like acceptance scale is found in the 40% formula. So it can be said that the panelists have accepted soba candy with the addition of seaweed because the acceptance scale is ≥ 5 .

Based on the Kruskal-Wallis test at the 95% confidence level, it was shown that soba candy with the addition of *Eucheuma cottonii* seaweed was significantly different (Appendix 5). The test was

continued with the Duncan multiple comparison test. Duncan's test results on color showed that the 40% formula (B) was significantly different from the 30% formula (A) and the 50% formula (C). However, the 30% formula and the 40% formula are not significantly different. This is presented in Figure 1.

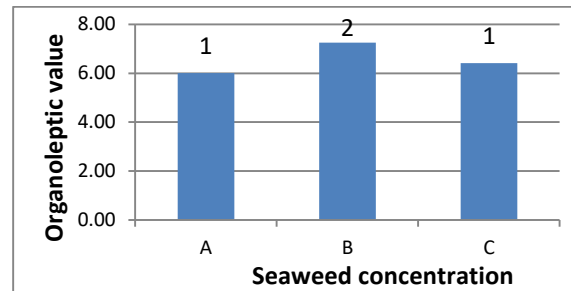


Figure 1. The hedonic color test results of soba candy with the addition of seaweed.

The hedonic test results showed that the 40% formula was preferred by the panelists. The color of the soba candy with the addition of a different seaweed gives a different color to the final product of the seaweed soba candy. In the 30% formula, the resulting color is slightly light brown, the 40% formula is light brown, while the 50% formula is produced dark brown. The higher the concentration of seaweed pulp, the darker the color will be.

This is in accordance with Herdiani's research (2003), on jams and *dodol* using seaweed that the more the addition of seaweed pulp, the color that is formed is less bright or a bit darker, because with the addition of more seaweed it requires more cooking time. a long time so that the browning reaction occurs.

One of the reasons for the formation of brown color in candy is the brown sugar color. The brown color of brown sugar is caused by a non-enzymatic browning reaction, namely a caramelization reaction. The caramelization process is that each sucrose molecule is broken down into glucose and fructose molecules. High temperatures are able to remove water molecules from each sugar molecule, so that glucosan and fructosan (dehydration) are formed. After the process of breaking and dehydration, a polymerization reaction occurs, namely the formation of colored polymer components, causing a brown solution (Winarno, 2008).

According to Hodge and Ozman (1976) in Astawan, et al., (2004), if the product is added with sugar, if it is heated longer, a caramelization process occurs, namely a non-enzymatic browning reaction. The caramel that forms during heating gives food products a brown color. Another factor that causes chocolate candy color besides brown sugar is the use of seaweed (*E. cottonii*). The seaweed used is a group of red algae. Types of seaweed generally have a colorant in their tissues known as pigments. The dominant pigments in seaweed are carotene pigments with the dominant pigment types being β -carotene, zeaxanthine, and cryptosantoin.

Texture

Texture has an important role in the acceptability of food. Assessment of texture, among others, is by assessing the smoothness and elasticity of the product and is one of the parameters which is a combination of the physical state of a food and is sensed by sight and touch. The physical state of a food includes size, shape, quantity, basic properties and elemental structure (Carpenter, et al., 2000 in Riyadi 2007).

The hedonic test results of the texture of seaweed soba candy were in the interval 5.01 - 6.77 with the usual acceptance scale to like. From this test the lowest value is found in the 30% formula, namely 5.01 with the usual acceptance scale, while the highest value is 6.77 with the like acceptance scale in the 40% formula and the 50% formula has a value of 5.69 with a somewhat like acceptance scale. So it can be said that the panelists have accepted soba candy with the addition of seaweed because the acceptance scale is ≥ 5 .

The Kruskal-Wallis test at the 95% confidence level, showed that the soba candy with the addition of *Eucheuma cottonii* seaweed was significantly different (Appendix 5). The test was continued with the Mupltiple comparison test (Duncan). The results of Duncan's test on texture show that the three formulas (30%, 40% and 50%) are significantly different, respectively, as shown in Figure 2.

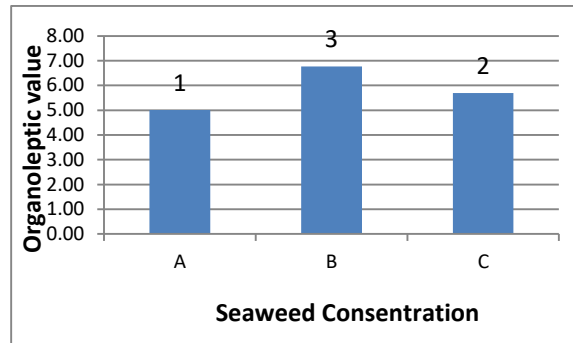


Figure 2. The hedonic texture test results of soba candy with the addition of seaweed.

Based on the results of the characteristic test, it turned out that the 40% (B) formula was preferred by the panelists. This is presumably because the texture of the candy produced is soft so that it is favored by panelists when compared to soba candy with the 30% formula (A) the texture of the candy is rather soft and the 50% formula (C) the texture of the candy is soft. One of the causes of soft candy is the addition of seaweed.

The addition of a large amount of seaweed can affect the texture of the candy to become mushy which is less favorable for panelists. The results of the research by Astawan, et al., (2004), on seaweed jam and *dodol* showed that the increasing concentration of the addition of seaweed pulp to the formula caused panelists' acceptance of the texture tended to decrease. The soft texture of the candy is caused by the formation of the gel from the seaweed.

According to Fardiaz (1989), gel formation is a phenomenon of joining or crosslinking polymer chains to form a continuous three-dimensional mesh. This net then catches or immobilizes the water in it and forms a strong and rigid structure. The properties of this gelling vary from one type of hydrocolloid to another, depending on the type. Gel has properties like a solid, especially elastic properties and stiffness.

Kappa-carrageenan and iota-carrageenan are fractions that are able to form gel in water and are reversible, that is, they melt when heated and form a gel again when cooled. The heating process with a temperature higher than the gel formation temperature will result in the carrageenan polymer in the solution becoming a random coil. When the temperature is lowered, the polymer will form a double

helix structure and if the temperature decrease continues, these polymers will be cross-linked strongly and with increasing helical shape an aggregate will form which is responsible for the formation of a strong gel (Glicksman, 1969 in Samsuari, 2006). If this continues, there is a possibility that the aggregate formation process will continue and the gel will shrink while releasing water. This process is called syneresis (Fardiaz, 1989).

Appearance

In addition to being judged by the eye, the appearance of food products can also be seen from the perception of texture. The characteristics of food that are included in the appearance group are color, size, shape, surface texture and clarity (for liquids) (Carpenter et al. 2000 in Riyadi, 2007).

The hedonic test results of the appearance of seaweed soba candy were in the interval 5.17 - 6.91 with a somewhat like to like acceptance scale. Based on this test, the lowest value is found in the 30% formula, namely 5.17 with the usual acceptance scale. While the highest score is 6.91 with the like acceptance scale found in the 40% formula, and the 50% formula has a value of 5.69 with the like acceptance scale. This shows that seaweed soba candy is accepted by the panelists because it has a score of ≥ 5 .

Based on the Kruskal-Wallis test at the confidence level of 95%, it shows that the treatment carried out is significantly different from the appearance of the seaweed soba candy produced (Appendix 5). Duncan's test results on color showed that the 40% formula was significantly different from the 30% formula and the 50% formula. However, the 30% formula and the 50% formula are not significantly different. The test results are presented in Figure 3.

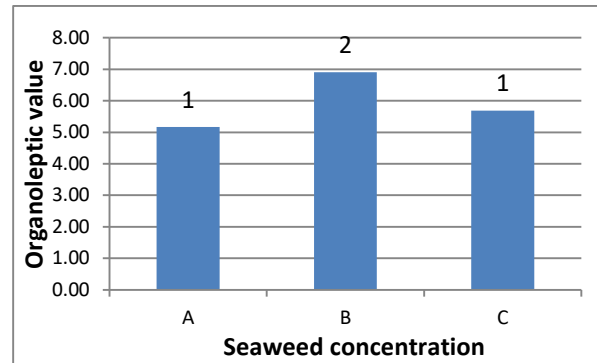


Figure 3. The hedonic appearance test results of soba candy with the addition of seaweed.

The hedonic test results showed that the 40% formula was preferred by the panelists. This is presumably because the color of the seaweed soba candy produced is a light brown color while in the 50% formula the resulting brown color is dark brown. This is in accordance with Herdiani (2003) research on jam and *dodol* which states that the more the addition of seaweed pulp, the color that is formed is less bright or a bit darker. This is because the addition of more seaweed requires a longer cooking time. With the longer the cooking time, a browning reaction can occur.

In the process, a chemical reaction occurs, namely the Maillard reaction. The Maillard reaction is the main reaction between reducing sugars and amino components which increase in speed with increasing temperature. The results of this reaction produce a brown product (Winarno, 2008).

Aroma

Aroma is one of the parameters that determines the good taste of a food. In food industry, the test of aroma is considered important because it can quickly provide an assessment of the results of the product, whether the product is liked or disliked by consumers (Soekarto, 1985 in Ratna, 2004).

Winarno (2008) states that one of the factors that determines a food that is acceptable to consumers is aroma. The aroma of food determines the delicacy of these food ingredients. Food that does not contain aroma is less preferred by panelists / consumers. Good food is characterized by a pleasant aroma.

The hedonic test results showed that the scent of seaweed soba candy was in the interval 6.65 - 7.09 with the same acceptance scale, namely like. From this test, the lowest value is found in the 30% formula, namely 6.65, the 50% formula, namely 6.73, while the highest value is 7.09 with the same acceptance scale, namely like it is in the 40% formula. So it can be said that based on the organoleptic test, this candy was accepted by the panelists because it had an acceptance score of ≥ 5 .

Based on the Kruskal-Wallis test at the 95% confidence level, it shows that the treatments carried out were not significantly different from the aroma of seaweed soba candy produced (Figure 4). This was due to the dominant aroma of brown sugar and coconut milk which masked the smell of seaweed, so the aroma from each treatment was judged by the panelists with the same aroma.

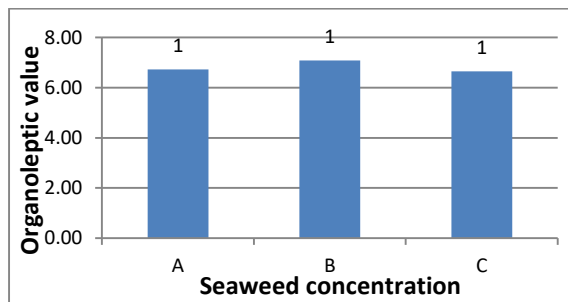


Figure 4. The hedonic aroma test results of soba candy with the addition of seaweed.

Ratna's (2004) research results show that the aroma of jelly candy is not significantly different. The aroma is dominated by the caramelized aroma of the sucrose solution which melts during the cooking process until it is smooth. According to Winarno (2008), when the sucrose solution is evaporated, the concentration will increase, as will the boiling point. This situation will continue until all the water evaporates. When this situation has been reached and the heating is continued, the liquid that is there is not consisting of water but liquid sucrose which melts. When the melted sugar continues to heat, the caramelization begins.

The delicious aroma is also caused by coconut milk, because coconut milk contains nonylmethylketone compounds which at high

temperatures will be volatile and cause a pleasant smell (Khairulanam, 2008). Herdiani (2003) in seaweed jam and *dodol* added that the addition of excess seaweed can reduce the panelists' preference, because seaweed has a distinctive odor that is not liked by panelists, namely fishy smell.

Taste

Taste is the response of the tongue to stimuli provided by a food which is one of the important factors affecting the level of acceptance of panelists / consumers of a food product. Taste sensing is divided into 4 main tastes, namely sweet, sour, salty and bitter (Winarno 1997). Even though food products have good color, aroma, appearance and texture, if they taste bad, the panelists / consumers will not accept them.

The hedonic test results of seaweed soba candy show that the taste of seaweed soba candy is in the interval 6.51 - 7.32 with the same acceptance scale, namely like. From this test, the lowest value of seaweed soba candy was 6.51 in the 30% formula and the 50% formula, namely 6.67 and the highest value was 7.32 in the 40% formula with the same acceptance value, namely like. So it can be said that the panelists accepted this candy.

Based on the Kruskal-Wallis test at the 95% confidence level, it shows that the treatments carried out were not significantly different to the taste of the seaweed soba candy produced (Figure 5).

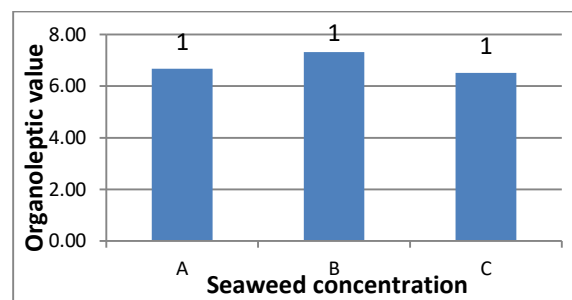


Figure 5. The hedonic taste test results of soba candy with the addition of seaweed.

The same taste in seaweed soba candy is caused by the dominant taste of brown sugar and coconut milk which masks the taste of the seaweed, so the obvious taste is the sweet and savory taste of

brown sugar due to the coconut milk. In the research conducted by Astawan, et al., (2004) on seaweed jam and *dodol*, that sugar and brown sugar in making *dodol* can act as a flavor enhancer. Nurwati (2011), in the formulation of hard candy, also states that high levels of sucrose in the treatment will affect the taste of candy, the higher the sucrose, the sweeter the candy taste.

Selected Soba Candy

Based on the Bayes test, it shows that formula B of soba candy with the addition of *Eucheuma cottonii* seaweed 40% has the first rank with a value of 3.00, then the second rank is formula C with the addition of *Eucheuma cottonii* seaweed 50% with a value of 2.38 and the last ranking is formula A with the addition of *Eucheuma cottonii* 30% seaweed with a value of 2.13. So it can be said that soba candy with the addition of 40% *Eucheuma cottonii* seaweed is the product of choice. According to Marimin (2004), the highest total value obtained from the multiplication of the weight value and ranking is the selected product.

Organoleptic Quality Characteristics

Organoleptic quality characteristics assessment parameters using the hedonic quality test in SEAFast (2006) include shape, taste and aroma parameters. Based on this, a quality test was carried out on the selected product (Formula B). The results of the hedonic quality test of the selected seaweed soba candy and the assessment based on SNI for soft candy are presented in Table 2.

Table 2. Quality characteristics of the Soba Candy

No	Criteria	Selected Product (40% Seaweed)	SNI 3547-2-2008
1	Shape	Soft, less neat	Soft
2	Taste	Tasty, Kind Specific	Normal
3	Aroma	Kind Specific, Fresh without extra aroma	Normal

Table 2 shows that based on SNI quality requirements for non-jelly soft candy, the selected

product, namely the addition of 40% seaweed, has a soft shape, normal taste and smell / aroma is also normal.

Chemical Characteristics

Analysis of chemical characteristics carried out on selected products (*Eucheuma cottonii* seaweed concentration 40%) is a proximate analysis consisting of analysis of water, ash, fat, protein and carbohydrate content. The results of the proximate analysis are presented in Table 3.

Table 3. Proximate Analysis Results of Soba Candy

No	Proximate	Soba Candy- Seaweed (%)	Soba Candy- Non-seaweed (%)	SNI 3547-2-2008 Non-Jelly Soft Candy
1	Water	9,94	9,60	Max.7,5%
2	Ash	0.92	0,90	Max.2,0%
3	Fat	4,25	4,39	Not required
4	Protein	3,68	3,25	Not required
5	Carbohydrate	82,13	82,75	Not required

IV. Conclusion

The selected soba candy formulation without seaweed is 1 : 2 brown sugar-coconut milk ratio, and the soba candy formulation with the addition of 40% seaweed is the selected product (hence, brown sugar 100 g, coconut milk 200 mL and seaweed 40 g).

The results of the hedonic test (level of preference) of the selected products showed an average quality value of appearance 6.91, texture 6.77, aroma 7.09, color 7.26 and taste 7.32 with common acceptance scale, namely like.

The results of the quality characteristics of the selected products show that seaweed soba candy has a soft shape, normal taste and smell / aroma is also normal with the results of proximate analysis, namely 9.94% water content, 0.92% ash content, 4.24% fat content, protein content 3,68% and 82.13% carbohydrate content.

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