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Research Article

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Study of Proportions Seaweed *Eucheuma cottonii* L. and Cooking Time on Quality of Functional of Seaweed *Dodol*

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ABSTRACT

Seaweed as a source of nutrition contains carbohydrates, protein, lipid and ash. Ones of ingredients that works for healthy were dietary fiber. *Eucheuma cottonii* seaweed contains carrageenan, which can act as a stabilizer, a material thickening, gelling agent, and emulsifiers. This research is aim to know the level of resilience *Dodol* with the proportion of seaweed and cooking time. The study was conducted using a randomized block design consisting of two factors. The first factor is proportions seaweed thickener composition, glutinous rice flour, rice flour (30:35:30, 40:25:20, 50:15:10), the second factor is cooking time (20, 30, 40 minutes) repeated three times. The observations parameter includes moisture content, ash content, protein, lipid, crude fiber, and texture.The research results showed that has interaction between the proportion of seaweed and cooking time. The proportion of seaweed and cooking time gives effect to the moisture content and the texture of *dodol* seaweed. The proportions give effect to the moisture content, ash, lipid, crude fibre, and texture while treatment cooking time gives effect to the moisture content, ash, protein, lipid, and texture of *dodol* seaweed. The best treatment is produced by treatment of 50 g of seaweed: 15 g of glutinous rice: 10 g of rice flour and 40 minutes cooking time with the result 62.10% moisture content, 3.32% ash content, 2.42% protein, 3.25% lipid, 5.20% crude fibre, 76.70 N texture.

Keywords: *Proportion of seaweed, cooking time, dodol seaweed.*

1. Introduction

Seaweed can be developed into various types of derivative products with high health value. Seaweed as a source of nutrients contains carbohydrates, proteins, lipid and ash which is largely a compound of sodium and potassium salt (Anggadiredja et al., 2006). Seaweed type *Euchema cottonii* L. as producer of carrageen have high fiber content. The dietary fiber content of seaweed *Eucheuma cottonii* reached 67.5% consisting of 39.47% insoluble food fiber and 26.03% water soluble (Kasim, 2004 in Tamaheang et al., 2017). Some processed products from seaweed are seaweed candy, seaweed jam and seaweed candy, besides seaweed can be processed into *dodol* product.

In this research, we used seaweed powder as carrageen made from seaweed species *Eucheuma cottonii* has the potential to serve as a healthful food provides a chewy texture. The composition of 1 kg *dodol* consists of 1 kg of glutinous rice flour, 1 to 1.3 kg of sugar, 0.8 kg of brown sugar, 1.5 kg of coconut milk, 3.5 litre of filtered water and including rice flour 1 kg brown sugar 0.5 kg to 0.8 kg, coconut milk ½ ltr, and half of the filtered water (Nasaruddin et al., 2012).

The *dodol* quality aspects divide two, first is ingredients composition, and the second is cooking time. An indicator of *dodol* quality is color, taste, texture, appearance and nutritional content. Those determined by cooking time and temperature (should below than 80^0C), mistake such as overcooked or underdone will make texture not “kalis”, bad taste and color unenticing. Therefore, it is necessary to study the comparison of the amount of seaweed, glutinous rice flour and the cooking time

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treatment so that it can produce *dodol* with good characteristics and avalaible with the quality requirements of *dodol* according to (Indonesian Nasional Standard) SNI.

2. Materilas and Methods

Raw materials used in this research is the type of seaweed *Eucheuma cottonii* obtained from seaweed collectors in Sumenep, Madura. Glutinous rice flour and rice flour are obtained from Triple A food store in Malang, and HCl, H_2SO_4, NaOH, $Al(OH)_3$, Na_2CO_3 chemicals are obtained from Toko Makmur Sejati Chemicals Malang.

The experimental design used was Randomized Block Design consisting of two factors with basic composition refers to Astawan et al., 2004 **[**seaweed(s): glutinous flour(gf): rice flour(rf) 30(s):35(gf):30(rf)**]**. Factor I is consists of three group first is 30(s):35(gf):30(rf);second 40(s):25(gf):20(rf); and third 50(s):15(gf):10(rf). Factor II is the cooking time with the level of 20, 30, 40 minutes. Observation parameters include moisture content (gravimetric method, AOAC 2005), ash content (Sudarmadji et al., 2003), protein content (Kjedahl method, Sudarmadji et al., 2003), lipid content (Soxhlet method, Sudarmadji et al., 2003), texture / hardness test (textur analyzer, Ahmad et al., 2010), and crude fiber (AOAC, 2005).

Implementation of the research begins with the manufacture of seaweed porridge, and sugar solution. Then followed by mixing the sugar solution, seaweed porridge, glutinous rice flour, and rice flour, with a level according of treatment and cooking for 20-40 minutes (according to treatment). The process ends with printing and cooling to get the *dodol* seaweed to measure the test variables.

3. Results and Discussion

Water Content

The composition of water was increasing in line with increasing seaweed content. The water content in *dodol* have a lubricating effect between the particles and flow relatives unhindered, when the temperature increases, this effect becomes more significant (Chuah et al., 2007). Cooking time and temperature affect water flow content into *dodol* structure. The ideal water content of *dodol* seaweed ranges from 46.20 - 63.57%, the complete results are presented in Table 1 and Figure 1 & 2.

Table 1. Average water content and texture of *dodol* seaweed due to different portion of materials and cooking time

Proportions seaweed(s): glutinous rice flour(gf): rice flour(rf) and cooking times	Water content (%)	Texture (N)
Proportions 30 : 35 : 30 – 20 minutes	47,17 b	59,04 a
Proportions 30 : 35 : 30 – 30 minutes	46,89 b	62,34 b
Proportions 30 : 35 : 30 – 40 minutes	46,20 a	65,33 c
Proportions 40 : 25 : 20 – 20 minutes	50,14 c	64,69 b
Proportions 40 : 25 : 20 – 30 minutes	50,23 cd	67,70 c
Proportions 40 : 25 : 20 – 40 minutes	50,47 d	69,89 e
Proportions 50 : 15 : 10 – 20 minutes	63,57 g	67,76 d
Proportions 50 : 15 : 10 – 30 minutes	62,52 f	70,62 e
Proportions 50 : 15 : 10 – 40 minutes	62,10 e	76,85 f

Description: The value followed by the same letter means not significantly different based on Duncan test α = 5%

The larger portion of the seaweed produces a higher water content. Thatis the larger the carragenan portion, and the stronger ofbinding potential of the water due to the greater the moisture content of the product. Glutinous starch contains high carbohydrate, that is in glutinous flour there are two compounds of amylose and amylopectin. The more concentration of glutinous flour used is the higher amylopectin fraction so that in the process of heating the material, the starch will swell and eventually break and the water holding capacity is lower (Suyanti, 2004).

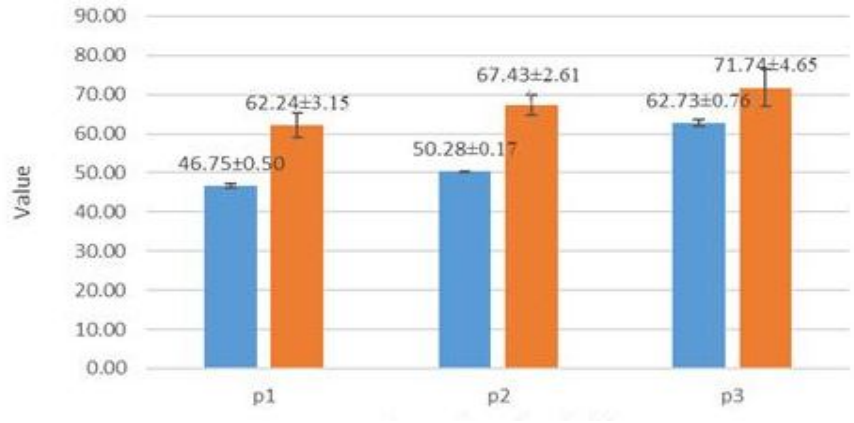

Figure 1. Water content and texture of *dodol* on different seaweed proportions.

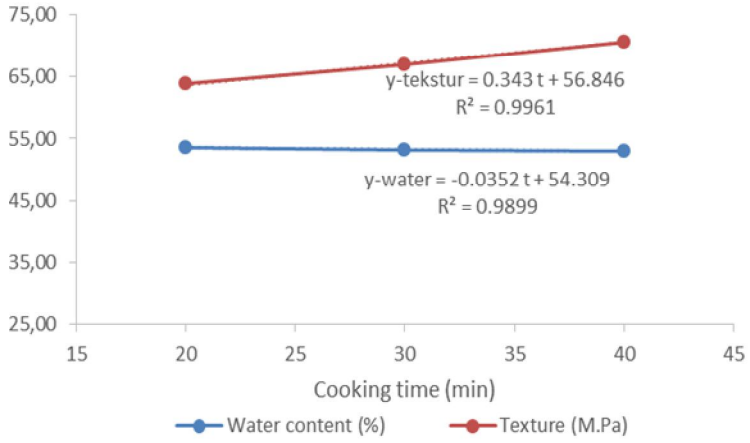

Figure 2. Water content and texture of *dodol* at different cooking time.

Texture

Texture of *dodol* gets harder with the added portion of seaweed, as well as the longer cooking time (Figures 1 and 2). The use of thickening in the manufacture of *dodol*, seaweed has a higher viscosity compared to glutinous rice flour. The higher texture value of *dodol* means its increasingly chewy. Changes in texture is possible because the seaweed contains carrageenan that has the ability or high water holding capacity. According to Hardian (1994 in Sembiring 2002) states the type of seaweed *Eucheuma cottoni* produce carrageenan that can react and function well with sugar, starch, gum and others. The formation of the gel is due to the double helix structure by the carrageenan polymer contained in the seaweed grass. The value of elasticity will increase if the product loses water.

Glutinous rice flour gives a chewy nature so as to form a *dodol* texture to be elastic. High levels of amylopectin make it very easy to gelatinize when added to water and obtain a heating treatment. This happens because of the binding of hydrogen with glutinous rice flour molecules (gel) that are chewy (Hartati, 1996). The old cooking time, causing the water content of the product is getting smaller, the harder the product, *dodol* texture is stronger, so to suppress the greater the energy required.

Ash Content

Ash content of *dodol* seaweed increases with portion of seaweed added and its decreases with cooking time added. The ash content of *dodol* seaweed of the this research can be seen in Table 2, and the over all picture is presented in Figures 3.

Table 2. Mean of ash content, protein, lipid, and coarse fiber of *dodol* due to seaweed proportion and the effect of cooking time.

Treatment	Ash (%)	Protein (%)	Lipid (%)	Crude fiber (%)
Proportion of materials				
P1 (30:35:30)	2,46 a	2,93 a	3,66 c	4,75 a
P2 (40:25:20)	2,67 a	2,83 a	3,37 b	4,96 a
P3 (50:15:10)	3,55 b	2,67 a	3,21 a	5,38 b
Cooking times				
T1 (20 min)	3,13 b	3,14 b	3,34 a	4,86 a
T2 (30 min)	2,93 b	2,70 ab	3,39 a	5,09 a
T3 (40 min)	2,61 a	2,64 a	3,51 b	5,11 a

Description: The value followed by the same letter means not significantly different based on Duncan test α = 5%

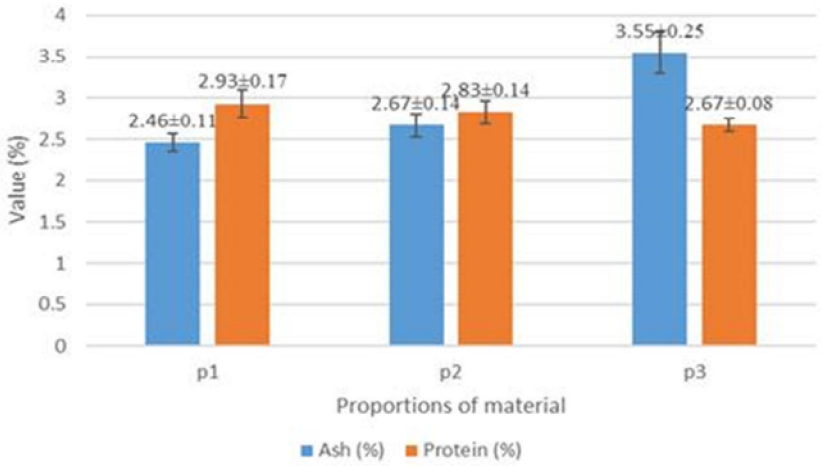

Figure 3. Ash and protein content of *dodol* at different proportion seaweed.

Seaweed contains a high mineral, ie 29.39 mg / 100 g (KKP, 2012), so a large portion of seaweed in the manufacture of *dodol* seaweed causes ash content to be large. According to Gamman & Sherington (1994) mineral content in seaweed can be reduced by the cooking process or processing, as a consequence ash content of *dodol* seaweed is reduced by the longer cooking time.

Protein

Protein content of *dodol* seaweed tends to decrease with portion of seaweed added because the portion of the glutinous rice reduced that contribute to the protein content. The protein content decreases with cooking time added. This can be seen in Table 2 and Figure 3.

Cooking time during processing can also cause a decrease in protein. The effect of warming on *dodol* can cause physical changes, flavor and taste and chemical composition (AOAC, 2005). Protein of *dodol* damage due to heating will affect the content of amino acids that correlate to the nutrient content consumed. In addition, according to Martos et al. (2011) the protein of the food is denatured when heated at 60-90 °C for an hour or more. In the long cooking time, the protein will be moredenatured.

Lipid

The resulting lipid content of seaweed *dodol* decreases with portion of seaweed added, and increases with cooking time added (Table 2 and Figure 4)

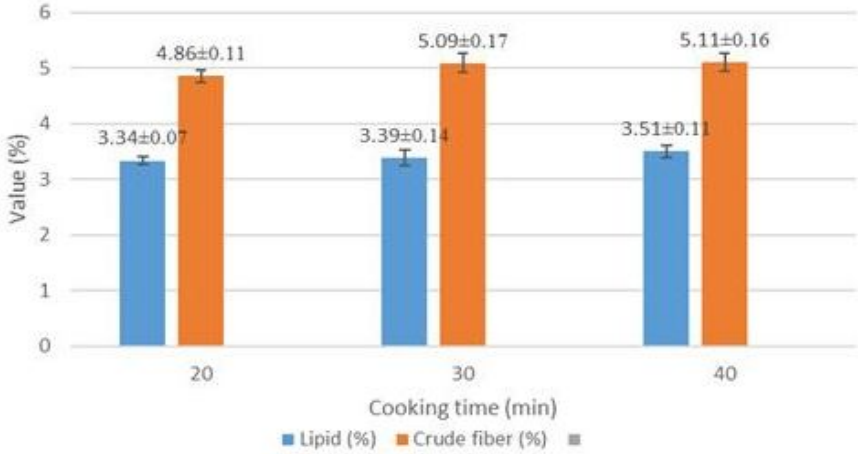

Figure 4. Lipid and crude fiber content of *dodol* at different cooking times

The difference of the results is due to the use of thickening materials, where the glutinous flour has a higher lipid content of 4% (Sudarsono, 1981), and compared to 0.4% seaweed lipid (KKP, 2012). The cooking time affects the product, the longer the cooking cause the decrease of *dodol* water content. The cooking time causes the water to evaporate so that the water content decreases. Water content affects the fat content of the resulting product, the higher the water content the lower the lipid content and the lower the water content the higher the lipid content of *dodol* seaweed.

Crude Fiber

High levels of fiber in *dodol* seaweed caused its from thickener seaweed containing high total fiber compared to thickener glutinous rice, in accordance with the Astawan et al. (2004) study, that seaweed is a plant that contains many fibers. Fiber content in seaweed has a high nutritional value compared with the fiber content of glutinous rice.

Cooking time affects to crude fiber content of *dodol* seaweed. And its associated to water content, that is lower the water content the crude fiber increases. According to Permana et al. (2015) in the fibers are formed intramolecular hydrogen bonds that cause a decrease in water solubility, since most OH groups do not form H bonds with water molecules. Aktas, and Gençcelep, 2006 study found the fiber will made water vapor more easily removed during heating it make water content becoming lower.

The high fiber of dodol seaweed is expected to provide rich content of essential minerals, protein, dietary fibre, vitamins (A, B, C, E) and essential fatty acids (Mithril et al., 2012). It also has a range of bioactive compounds, which may be beneficial in relation to immunity body system (Cooksley, 2007).

4. Conclusion

The proportion of seaweed and cooking time have an effect on quality of *dodol* seaweed. The increased proportion of seaweed affects to increase of water content, ash content, crude fiber, and texture of *dodol* seaweed. The cooking time treatment has an effect to content of water, ash, protein, lipid, and texture of *dodol* seaweed. The best treatment resulted from seaweed treatment 50 g: glutinous flour 15 g: rice flour 10 g and 40 minutes cooking time with 62.10% water content, 3.32% ash content, 2.42% protein, 3.25% lipid content, 5.20% crude fiber, and texture 76.70 N.

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