

# THE UTILIZATION OF RED MEAT WASTE IN THE MAKING OF CRACKERS

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## ABSTRACT

Red Tuna Fish waste contains vitamin B6 which functions to increase hemoglobin production, maintain brain cell function, and help the body produce serotonin and norepineprine hormones. The formulation of the problem in this study is what is the right composition for making tuna red meat crackers. How is the community's acceptance of the quality of the addition of tuna red meat crackers. The research objectives were to determine the exact composition of tuna red meat crackers and to determine the public acceptance of the quality of crackers with the addition of tuna red meat waste based on color, taste, aroma and texture.

This research uses analytic observational research where the research is conducted by analyzing acceptance. The population used was 352 people in Bilato Village, Bilato District and a sample of 176 respondents. Data collection techniques using hedonic questionnaires with data analysis techniques using qualitative descriptive analysis.

The results showed that the crackers preferred by the panelists were 100 gr and 200 gr with very like criteria but the most preferred by the panelists were 100 gr crackers with very like criteria, 50 gr crackers were less preferred by the panelists with moderate criteria. Suggestions from research for campus institutions as references and information for further research, for students to further modify the food material for tuna red meat waste so that it can be used as the latest research material and see the RDA contained in fish waste red meattuna

**Keywords:** waste, red meat, tuna fish, crackers

## INTRODUCTION

Indonesia has a sea area wider than land and is an archipelago country, Indonesia has a lot of marine wealth such as coral reefs, mangrove forests, seaweed, fisheries and other types of marine life. Tuna fish is one aspect of fisheries that greatly contributes to the Indonesian economy [3].

Tuna fish produces a lot of products and is used for export and import of parts of the fish that are used and made into products,

only red meat is easy, while red meat which contains pigments from the remaining fillets has not been maximized, the remaining red meat of the fillet is tuna waste. The red meat of tuna contains a lot of minerals, calcium, phosphorus, iron, sodium, vitamin A (retinol), and vitamin B in the thiamin, riboflavin and niacin groups [13].

Tuna fish are generally used for the production of canning and freezing or fresh fish, either whole or in the form of loins.

Fresh fish in the form of frozen loin, fillet (frozen fillet), and steak (frozen steak), the production process produces a large amount of waste for exporting companies [4].

The body shape of the tuna fish is like a cigar, on the upper part it has dark blue scales which have two dorsal fins and a bright yellow additional fin. Tuna is included in the *scrombidae* family [22].

waste is the residual effort of the human tuna production process. The tuna production process leaves a large amount of waste in the form of red meat, head, bones, skin, tail, and the entrails of Toro or belly [20].

Based on the author's interview with quality control (QC) at the place of the Gorontalo Sea Camar tuna tuna fish processing, the processing of tuna is semi-finished, the products of which are directly exported, leaving a lot of waste. The pattern of tuna processing in the Gorontalo Sea Camar tuna fish company is the same as that applied in several tuna processing companies in Indonesia [18]

The Gorontalo Sea Camar tuna company produces 10 heads or 0.47 tonnes of tuna of different weight every day, the weight of tuna is 47kg-55kg, the calculation results of ten different tunas, the average weight of one fish to be produced is 47kg. The tuna fish produce a composition of waste and a composition of types of waste, while the composition of waste is 23.9 kg-27.4 kg, a total weight of 23.57% and a composition of types of waste respectively 6.24 kg of red meat, 2.08 kg of skin, stomach contents of toro or belly 2,58kg, 1.16kg tail, 9.02kg head, 2.48kg bones, average weight 23.57kg. Seeing the large amount of tuna red meat waste, namely 6.24 kg produced from 1 (one) day of fresh fish production, provides an opportunity and encourages the author's desire to make tuna red meat waste as the main ingredient in the

manufacture of advanced products, namely use crackers increase the selling price of tuna for the welfare of the community, make cracker products a business opportunity for the community, reduce the composition of the types of waste produced from fresh tuna production, increase consumption and can inform the public about the benefits. The nutritional content of tuna red meat waste and informs the public that apart from being traditionally processed, tuna red meat waste can also be processed into a further product, namely crackers [17].

tuna red meat waste is the remainder (tetelan) of the remaining production produced from a tuna fish along with its bones, skin, head, and stomach contents. tuna red meat waste has a large enough potential to be used as an advanced product because it is sold cheaply, is easy to obtain and underutilized [19].

The red meat waste of tuna in the cracker-making texture is chewy, does not smell rancid and has not been oxidized. By processing it into crackers, it is hoped that the tuna red meat waste will be given treatment such as washing, steaming, and adding spices to avoid its oxidation and rancidity [8].

The nutritional content of tuna red meat waste, tuna red meat waste contains protein and fat, the main benefit of tuna red meat waste is that it is a complete source of protein, good for maintaining the health of our body tissues such as muscle tissue, hormone formation, antibodies, enzymes, and collagen. consumption of red meat waste of 85 grams of tuna provides 24-30 grams of protein / day. Fat in tuna red meat waste is healthy fat because it is low in saturated fat, has the benefit of lowering triglyceride levels, maintaining heart health, blood pressure, blood clotting, and the risk of stroke and heart failure. tuna red meat waste or pigments derived from myoglobin

and hemoglobin containing high vitamin B6 provide a very important function for the body, such as increasing hemoglobin production, maintaining brain cell function, helping the body produce serotonin and norepineprine hormones (regulates mood and stress). consumption of 100 grams of tuna red meat waste containing 0.5-0.9 grams of vitamin B6 really helps the body meet daily needs [7].

Tuna red meat waste is part of the body of the fish that is not used. The tuna red meat waste is organic if it is not utilized and if it is used again it will produce products that have added value. It is further stated that generally unused tuna red meat waste can be turned into a product, namely crackers based on tapioca flour. Crackers are products made from tapioca flour or starch, have a taste and can be accepted by the community. The characteristic of crackers is dry, crunchy texture and tasty, and can be stored for a long time [16].

Crackers with raw materials of tuna red meat waste mixed with tapioca flour contain nutrients that the body needs. namely carbohydrates, protein, fat, calcium, phosphorus, iron, and vitamin A. The quality of tuna red meat crackers depend on the composition of the amount of tuna red meat waste contained in the crackers, the more tuna red meat waste is contained in the crackers the better the quality [22].

Crackers are snacks made from tapioca flour dough mixed with flavoring ingredients such as shrimp or fish and then shaped into a spike and then steamed. After being cooked, the crackers are stored overnight and then cut into thin strips then dried under the sun and then fried in a lot of oil [25].

Crackers consists of two types, namely sliced crackers and molded crackers, the main ingredient used in the manufacture of crackers, namely tapioca flour, is known as

puffable material as an ingredient of flavor and water as a form of dough. The addition of tuna red meat waste can affect the characteristics of the crackers because tuna red meat waste is a protein source, the greater the red meat tuna waste used can increase the water conten[11].

In terms of raw materials, crackers are classified into three groups, namely fish crackers, prawn crackers and mollusc crackers, but people only know that there are two types of crackers based on raw materials, namely non-fish and fish crackers [1].

Non-fish crackers usually use vegetable raw materials such as onion crackers and cassava crackers, while fish crackers are crackers that use fishery products as raw materials.

The choice of tapioca flour in making tuna red meat crackers is because it has many advantages, namely it will affect the crispness of the crackers, the characteristics of the crackers, the volume of development and an attractive appearance. Besides that, tapioca flour has advantages in making crackers, which are easy to obtain and cheap. Tapioca flour is a source of carbohydrates containing very little protein and fat so it is very good if it is mixed with tuna red meat waste in making crackers, seeing the nutrients contained in tuna red meat waste and the public's interest in crackers. The author wants to develop a tuna fish cracker waste red meat cracker product by marketing it. With the production of tuna red meat crackers, it is hoped that it can increase the variety of crackers in the market. The marketing area for crackers is very wide. Consumption is not limited to customrace, as well as social level, so that crackers can be marketed in all regions within the country. Even now, crackers are also marketed abroad [2].

Tapioca flour is a tuber variety that is processed into starch or tapioca flour, namely cassava (*Monihot utilisima*). starch is a plant source of carbohydrates that is widely used by the food industry as a raw material for thickening, filler and binder, such as making soups, sausages, meatballs, pudding and crackers. The process of making tapioca flour crackers is the main ingredient because in the manufacture of crackers it has the advantage that it affects the crispiness of the crackers, the volume of development and the characteristics of the crackers. Tapioca flour used in the manufacture of crackers is dried and mashed starch made from white or yellow cassava to produce white and slippery flour. In addition, tapioca flour must be of good quality, odorless, dry and smooth. if tapioca flour is used less well it will affect the yield of crackers [16].

Tapioca flour or starch is an excellent source of carbohydrates and energy, containing very little protein and fat. The composition of nutrients per 100gr of tapioca flour with energy 362.00cal, 0.50gr protein, 86.90gr carbohydrates, 0.30gr fat and 12.00g water. Tapioca flour has similar properties to starch and sago flour, so that its use can be exchanged with the two ingredients. starch is composed of 83% amylopectin and 17% amylose with insoluble properties in cold water, can form a gel in hot water, tasteless, colorless. Tapioca starch is a starch granule that is insoluble in cold water, it will absorb water (hydration) and slightly reversible because the starch can be dried again without changing its structure. tapioca flour is a complex polysaccharide consisting of two components namely amylose and amylopectin [5].

Based on this background, researchers are interested in knowing the organoleptic test of the composition of tuna red meat

waste, the addition of tapioca flour as a basic material for making tuna red meat crackers. The objectives of this study are as follows to find out the exact composition of tuna fish red meat crackers To determine the public's acceptance of the quality of crackers, the addition of red tuna waste meat based on color, taste, aroma and texture

## **RESEARCH METHODS**

This study used an analytical observational study where this research would be conducted by analyzing the acceptance of tuna red meat crackers for the community at one time. This research was conducted in Bilato Village, Bilato District, Gorontalo Regency on 22-9-2020.

The data collection technique was carried out using a hedonic questionnaire provided by the researcher.

This study uses the human senses so that it gets different results. this assessment includes color, taste, aroma and texture.

This assessment uses a culinary nutrition laboratory with the aim of knowing the number of people who will be given tuna red meat crackers.

The data analysis technique used in this research is the preference test using qualitative descriptive analysis method.

The credibility of the research is to find out the truth of the data that has been obtained. The researcher will validate the data by collecting the data from the research. The validity of the data was carried out by using a data triangulation approach including method triangulation and theory triangulation. Perform testing and check the results of data against data sources with different techniques.

The results of the data that have been tested are re-checked from the data source and will be compared with various sources, methods and theories.

This study uses 2 variables, namely the independent variable in this study is crackers with a mixture of red meat tuna waste 50gr, 100gr, and 200gr. While the dependent variable in this study is public acceptance (color, taste, aroma and texture).

The population in this study were 352 people in Bilato Village, Bilato District, Gorontalo Regency.

The sample is a portion of the population that represents the characteristics of the population. Sampling is done by means of Non Probability Sampling (Purposive Sampling), namely the sample is selected from among the population according to what the researcher wants, so that the sample can represent the desired population characteristics. The sample in this study was a part of all the people of Bilato Village, Bilato District, Gorontalo Regency who have ages 15–35 years and have junior high school education as many as 176 people.

The red meat waste of tuna used in this research is the waste of red meat tuna obtained from the tuna company, Sea Camar Gorontalo, as much as 5 kg. To produce tuna red meat crackers, the ingredients needed in the cracker making are: tapioca flour, tuna red meat waste, coriander, garlic, baking powder, salt, water and coconut oil.

The tools used in this study were tablespoons, glasses, trays, blenders, pans, drains, cutting boards, steamer and gas stoves.

The materials used in this study were tapioca flour, tuna red meat waste, ketunbar, garlic, baking powder, salt, water, and cooking oil.

The cracker recipe is tapioca flour, tuna red meat waste, coriander gintar, garlic, baking powder, salt, and water.

The process of making crackers is carried out by selecting materials, using spices, printing, steaming, cooling, slicing,

drying, frying, packaging. the stage in making crackers is preparing the tools that will be used when making crackers, preparing the materials to be used in making tuna fish red waste crackers, then weighing the ingredients to be used when making crackers. implementation stage, mixing tuna red meat waste and tapioca flour

Then add the coriander, garlic, salt, baking powder and enough water, then mix again until the mixture is evenly mixed. Flatten the dough, form into a oval, then steam for 30 minutes. then the steamed dough is stored overnight and sliced into the same thickness, then dried in the sun and fried in hot oil at a temperature of 1000C. Cool it, then put it in a clean, dry container and tightly closed. subjective assessment was carried out by means of the organoleptic test. The organoleptic test is an assessment that uses the senses. The type of organoleptic test used is the preference / hedonic test which states his / her likes / dislikes of a product.

Acceptability of Tuna fish waste red meat crackers was collected by means of organoleptic tests including color, taste, aroma and texture using the hedonic test method as the main data carried out by panelists as many as 176 people as panelists, with a hedonic scale of very fond/moderate, don't like it

## RESEARCH RESULT

Through the organoleptic test, namely the hedonic test which was carried out on a panel of 176 people. This organoleptic test includes the color, taste, aroma and texture of the crackers with the addition of different amounts of tuna red meat waste. The result of the addition of tuna red meat waste will affect the taste and determine the quality of the crackers produced. The panelists' acceptance of crackers preferred crackers with a lot of mixed tuna red meat waste

compared to crackers with a little mixture of tuna red meat waste. The organoleptic test used was the hedonic test as the main data. the results of the average value of the test panelists' preference for crackers fortified with tuna red meat waste.

## DISCUSSION

The exact composition of tuna red meat crackers. Based on the table of research results above, the treatment of tuna red meat crackers 50gr 100gr and 200gr has different preference values on the results of the hedonic test data including color, taste, aroma, and texture. As many as 176 panelists who carried out the hedonic test of the criteria of very like, like, and dislike, the highest average value of the preference test on the treatment of 50gr tuna red meat cracker was on the color test, namely 38.7 with the conclusion that it is very like. The highest value of 100gr tuna red meat cracker treatment was in the color test as much as 42.6%, the taste test as much as 43.9%, the aroma test as much as 35.8% and the texture test as much as 43.2% with the conclusion very like. The highest value of the 200gr tuna red meat cracker treatment was in the color test as much as 39.6%, the taste test as much as 47.3%, the aroma test as much as 43.4% and the texture test as much as 42.0% with the conclusion that it is very like.

The cracker product composition of tuna red meat waste as much as 50 gr, 100 gr, and 200 gr to the organoleptic preference parameters which include color, taste, aroma and texture of the cracker product most liked by the panelists, namely crackers composed of 100 gr tuna waste red meat. whereas according to Wijayanti (2012) the proportion of tuna and tapioca flour includes (10%: 90%), (15%: 85), (20%: 80%), (25%: 75%), and (30%: 70%). %) to the organoleptic preference parameters which include color, taste, aroma and texture of

tuna fish cracker products has a very significant effect on organoleptic characteristics of the color, taste, aroma and texture of the tuna fish cracker products public acceptance of the quality of crackers with the addition of tuna red meat waste based on color, taste, aroma, and texture.

The acceptability of the organoleptic test through the hedonic test which includes indicators of color, taste, aroma and texture is a person's ability to spend the food served according to their needs. Food acceptance in general can be seen from the amount of food consumed and food acceptance can also be assessed from the answers to questions related to the food consumed.

The panelists' acceptance of the cracker product by adding the tuna red meat waste was measured by using an assessment of the aspects of color, taste, aroma and texture. Based on these results, it shows that when the composition of tapioca flour with the addition of tuna red meat waste, the average calculation of the hedonic test is the main data in data collection. These data indicate that the results shown are the addition of red meat tuna waste 50 gr, 100, and 200 gr, which is much in demand by the panelists, namely crackers with a lot of red meat composition of tuna waste. Thus the amount of tuna red meat waste affects the color, taste, aroma and texture of the crackers in a different amount for each treatment.

The panelists' acceptance of the crackers was still more like the ones with the addition of tuna red meat waste compared to the crackers with only a little additional tuna red meat waste. The panelists' acceptance of the cracker product with the addition of tuna red meat waste was measured using the panelists' characteristics, namely an assessment of the aspects of color, taste, aroma and texture. the acceptability of the organoleptic test through the hedonic test

which includes indicators of color, taste, aroma and texture.

### **Tuna fish meat waste crackers 50gr**

#### **Color**

Generally, the color of the crackers made in this study is brownish yellow. based on the hedonic test of red meat crackers of tuna 50gr: 200gr of tapioca flour has a yellowish white color, but the panelists prefer to like it very much. This treatment is in accordance with the research of Rachmansyah et al. (2018) the lowest average value of color appearance was found in the treatment of adding fish bone meal (2.5%: 97.5%) tapioca flour, which had a yellowish white color with the usual criteria. This is in accordance with the theory of Yuliani et al. (2018) stated that the fish content of up to 12% in tapioca flour gave the same color as the control treatment, namely yellowish white.

#### **Taste**

In general, the taste of the crackers made in this study is the typical savory taste of fish crackers. based on the hedonic test of red meat crackers of tuna 50gr: 200gr of tapioca flour, it has a slightly savory taste, which is typical for fish crackers, so that panelists with moderate criteria are less preferred. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago starch, the treatment of snakehead fish (30: 70) sago flour has a real difference, which is somewhat savory, typical of fish crackers and less favored by panelists.

#### **Flavour**

In general, the flavour of crackers made in this study is the distinctive delicious flavour of fish crackers. Based on the hedonic test, the red meat crackers of tuna, 50gr: 200gr of tapioca flour, had a rather delicious flavour, which was typical of fish crackers, which panelists did not like with

moderate criteria. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago starch, the treatment of snakehead fish (30: 70) sago flour has a rather delicious aroma typical of fish crackers and is less liked by panelists. This is in accordance with the theory of Wellyalina and Aisman (2013) which states that the more flour added to the red tuna dough will cause the smell of fish used as the basic ingredient to decrease.

#### **Texture**

In general, the texture of the crackers made in this study is crunchy and has a volume of expansion. Based on the hedonic test, the red meat crackers of tuna 50gr: 200gr of tapioca flour had a slightly crunchy texture, and slightly fluffy, less favored by panelists with moderate criteria. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago starch, treatment of snakehead fish (30: 70) tapioca flour has a slightly soft texture and is less liked by panelists.

### **100 Gr tuna meat crackers**

#### **Color**

The color of the crackers made in this study is generally brownish yellow. Based on the hedonic test, red meat crackers of 100gr tuna: 100gr tapioca flour have an attractive color, namely yellow-brown, favored by panelists with very like criteria. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago flour. In general, the color of the crackers made in this study were brownish cream, the treatment of snakehead fish crackers (50: 50) tapioca flour had a significant difference, namely having a brownish cream color and favored by the panelists. According to Muchtadi and Ayustaningwarno (2010)

there are five causes for a food ingredient to become colored, namely the rubberenoid pigments in foodstuffs, chemical reactions such as browning and oxidation reactions as well as natural and artificial dyes.

### **Taste**

In general, the taste of the crackers made in this study is the typical savory taste of fish crackers. Based on the hedonic test of 100gr tuna red meat crackers: 100gr tapioca flour, which has a distinctive savory taste of fish crackers, the panelists really liked it. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago flour, the treatment of snakehead fish (50: 50) tapioca flour had a significant difference in experiencing an increase in the taste value, namely the typical savory fish cracker and was very popular with the panelists. This treatment is also in accordance with Ratnawati's (2013) research on the experiment of making banyar fish flavored crackers with the basic ingredients of mocaf and tapioca composite flour that shows that fish crackers with sample A (5: 5) have a real fish taste and have the highest average score compared with other samples.

### **Flavour**

The flavour of crackers made in this study is generally the delicious aroma of fish crackers. Based on the hedonic test of 100gr tuna red meat crackers: 100gr tapioca flour, which has a distinctive delicious aroma of fish crackers, the panelists really liked it. This treatment is in accordance with the research of Ratnawati (2013) on the experiment of making banyar fish flavored crackers with the basic ingredients of mocaf and tapioca composite flour where the three fish cracker samples that have a very real fish aroma are fish crackers with a sample (5:5).

### **Texture**

The texture of the crackers made in this study is generally crunchy and has a volume of expansion. Based on the hedonic test, 100gr of tuna red meat crackers: 100gr of tapioca flour has a crispy texture with a good volume of development, which panelists like very much. This treatment is in accordance with the research of Ratnawati (2013) on the experiment of making Banyar fish flavored crackers with the basic ingredients of mocaf and tapioca composite flour that the sample (5: 5) has an ideal texture and has the highest average score compared to other samples.

### **Tuna meat crackers waste 200gr Color**

The color of the crackers made in this study is generally brownish yellow. based on the hedonic test, red meat crackers of tuna 200gr: 50gr tapioca flour had a less attractive color, which was brownish, but the panelists liked it with very fond criteria. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago starch, the treatment of snakehead fish (70: 30) tapioca flour had a significant difference in experiencing an increase in color, namely brown and disliked by panelists. According to Novitasari (2015), the color pigment of fish meat is influenced by the bone marrow and muscle found in the meat, the bone marrow is rich in hemoglobin and the muscles are rich in myoglobin, both of which contribute to the red color, the meat when it is heated (frying) will happen denaturation of globin, the results of the denaturation if oxidized will produce a brown color. taste. In general,

### **Taste**

The taste of the crackers made in this study is the typical savory taste of fish crackers. Based on the hedonic test, 200gr of tuna red meat crackers: 50gr of tapioca



flour had a more distinctive taste than fish crackers, which panelists liked very much. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago flour, the treatment of snakehead fish (70: 30) tapioca flour had a significant difference in experiencing an increase in taste, namely savory and preferred by panelists.

### **Flavour**

Generally, the flavour of the crackers made in this study is the typical delicious fish crackers. Based on the hedonic test, 200gr of tuna red meat crackers: 50gr of tapioca flour had a more delicious flavour, which was typical of fish crackers, which the panelists liked very much. This treatment is in accordance with the research of Laiya et al. (2014) regarding snakehead fish crackers mixed with sago flour, the treatment of snakehead fish (70: 30) tapioca flour produced a delicious aroma which was very popular with the panelists.

### **Texture**

The texture of the crackers made in this study is generally crunchy and has a volume of expansion. based on the hedonic test, the red meat crackers of tuna 200gr: 50gr tapioca flour had a less crunchy and less fluffy texture, but the panelists liked the criteria very like it. This treatment is in accordance with the research of Ratnawati (2013). regarding the manufacture of banyar fish crackers with mocaf and tapioca flour, that the sample (7: 3) has a fairly ideal texture.

Fish meat is more responsible for decreasing the volume of cracker development because protein can bind water more than starch and water will disappear suddenly so that when it is fried it becomes a little less [14]. This causes the volume of fish cracker development to be small compared to the volume of tapioca flour cracker

development without the addition of fish meat.

### **CONCLUSION**

The acceptability of the crackers added by the tuna red meat waste from the aspects of color, taste, aroma and texture can be concluded from the treatment:

The cracker composition that many panelists like is the additional cracker 100gr of tuna red meat waste with 100gr of tapioca flour,

The public's acceptance of the quality of crackers with the addition of 100 gr tuna red meat waste was preferred by the panelists with very like criteria.

### **REFERENCES**

- [1] National Standardization Agency. 2016. Fish, shrimp and mollusc crackers SNI 8272-2016. National Standardization Agency. Jakarta
- [2] Cahyo, Saparinto. 2011. Processed Variations of Fishery Products at Industrial and Household Scale. First Edition, First Edition. Main Partners. Yogyakarta
- [3] Faizah, R. 2010. Biology of Reproduction of Big Eye Tuna (*Thunnus Obesus*) in the waters of the Indian Ocean. Thesis, Bogor Agricultural University
- [4] Jati, AK. 2014. Supply Chain System and Handling of Tuna Loin in Maluku Waters. Bogor Thesis (ID). Bogor Agricultural Institute
- [5] Kuntari, AN. 2015.a combination of tapioca flour and carrageenan (*Eucheuma cattonii* Doty) in the process of making vegetable meatballs from white oyster mushrooms (*Pleurotus ostreatus*). Biology Stusi Thesis Program. Faculty of Biotechnology. Atma Jaya University Yogyakarta

- [6] Laiya, N. Harmain, Marsuci, R. Yusuf, N. 2014. a formulation of snakehead fish crackers substituted with sago flour. *Journal of Fisheries Technology*, Faculty of Agricultural Sciences. Gorontalo State University
- [7] Mentari, D.P. 2011. Quality Control in the Lion Tuna (*Thunnus Sp*) Production Process using the six sigma method. thesis of the Faculty of Fisheries and Marine Affairs. Bogor Agricultural Institute
- [8] Moniharapon, T. Fredy, P. 2016. Utilization of red meat from Tuna loin waste in fish sauce processing. Thesis of Fishery Product Technology. Faculty of Fisheries and Marine Science. Pattimura University Ambon.
- [9] Muchtadi and Ayustaningwarno, F. 2014. *Food Technology: Practical Teortion and Applications*. Your Graha Ilmu. Yogyakarta
- [10] Mustard. 2013. Study of Making Shredded Cork Fish (*Ophiocephalus striatus*) as a Food Supplement. Thesis of Food Processing Science and Technology Study Program. Faculty of Agriculture. Hasanuddin University. Makassar
- [11] Ningsih, ES. 2018. Addition of Various Concentrations of Powdered Rusip in Crack Making. Thesis of the Faculty of Agricultural Product Technology, University of Lampung, Bandar Lampung
- [12] Novitasari, N. 2015. the effect of using different types of fish on the quality of pempek. Thesis, State University of Padang
- [13] Nurilmala, M. Agoes, M. Jacob, R. Ahmad, D. 2017. Characteristics of Yellowfin Tuna Fish Skin Gelatin. Thesis, Faculty of Fisheries and Marine Science. Bogor Agricultural Institute
- [14] Son, MRA. novianti, R, Herpandi. 2015. Fortification of Cork Fish Bone Flour (*Channa striata*) on Crackers as a Source of Calcium. *Fishtech Journal* 4 (2) 128-139
- [15] Rachmansyah, F. Liviawati, E. Rizal, A. Kurniawati, N. 2018. *Journal of Fisheries and Marine Affairs*, Padjadjaran University
- [16] Ratnawati, R. 2013. Experiment of Making Banyar Fish Flavor Crackers Using Mocaf and Tapioca Composite Flour as a Base Material. Service and Production Technology Thesis. Faculty of Engineering, State University of Semarang.
- [17] Rinjani, 2017. Potential Utilization of Tuna Fisheries Industry. thesis, Faculty of Fisheries and Marine, Bogor Agricultural University
- [18] Sitkun, D. Linawati, H. Ella, S. 2013. Utilization of Tuna Meat as Kamplang Crackers and Characterization of Products. *Journal of Agribusiness and Agricultural Fisheries of UMMU*
- [19] Suprapti. 2012. food processing technology for soy sauce fish processed products. Jakarta
- [20] Wayan, K. Andi, A. Malik, H. 2014. Feasibility of Tuna Loin Manddihag (*Thunnus albacores*) Solid Waste for Diversified Product Raw Materials Thesis of the Makassar Diwa Diwa Marine High School, Pare Muhamadiyah University - Pare, South Sulawesi
- [21] Welliyalina, F. Aisman, A. 2013. The Effect of Comparison of Red Tuna and Maizena Flour on Nugget Quality. *Journal of Food Technology Applications*. Faculty of Agricultural Technology. Andalas University Padang.
- [22] Wijayanti, K. 2012. Effect of Proportion of Tuna and Tapioca Flour

- on the Quality of Tuna Fish Crackers (Thunnus Sp). Thesis, Faculty of Teacher Training and Education, Muhamadiyah University Malang.
- [23] Yuliani. Marwati. Wardana, H. Emmawati, A. Candrapurnawan, K. 2018.Characteristics of Fish Crackers with Cork Fish Bone Powder Substitution (Channa Striata) as Fortifying Calcium for Agricultural Product Technology. Faculty of Agriculture. Mulawarman University Samarinda
- [24] Zuhrina. 2011.The effect of the addition of banana peel flour (Musa Paradisiaca) on the acceptability of donuts. Thesis. Medan: University of North Sumatra
- [25] Zulfahmi, AN, Swastanti, F, Romadhon. 2014.utilization of mackerel fish meat (Scomberomorus commersoni) with different concentrations in the manufacture of fish crackers. Journal of Fishery Product Processing and Biotechnology.