Improving the Quality of Fishery Products by Maintaining Ideal Composition of Seaweed Caragenan: *Kappaphycus Alvarezii*

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Keywords: Carrageenan, Mackerel, Meatball.

Abstract: This study aim is to determine the ideal composition of good carrageenan as a natural preservative for improving the quality of fishery products. Other aim is to analyze the quality of fishery products by maintaining of seaweed carrageenan (Kappaphycus alvarezii). This research was conducted for 4 (four) months at the Laboratory of the Fishery Products Processing Technology Study Program Nunukan, Indonesia. Nunukan. Data were collected based on observations of organoleptic tests which consist of color, taste, texture, and aroma. The method used is an experiment with treatment A0 (meatballs without the addition of carrageenan) as a control, treatment A1 (meatballs with the addition of carrageenan 2.5%), treatment A2 (meatballs with the addition of carrageenan 5%), treatment A3 (meatballs with the addition of carrageenan 7, 5%). The composition ideal of carrageenan flour with a concentration of 2.5% could led the best effect on the elasticity quality of mackerel fish balls. The organoleptic value with the hedonic test of mackerel fish balls with the extra of carrageenan flour of 2.5% has an appearance parameter value IS 3.76 (neutral to like). The color parameter value is3.87 (neutral to like), and aroma parameter value is 3.87 (neutral to like). The taste parameter is 4.69 (like to very like) and the value of the texture parameter is 4.34 (like). Other material such water content is 66.04%, and protein content is 11.87%, while fat content is 1.13%. The essential material such as carbohydrate content is 8.59%, crude fiber content is 9.61%, and ash content is 1.53%.

1 INTRODUCTION

Most of Indonesia's territory is waters that have the potential to produce quite large marine products. One of them is seaweed which has high economic value because it can produce carrageenan (Dewi, et al, 2015).

Carrageenan is a polysaccharide extracted from several species of seaweed or red algae (rhodophyceae). Carrageenan is a hydrophilic linear sulfated galactan. These polymers are repeating disaccharide units. These sulfated galactans are classified according to the presence of the 3,6-anhydro galactose (DA) unit and the position of the sulfate group (Distantina, et al, 2010). Carrageenan functions as a thickener, emulsifier, suspending agent, preservative and stabilizing factor. Carrageenan is also used in the food industry to improve the appearance of coffee products, meatballs, sausages, nuggets, salads, ice cream, condensed milk, chocolate and jelly. (Ega, et al, 2016).

Fishery products have different durability and it depending on the nature of the food itself. Its usually handling during processing and storage. One of the main causes of damage to fishery products is contamination by microbes from outside or naturally present in these foodstuffs. To extend the shelf life of foodstuffs can be done in various ways, one of which is the extra of chemicals as preservatives.

Preservatives in fishery products have become an inseparable part, especially since the times they have demanded products that are practical, durable, and it also have an attractive appearance. The solution should be taken by the industry is to add preservatives for increasing product quality and make it last longer. One of the preservatives that often used is chemicals, but if it used in excess, so it can cause endanger health. It can be stated that carrageenan is an alternative as a natural food preservative and is safe to use to improve the quality and quality of processed fishery products, especially seaweed. So the author took the title Improving the Quality and Quality of Fishery Products by Adding the Ideal Composition of

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Seaweed Carrageenan (Kappapychus Alvarezii).

2 LITERATURE REVIEW

The high value of Indonesia's wealth, especially the fisheries sector which is supported by the vastness of Indonesia's oceans. It also provides its own points for increasing people's income.

A. Types of Processed Fishery Products

To meet the need for animal protein, it can be obtained through the use of non-economical fish bycatch products into products that have added some values. One of the efforts to increase the diversification of processed fishery products is by developing fishery product processing technology that can increase the selling value of these products (Juminda, F, 2015).

Surimi is a semi-finished material made from white meat, tasteless and odorless and it has high gelling ability. The advantages of using surimi such as (1) surimi can be used directly for processing food products such as meatballs, sausages, nuggets, kamaboko, burgers and others. (2) Surimi is odorless, free of bones and thorns so that the processed product is easier to consume by people of all ages. (3) The supply and price are relatively stable because surimi can be stored and this facilitates are the planning of processed production. (4) The cost of storage, distribution and transportation is cheaper because surimi can be stored for a long time. (5) Save time and labor because the handling is cheaper. (6) The problems that arise due to waste disposal are smaller (Peranginangin, et al, 1999).

The manufacture of surimi-based processed products uses a variety of fillers and binders. These fillers and binders can be distinguished according to their protein and carbohydrate content. The filler is usually a material that has a high carbohydrate content and has little effect on the properties of the emulsion. The binder is usually in the form of vegetable or animal protein, with higher protein content, and it can improve the properties of the emulsion. Some of the processed surimi-based products that use fillers and binders are as follows:

B. Fish Sausages (Sosis Ikan)

Sausage is meat or a mixture of several meats that are mashed and mixed with spices or herbs. The thing that needs to be considered in processed sausages is the binder. To get good quality sausage, so flour is needed as a binder of good quality. The binder in sausages serves to attract water, and it gives a distinctive color, with form a dense texture, also it improve the emulsion stability, and to reduce cooking time shrinkage, improve taste and slice properties. The binder will bind with water to form a mass, strengthening the emulsifier ability of the meat. It leads the emulsion more stable. Sausages on the market are made from a mixture of meat, flour, and STPP (sodium tripolyphosphat) as a binding material. STPP is an inorganic compound in the form of white crystals which is usually used for food preservatives and texturizers, but it is currently the use of chemicals in limited. For this reason, that why a natural STPP substitute is still needed. The natural STPP is namely carrageenan. Carrageenan is obtained from seaweed extraction and it is an alternative to STPP.

C. Fish Meatball (Bakso Ikan)

Meatballs are foods that are favored by various groups of people of all ages in all corners of Indonesia. Fish ball is a processed fish product that is round in shape, highly nutritious, tastes delicious. It can be eaten under any circumstances and it is also very easily accepted by anyone. Fish balls are made by adding spices, salt, garlic, pepper, ice 20% and flour 10-30% (Ministry of Fisheries and Marine Affairs RI Agency for Research and Human Resources for Marine and Fisheries. Fisheries Training and Extension Center, 2016).

D. Fish Nugget (Nugget Ikan)

Fish nuggets are a food favored by the community, especially children. According to Lukman et al (2009), Evanuarini and Purnomo (2011) in the Ministry of Fisheries and Marine Affairs RI Agency for Research and Human Resources for Marine and Fisheries and Fisheries Training and Extension Center (2016) noticed that Nuggets are restructured meat products with dough and coating to maintain quality. In the manufacture of nuggets, the filler and basic ingredients determine the characteristics of the nuggets produced. It is usually used as the main ingredient in the form of fish as the main ingredient, while the filler is in the form of wheat flour, tapioca and cornstarch.

3 RESEARCH METHODS

The design used in this study was a completely randomized design (CRD) with 4 treatments and 3 replications. Variations in addition of carrageenan concentration to the weight of the mackerel used are:

A. Control without the addition of carrageenan (sausage, nuggets and mackerel fish meatballs)

B. Sausage, Nuggets and Mackerel Fish Meatballs with the addition of 2.5% Carageenan flour
C. Sausage, Nuggets and Mackerel Fish Meatballs with the addition of 5% Carrageenan flour Sausage, Nuggets and Mackerel Fish Meatballs with the addition of 7.5% Carrageenan flour

4 RESULT AND DISCUSSION

A. Physical Characteristics of Mackerel Fish Meatballs with the Addition of Carrageenan

The physical properties of a product greatly determine the level of consumer acceptance of the product. The physical properties of a product also affect the quality of the product and the price of the product. Making mackerel fish balls with various variations of the addition of carrageenan flour may cause changes in the physical properties of the mackerel fish balls producing.

B. Gel Strength

Testing the hardness level of mackerel fish balls was carried out with the Llyoid Instrument. The testing technique is carried out by determining the maximum force required to break (share force) the cooked mackerel fish ball product. The maximum force (N) here is the maximum force required to give the formation of the meatball. This means that the higher the force required to break with the same level of damage.

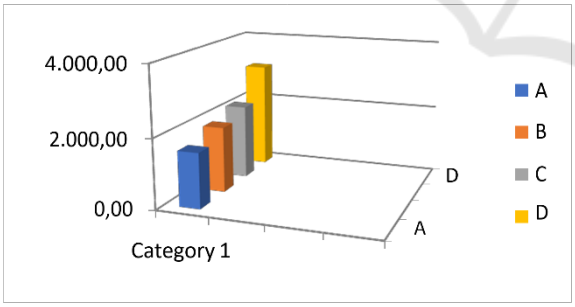

Figure 1: Gel Strength of Mackerel Meatballs with the Extra of Different Carrageenan Flour.

In Figure 1 it can be seen that the gel strength of the mackerel fish ball increased with the increase in the concentration of the addition of carrageenan flour. The gel strength of the mackerel fish balls produced ranged from 1,673.17 Blooms (A treatment) to 3,090.61 Blooms in D treatment.

The results of statistical analysis ANOVA test showed that the addition of carrageenan flour had a significant effect ($\alpha < 0.05$) on the real gel strength (α: 0.05) with the extra of carrageenan flour as much as 7.5%. This shows that the extra of carrageenan flour is directly proportional to the increasing in gel strength of mackerel fish balls. The difference in gel strength of the mackerel balls produced for each treatment was caused by the extra of carrageenan flour from the mackerel fish balls. The results showed that the extra of carrageenan flour as much as 0%, 2.5% and 5% had a different effect on the addition of carrageenan flour as much as 7.5%. This shows that the addition of carrageenan flour is directly proportional to the increasing in gel strength of mackerel fish balls. The difference in gel strength of the mackerel fish ball produced for each treatment was caused by the extra of carrageenan flour.

The ability of meatballs to form a compact structure is basically due to the ability of the meat to bind together. This bonding process is caused by heating. Carrageenan in fresh meat does not show a tendency to bind to each other (Peranginangin, 1987 in Dwi, Wiwin. 2008).

Fish meat protein, especially myosin, is responsible for the good or bad formation of gels and emulsions in soft meat products. Small myosin aggregates are thought to play a role in the formation of fat emulsions. In addition, these aggregates have the ability to expand when heated and bind all components including water. It is determining the consistency of the meatball product (Schut, 1976 in Dwi, Wiwin. 2008).

The addition of salt also serves to increase the ionic strength of the meat and dissolve the actomyosin of the meat into cell forms which it if heated for a certain time will form an elastic gel. Starching can be viewed as a simple filler or binding agent for protein gels. Gel formation is also influenced by the addition of a thickening agent added to the meatball which will react with starch to form a structure.

C. Test

1) Bite Test

Elasticity affects a person's palatability to a product. The elasticity is based on the ease of chewing time without losing the proper tissue properties. Elasticity involves the easy initial penetration of the teeth into the meatball, the ease of chewing into smaller pieces and the amount of residue left during mastication (Lawrie, 2003 in Sudrajat, G. 2007). The results of the bite test on mackerel fish balls with the addition of different carrageenan flours are compact and sturdy, so the texture of the meatballs formed becomes chewy (Fitrial et.al. 2005, in Dwi, Wiwin. 2008). The bite test of the mackerel fish balls

produced ranged from 2.69 (weak) to 5.79 (chewy and acceptable). Mackerel fish balls which have chewy and acceptable properties are the addition of 2.5% carrageenan flour. (treatment B).

The results of the ANOVA test showed that the addition of carrageenan flour had a significant effect ($\alpha < 0.05$) on the results of the bite test (elasticity) of the mackerel fish balls produced. The results of further tests with Duncan's DMRT as shown showed that the addition of carrageenan flour had a significantly different effect for all treatments on the value of the bite test.

The addition of carrageenan flour can help the formation of gels that can improve the elasticity properties. The consistency of carrageenan gel formation can be influenced by several factors, including the type and concentration of carrageenan and the presence of ions. Carrageenan can bind well with water and protein and the meatballs also have the strength to withstand external pressure and return to their original shape after the pressure is removed. This property is called ductility.

2) Folding Test

The folding test is one of the tests on the quality of the meatball gel. The quality level used is on a scale of 1 to 9 (1 = completely cracked/cracked into pieces when pressed with both fingers, up to 9 = not cracked when folded in four). The value of the folding test results obtained is 2.78 (cracked but still united when folded in half) to 5.70 (slightly cracked when folded in half to slightly cracked when folded in four).

The results of the folding test on mackerel fish balls with the addition of different carrageenan flour were directly related to the gel texture, especially the gel strength. The higher folding test value, the better the gel strength of the product. The higher concentration of carrageenan flour is in the mackerel fish ball product or it is higher the gel strength. The results of the ANOVA test showed that the addition of carrageenan flour had a significant effect ($\alpha < 0.05$) on the value of the folding test of mackerel fish balls produced and the results of further tests with Duncan's DMRT showed that the treatment of adding carrageenan flour of 0% gave a significantly different effect with treatment 2, 5%, 5% and 7.5%. The extra of carrageenan flour treatment of 2.5% gave a significantly different effect with the treatment of 5% and 7.5%. However, the extra of carrageenan flour by 5% did not give a significantly different effect from the 7.5% treatment.

3) pH

The pH measurement aims to determine the acidity level of mackerel fish balls caused by hydrogen ions (H+). The final product that undergoes cooking and salting depends on the pH of the meat.

High temperatures increase the rate of pH decrease while low temperatures inhibit the rate of pH decrease (Suparno, 1998 in Sudrajat, G. 2007). The average pH value of mackerel fish balls with the extra of carrageenan flour is different. The pH of mackerel fish balls ranged between 7.15 and 7.17, which means that the acidity level of the mackerel fish balls which produced in a neutral range. Based on the results of the ANOVA test, it showed that the extra of carrageenan flour had no significant effect ($\alpha > 0.05$) on the pH value of mackerel fish balls.

D. Organoleptic Quality of Mackerel Fish Meatballs with the Addition of Carrageenan

Sensory test conducted in this study is a preference test which includes appearance, color, aroma, taste and texture. In Table 1 it can be seen that the results of the calculation of the average organoleptic value could be done by the preference test (hedonic test) of mackerel fish balls with the addition of carrageenan flour.

Table 1: Results of the Hedonic Organoleptic Test on mackerel fish balls with the addition of different carrageenan flour.

No	Parameter	Treatment			
		A	B	C	D
1.	Visibility	3.06	3.76	3.78	3.40
2.	Color	3.64	3.87	3.96	3.56
3.	Aroma	3.77	3.87	4.48	3.76
4.	Taste	3.96	4.69	4.56	3.76
5.	Texture	3.27	4.34	4.15	3.48
	Total	17.58	20.28	20.65	17.78
	Average	3.58	4.09	4.17	3.59

Note: From 15 Panelis

The physical test results obtained were very significant where the addition of carrageenan had a significant effect ($\alpha < 0.05$) on gel strength, fold-test and bite-test values, but had no significant effect ($\alpha > 0.05$) on the pH of mackerel fish balls. The hedonic test results showed that the addition of carrageenan flour had a significant effect ($\alpha < 0.05$) on the appearance, taste and texture parameters, but had no significant effect ($\alpha > 0.05$) on the color and aroma parameters on consumer preferences for mackerel fish balls.

The extra of carrageenan flour with a concentration of 2.5% gave the best effect on the elasticity quality of mackerel fish balls. The chemical characteristics of mackerel fish balls with the addition of carrageenan flour of 2.5% which has a water content of 66.04%, protein content of

11.87%, fat content of 1.13%, carbohydrate content of 8.59%, crude fiber content of 9.61%, ash content of 1.53%,. The physical characteristics of mackerel fish balls with the addition of carrageenan flour as much as 2.5% are having a gel strength of 3,090.61 Bloom, a pH of 7.17, a bite test value of 5.79 (acceptable, slightly chewy), and a folding test value of 2. 78 (slightly cracked when folded in half). The organoleptic value with the hedonic test of mackerel fish balls with the addition of carrageenan flour of 2.5% and it has an appearance parameter value of 3.76 (neutral to like), while the color parameter value is 3.87 (neutral to like), and the aroma parameter value is 3.87 (neutral to like). Based

Table 1 result can be identified that the value of the taste parameter is 4.69 (like to very like) and the value of the texture parameter is 4.34 (like).

5 CONCLUSION

Based on the tes t which already done in previous, it can be concluded that treatment A1 (meatballs with the addition of carrageenan 2.5%), treatment A2 (meatballs with the addition of carrageenan 5%), treatment A3 (meatballs with the addition of carrageenan 7, 5%). The composition ideal of carrageenan flour with a concentration of 2.5% could led the best effect on the elasticity quality of mackerel fish balls. The organoleptic value with the hedonic test of mackerel fish balls with the extra of carrageenan flour of 2.5% has an appearance parameter value IS 3.76 (neutral to like). The color parameter value is3.87 (neutral to like), and aroma parameter value is 3.87 (neutral to like). The taste parameter is 4.69 (like to very like) and the value of the texture parameter is 4.34 (like). Other material such water content is 66.04%, and protein content is 11.87%, while fat content is 1.13%. The essential material such as carbohydrate content is 8.59%, crude fiber content is 9.61%, and ash content is 1.53%.

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