ISSN 2320-9186

Global Scientific JOURNALS

GSJ: Volume 6, Issue 8, August 2018, Online: ISSN 2320-9186
www.globalscientificjournal.com

The Effect Of Carrageenan Flour Addition On Catfish "Otak-Otak" Preference Level

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KeyWords
Carrageenan flour, preference level, fiber source, "otak-otak"

ABSTRACT

The purpose of this research was to found out the percentage of carrageenan flour addition to catfish "otak-otak"and increase consumption of fishery products in the community. This research was conducted at Fishery Products Processing Laboratory, Faculty of Fisheries and Marine Sciences and Food Chemistry Laboratory, Faculty of Agriculture Industry Padjadjaran University from March to May 2018. The research used is experimental method with the addition of carrageenan flour by 0%, 0.5 %, 1%, 1.5% and 2% based on surimi. The observations parameters were made on the level of impression that included the appearance, aroma, texture and taste by semi-trained panelists, fold test, water content test, ash content, and fiber content in catfish "otak-otak" . The results of this concluded that 1.5% carrageenan flour addition on catfish "otak-otak" was the most preferred treatment by panelists compared with other treatments with 7.5 mean value of appearance, 7.4 aroma, 8 textute and 7.9 taste, with water content of 12.05%, ash content of 1.80% and fiber content of 2,05%.

INTRODUCTION

Indonesia has the potential of fishery products consisting of freshwater fish and sea water fish. One of the potential fresh-water fish is catfish. Catfish are type of fish that are favored by people and have relatively affordable prices. Catfish production in 2017 reached 1.8 million tons or increased by around 131.7% based on the previous year's achievement (Ministry of Maritime Affairs and Fisheries 2017). This production increase can support and drive the economy of the community so that it can support government programs on food and nutrition security. Catfish has high protein, smooth meat, regular spines and can be served in a variety of preparations, low cholesterol and low prices that make the favorite catfish among lower, middle and upper class society (Hendriana 2010).

Community habits in cooking catfish are usually fried catfish and so on. Besides, that catfish can also made into fish jelly products because they have economical prices. Diversification products using catfish raw materials have not been done much. Diversification is one way for product development to be carried out to obtain new innovations with high economic value and exceed fish raw materials. Making a diversified product must be developed because it can be used as an alternative to foster people's habits to consume fish. The diversified products that are commonly consumed are nuggets, sausages and “otak-otak”.

“Otak-otak” is one of the products of fishery diversification. “Otak-otak” is one of the typical Indonesian foods that is often consumed. The community generally knows “otak-otak” because they have a good taste and a fairly simple processing method. “otak-otak” processing can be done by steaming, roasting and frying (Nurjanah et al. 2005).

“Otak-otak” processing that uses catfish raw materials can reduce production costs. However, catfish have the disadvantage of low gel formation which results in poor “otak-otak” texture. This is caused by catfish that having high sarcoplasmic and fat content which is disturbing in the process of gel formation (Yakhin 2015). The curing agent in the hydrocolloid form, carrageenan, needs to be added to give “otak-otak” that chewy textur, so that they are accepted by consumers. Carrageenan is a natural emulsifier which is the extraction result from Eucheuma cottonii seaweed. Carrageenan functions as an emulsifier and gelling agent so as to make the product become supple. According to Sitanggang (2015), carrageenan is able to form a gel that causes a more supple texture with the addition of carrageenan.

Based on the description above the purpose of this research is to find out the percentage of carrageenan flour addition in the catfish “otak-otak” most favored by panelists using hedonic tests and increasing consumption of fishery products in the community. This research is expected to provide information for the public about carrageenan which can be used as a healing material and provide information on the amount of carrageenan flour addition to the level of catfish “otak-otak” preference.

METHOD OF RESEARCH

Research on place and time

This research was carried out in the Fisheries Product Processing Technology Laboratory, Faculty of Fisheries and Marine Sciences, Padjadjaran University in March to May 2018, while chemical testing was carried out at the Faculty of Agricultural Industrial Technology, Padjadjaran University.

Research methods

This research consists of two stages: catfish meat surimi making and catfish “otak-otak” making by adding carrageenan flour. Making surimi is carried out according to (Suzuki 1981) in (Wijayanti et al 2012) which is the fish is washed and filtered, then skinned, the meat is crushed using a meet grender, the next process is washing it with ice water which is 5-10° C twice with 4: 1 ratio of water and meat, meat and ice water are stirred periodically for 15 minutes then filter using a blancu cloth and do the last washing with 0.3% kitchen salt (NaCl) addition, then filtered it again.

The next stage is catfish “otak-otak” making with the addition of carrageenan flour. The method used in this research is an experimental method. Using five treatments with 20 semi-trained panelists as repetitions. Panelists in this research are Faculty of Fisheries and Marine Sciences students who have experience in organoleptic assessment. Five carrageenan enhancement treatments from fish meat are:

1. Treatment A: Adding 0% carrageenan flour
2. Treatment B: Adding 0.5% carrageenan flour

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3. Treatment C: 1% Addition of carrageenan flour
4. Treatment D: 1.5% Addition of carrageenan flour
5. Treatment E: Adding 2% carrageenan flour

Tools and materials

The tools used in this research are digital scales with accuracy of 0.1 g, Meet Grender, basins, pans, knives, spoons, plates, blancu cloth, stoves, cutting boards, pans, Styrofoam plates, organoleptic assessment sheets. The materials used in this research are sangkuriang catfish, carrageenan (types of kappa carrageenan), salt, garlic, shallots, pepper, spring onions, coconut milk, curai ice, banana leaves and tapioca flour.

Organoleptic Test (Hedonic Test)

Organoleptic testing is a way of testing using the human senses as the main tools for assessing product quality. Assessment using these sensory tools includes specifications for the appearance, aroma, taste, and texture quality as well as several other factors needed to assess the product (Irma et al 2015). One of the organoleptic tests is the hedonic test. Hedonic Test is a test method used to measure the level of preference for a product using an assessment sheet. Hedonic testing is used in this research to determine the level of acceptance of a product. The hedonic test includes appearance, aroma, texture, and taste of the catfish "otak-otak" that have been added with carrageenan flour. Hedonic Test value scale ranges from 1-9 that is (1) very dislike, (3) dislike, (5) normal / neutral (7) likes, (9) very like. The acceptance limit for this product is ≥ 5 meaning that the product tested has the same or greater value than 5 then the product is declared still accepted or favored by the panelist.

Data analysis

Organoleptic test data were analyzed by Friedman's two-way non-parametric statistics to determine panelist acceptance of the effect by adding carrageenan flour to catfish "otak-otak" on the level of preference and determination of different concentrations using five treatments. The statistics used in Friedman's analysis are as follows:

$$X_r^2 = \frac{12}{bK(K+1)} + \sum_{t=1}^{t} (Rj)^2 - 3b(K+1)$$

Description:

X_r^2 = Friedman Test Statistics
b = Repetitions
K = Treatments
Rj^2 = The total rank of each treatment

If there is the same number, the correction factor (Faktor Koreksi (FK)) is calculated using the following formula:

$$FK = 1 - \frac{\sum T}{BK\,(K^2-1)} \qquad X_r^2 = \frac{X_r^2}{FK}$$

Decision rules for testing hypotheses are:

H_0: The addition of carrageenan flour does not give a real effect on the catfish "otak-otak".
H_1: Addition of carrageenan flour gives a real influence on the catfish "otak-otak".

If the price $X_r^2 < X_{r(k-1)}^2$ then H_0 is accepted and H_1 is rejected. Whereas if the price $X_r^2 > X_{r(k-1)}^2$ then H_1 is accepted and H_0 is rejected. If the treatment H_0 gives a real difference and continues with the comparative test of the test. This test was conducted to significantly differentiate between treatments.

Description:

$|Ri-Rj|$ = Average difference rank
Ri = Average rank from sample-i
R = Average rank from sample-j
A = Wise error experiment

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B = Number of data and repetitions

k = Number of treatments

z = Value in table Z for multiple comparasion

Decision making on the best products is done by the Bayes method. Bayes method is one of the techniques used to analyze the best decision making from a number of alternatives or treatment with consideration of criteria (Marimin 2014).

RESULTS AND DISCUTION

Appearance

Appearance is one of several things that influences a product acceptance. Appraisal of appearance aims to determine the acceptance of panelists judged by the appearance, shape, brilliance, surface and color of catfish "otak-otak". The mean values of catfish "otak-otak" appear in Table 1.

Table 1. Average appearance of catfish "otak-otak"based on the treatment of carrageenan flour addition

Carageenan Flour Addition(%)	Median	Average
0	7	6,5 a
0,5	7	6,8 ab
1	7	6,6 ab
1,5	7	7,5 ab
2	7	7,9 b

Based on the results of research on the appearance of catfish "otak-otak", the average value of appearance ranges from 6.5 to 7.5 with the median value produced by all treatments is 7, which means that it is favored by the panelists. The addition of 2% carrageenan flour produces the highest average of 7.9 with the brilliant white catfish "otak-otak". The appearance of catfish "otak-otak" without the addition of carrageenan flour produces the lowest average compared to other treatments.

The addition of carrageenan flour in catfish "otak-otak" can increase the appearance of catfish "otak-otak", this is due to the carrageenan used in this research, namely commercial carrageenan. Commercial carrageenan has a high white degree value which reaches 88.48% so as to increase the brightness of kamaboko (Agustin 2010).

Based on the Friedman test, the addition of carrageenan flour to the catfish "otak-otak" gives a significant effect on appearance. This is due to the addition of carrageenan flour. Besides, surimi also able to make the catfish "otak-otak" become bright. This is caused by washing done in catfish surimi making as raw material for catfish "otak-otak". Making surimi in this research was done twice with the intention to reduce the amount of fat in the meat and cleanse the blood from the meat so that the color of surimi will be better or cleaner.

Aroma

According to Soekarto (2007), aroma is one of the parameters that determines a good taste of a food. Aroma is one of the factors that must be considered to influence consumer valuation of a product. According to Winarto (2004) stated that the aroma of food determines whether or not a food is delicious, so that some food industries conclude that the aroma test has sufficient sensitivity to quickly provide an assessment of whether the product is favored or not by consumers. The average value of the aroma of catfish "otak-otak" is presented in table 2.

Table 2. Average Aroma of Catfish "otak-otak"Based on the Treatment of Adding Carrageenan Powder

Carageenan Flour Addition(%)	Median	Average
0	7	6,8 a
0,5	7	7,0 a
1	7	6,8 a
1,5	7	7,4 a
2	7	6,2 a

Based on the Friedman test the addition of carrageenan flour did not give effect to the aroma of catfish "otak-otak", the

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aroma of fish meat was not too strong compared to the aroma of carrageenan flour. Carrageenan flour tends to have a neutral and odorless aroma (Sanjaya 2016). This is in line with Febiando's research (2014) on the addition of carrageenan toward red tilapia meatballs which also showed results that there was no significantly difference from the aroma criteria. The aroma from the catfish "otak-otak" apart from fish is also derived from spices such as white bottom, red onions and added pepper. According to Yamaguchi (1988) in Pratama (2011) the content of amino acids that play a role in aroma is phenilanin, tyrosine and tryptophan. In the catfish there are only fenilanin and tryptophan.

Texture

Texture assessment aims to determine the level of elasticity of a product. Along with the addition of carrageenan flour can increase the level of elasticity. According to Sitanggang (2015), carrageenan is able to form a gel that causes a more supple texture with the carrageenan addition. The average value of catfish "otak-otak" texture is presented in table 3.

Table 3. Average Textur of Catfish "otak-otak"Based on the Treatment of Adding Carrageenan Powder

Carageenan Flour Addition(%)	Median	Average
0	7	6,9 ab
0,5	7	7,2 ab
1	7	7,3 ab
1,5	8	8,0 b
2	6	6,1 a

Based on the Friedman test the addition of carrageenan flour significantly affected the catfish "otak-otak". The results of the assessment by the panelists on the texture of catfish "otak-otak" with the addition of carrageenan flour, the average value of 6.1 to 8 with a median value of about 6 to 8 is still favored by panelists. The highest value in the catfish "otak-otak" is 1.5% carrageenan flour addition with an average value of 8.0 is still favored by the panelists because it produces catfish "otak-otak" texture that is compact and chewy. The lowest value is found in the catfish "otak-otak" with the addition of 2% carrageenan flour with a median of 6, which is the catfish "otak-otak" tend to be solid. This is because the more addition of carrageenan flour the harder texture of a product will become.

The texture of the catfish "otak-otak" with 1.5% addition of carrageenan flour produces the best results compared to other treatments, this is caused by carrageenan that having the ability to form gels. Gel formation due to the heating process which causes the carrageenan polymer in the solution to be a random coil (random), if the temperature is lowered the polymer will form a double helix structure (double twist) and if the temperature decline continues the polymers will be strongly crosslinked and with the more helical forms will form aggregates which are responsible for the strong gels formation (Gliksman 1983).

Besides that, the strength of the gel in the catfish "otak-otak" is very much determined by the quality of the raw material, namely the freshness of the fish as raw material surimi which is an important component in the formulation of the catfish "otak-otak". Washing in surimi making is done twice, which is in line with Wijayanti's (2012) research that washing twice in dumbo catfish produces the best strength gel surimi. The first washing in surimi aims to eliminate sarcoplasmic protein, while the second washing is done by adding 0.3% salt from the meat weight to dissolve the myofibril protein and activating sol actomiosin (Chaijan et al. 2004).

Taste

Taste is one of the important judgments to make a decision in choosing a product whether or not it is accepted by consumers. Based on the results of the test, the addition of carrageenan flour gives a significant effect on the taste of the catfish "otak-otak". The average value of the hedonic test of the catfish "otak-otak" taste is presented in Table 4.

Table 4. Average Taste of Catfish "otak-otak"Based on the Treatment of Adding Carrageenan *Powder*

Carageenan Flour Addition%	Median	Average
0	7	6,5 ab
0,5	7	6,6 ab
1	7	6,9 ab
1,5	7	7,9 b
2	5	6,1 a

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Based on the results of the research, preference test of the catfish “otak-otak” with the addition of carrageenan flour produces “otak-otak” with an average value of 6.5 to 7.9 with a median value of 7 (preferred) and in the treatment of adding carrageenan flour by 2% the median value is 5 (normal / neutral) means the taste of all treatments in the catfish “otak-otak” is still favored by the panelists.

The taste of the catfish “otak-otak” tends to come from fish meat. Panelists in this research preferred the catfish “otak-otak” with 1.5% addition of carragean flour because the specific flavor of the fish produced not too strong and having a very elastic texture so it preferred by panelists compared to other treatments. The lack of a strong sense of fish is due to the use of surimi in the catfish “otak-otak”, according to Tan et al (1988) the final product produced by surimi has a tasteless taste that makes it possible to provide the desired flavor to the desired.

According to Suryaningrum et al. (2002), the food taste is influenced by the components contained in foods such as proteins derived from fish meat, fat and carbohydrates. Catfish has a fat content around 4.8 grams / 100 grams where fat can create a savory flavor (Vaas 1995). Catfish have an amino acid which is influential in flavor formation. Amino acids that play a role in the flavor formation are glutamate acid, glycine, alanine, arginine, methionine, valine and proline (Yamaguchi and Watanabe 1990).

Based on statistical test results on catfish “otak-otak” taste, there is a significant difference with the carrageenan flour addition and all treatments are still acceptable to panelists. The treatment without added carrageenan flour was not significantly different with the treatments of 0.5%, 1% and 2% but significantly different with the treatment of 1.5%

Decision Making by *Bayes Method*

The decision calculation results of relative weight values from the criteria of appearance, aroma, texture and catfish “otak-otak” taste are presented in Table 5

Table 5. Catfish “otak-otak” Assessment Matrix Using Bayes Method

Treatment	Criteria				Alternative Value	Priority Value
	Appearance	Aroma	texture	Taste		
A	7	7	7	7	7,00	0,20
B	7	7	7	7	7,00	0,20
C	7	7	7	7	7,00	0,20
D	7	7	8	7	7,22	0,21
E	7	7	6	5	5,77	0,16
Weight Criteria	0,13	0,14	0,21	**0,50**	33,98	1

Based on the criteria weight calculation of appearance, aroma, texture and catfish “otak-otak” taste, it was found that the taste had the highest criteria weight compared to the other criteria with a value of 0.50. This determines that the taste criteria are the most important in determining panelists' final decisions. Calculation using the Bayes method of adding carrageenan flour of 1.5% is the best treatment compared to other treatments. The highest alternative value with the criteria consideration can be used to analyze the best decisions (Marimin 2004). Overall the catfish “otak-otak”with the addition of carrageenan flour in all treatments are still favored by panelists

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Folding Test

Based on the results of the research, the addition of carrageenan flour in the catfish "otak-otak" can affect the texture so that a folding test need to be done. The folding tests results of catfish "otak-otak" from each treatment can be presented in table 6.

Table 6. Folding Test Value of Catfish "otak-otak" with Carrageenan Flour Addition

Carageenan Flour Addition%	Folding Test Value	Elasticity Levels
0	4	Chewy
0,5	4	Chewy
1	4	Chewy
1,5	5	Very Chewy
2	3	Enough Chewy

Based on the folding tests results of catfish "otak-otak" with the addition of carrageenan flour, the test values ranged from 3 to 5, which means that the elasticity of the catfish "otak-otak" is quite chewy to the very elastic one. The highest value generated from the folding test of catfish "otak-otak" is by adding 1.5% carrageenan flour, while the folding test value on the lowest catfish "otak-otak" is the addition of 2% carrageenan flour which produces "otak-otak" that tend to be solid. Carrageenan has the advantage of being able to form a good gel so that it causes a more supple texture along with the addition of carrageenan flour (Sitanggang 2015).

Water Content Test

Air content is air contained in ingredients that dissolve in percent. Water is an important parameter in food ingredients because it can affect the texture, appearance and taste of food. Water content test results in the catfish "otak-otak" without additional carrageenan flour and catfish brains that are most sought by panelists are presented in table 7.

Table 7. Catfish "otak-otak" Water Content Without Carrageenan Flour Addition and the Most Preferred Treatment

Carrageenan Flour Addition (%)	Value of water content (%)	SNI 7757-2013 (%)
0 %	12,62	<60
1,5 %	12,05	

Based on the results of the water content test there is a difference in the amount of water content contained in the catfish "otak-otak" without the addition of carrageenan flour and the catfish "otak-otak" that are most preferred by the panelists. The water content produced in the catfish "otak-otak" without the addition of carrageenan flour is higher compared to the catfish "otak-otak" favored by the panelists. This is because carrageenan has the ability to inhibit the entry of water and form a gel (Agustia 2009). In addition, a decrease in water content is thought due to a synergetic phenomenon in which water is released from the gel matrix (Saputro 2018). This is reinforced by the statement of Winarno (1996) that carrageenan gel is easier to experience syneresis. This is in line with the research of Ayadi et al (2009) stating that the addition of carrageenan can increase the water binding capacity and hardness in sausages.

Ash Content Test

Gray ash test is a test to determine the mineral content found in a food ingredient. Ash is an inorganic substance left over from burning organic matter. Ash content is usually associated with the mineral of a substance. Test results of ash content in catfish "otak-otak" without adding carrageenan flour and catfish "otak-otak" most preferred by panelists are presented in table 8 as follows.

Table 8. *Catfish "otak-otak" Ash Content Without Carrageenan Flour Addition and the Most Preferred Treatment*

Carrageenan Flour Addition (%)	*Ash Content Value* (%)	SNI 7757-2013 (%)
0 %	1,40	Maks. 2
1,5 %	1,85	

Based on the results of the ash test toward catfish "otak-otak" without carrageenan flour addition (0%), it was found 1.40%

ISSN 2320-9186
ash content inside and the catfish "otak-otak"'s fat content with 1.5% carragean flour added was 1.85%. Increase in catfish "otak-otak"'s ash content with addition of 1.5% carrageen flour compared with no added carrageenan flour due to the addition of carrageenan flour. Carrageenan has a high ash content. According to Yakhin et al. (2008), the addition of carrageenan increases the fish meatball ash content. This is due to the high ash content of carrageenan, which is 17.76%, so that more and more carragenan are added, therein the more ash is contained. Ash content can come from various minerals such as sodium, potassium, phosphorus, calcium, magnesium and selium.

Terms of "otak-otak" quality based on SNI 7757-2013 is that the maximum ash content in the "otak-otak" is 2% (b / b). The ash content produced from the catfish "otak-otak" added with carrageenan flour is still below the range of values required by SNI, so it can be said that the catfish "otak-otak" with the addition of carrageenan flour meet the requirements of SNI standards.

Coarse Fiber Test

Food fiber is a component needed for human health. In order to fulfill the fiber content in humans, the addition of food that is able to meet the fiber content is needed. One of them is carrageenan. Carrageenan has a high fiber content, this is because carrageenan comes from Echeuma cottoni seaweed which is rich of fiber. The results of the fiber content test in catfish "otak-otak" without addition and the catfish "otak-otak" most favored by panelists is presented in table 18 are as follows.

Table 9. Coarse Fiber of Catfish "otak-otak"Without Carrageenan Flour Addition and the Most Preferred Treatment

Carrageenan Flour Addition (%)	Fiber Content	
	%	mg/100g
0 %	2,01	2010
1,5%	2,05	2050

Based on the results of fiber content tests obtained from catfish "otak-otak" without the addition of carrageenan which is 2.01% while the fiber content in the catfish "otak-otak" with the addition of 1.5% carrageenan most preferred by panelists is 2.05%. The fiber content of the catfish "otak-otak" comes from the fiber contained in carrageenan. Catfish "otak-otak" with the addition of 1.5% carrageenan have a high fiber content compared to the one without the addition of carrageenan flour. The increasing addition of carrageenan flour will increase the amount of fiber content contained in a product. Carrageenan flour has a high crude fiber content of 5.35% (Ega 2016). The high content of crude fiber in carrageenan flour cause by the raw material of carrageenan is derived from E. Cottoni seaweed containing crude fiber reaching 65.07% which consists of 39.47% insoluble dietary fiber and 25.7% of soluble dietary fiber so it can be said that carrageenan can be used as healthy food that has fiber content inside (Kasim 2004).

CONCLUSION

Based on the results of the research that the addition of carrageenan flour in the catfish "otak-otak" produces the best treatment compared to other treatments, with the value of the characteristics of appearance, aroma and taste has a median value of 7 or preferable while the texture characteristics have a median value of 8, which is highly favored by panelists. The results of the test were 5 for folding test, 12.05 water content, 1.80 ash content and 2.05 fiber content.

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