Effect of Determination Temperature on Nutrition and Organoleptic Tuna Fish Floss

Teuku Rihayat1*, Suryani1, Zaimahwati1, Salmyah1, Sariadi1, Fitria2, Satriananda1, Alfian Putra1, Zahra Fona1, Juanda1, Raudah1, Mawaddah1, Nurhanifa1, Shafira Riskina1, Wildan Syahputra1, Safari1
1 Department of Chemical Engineering, Lhokseumawe State Polytechnic, 24301, Aceh, Indonesia
2 Department of Dermato Venereology, Medical Faculty, University Syiah Kuala, 24311, Aceh, Indonesia

*Corresponding author: teukurihayat@yahoo.com

Abstract. Tuna fish is one type of marine fish that is known to have benefits that are rich in protein and vitamin B6. One effort to utilize tuna is to process it into shredded fish. This study aims to determine the effect of steaming temperature on the nutritional and organoleptic content of tuna shredded fish and to obtain optimum temperature that produce shredded with the best nutritional and organoleptic content. The treatment in this study was the variation of steaming temperature, then an analysis was carried out on the resulting Fish Floss to the protein content, fat content, moisture content, ash content and organoleptic test (Flavor, taste, color, texture). The results of the study were processed using simple randomized design with 3 replications. The results showed that different steaming temperatures had a significant effect on the nutritional and organoleptic content of shredded fish. The best treatment was obtained at a steaming temperature of 55°C (A) with an average protein content value of 8.9812%; fat content of 1.3871%; moisture content of 4.9876%; ash content 3.6543%; organoleptic value of Flavor 9.0098; taste of organoleptic value 8.9654; color of organoleptic 8.8432 and organoleptic value of texture 8.876.

Keywords: Nutrition content, organoleptic content, tuna fish, steaming temperature variation

1. Introduction

The fisheries production in the city of Lhoseumawe in recent years has experienced fluctuations. Marine fisheries produce about 7405 tons of fish in 2014, 10066 tons in 2015 and 11526 tons in 2016 [1].

Fisheries sector are an important resource for people’s life and have the potential to be the main contributors to the national economy. This is based on the fact that Indonesia owns large fisheries resources in term of quantity of diversity. In addition, fisheries sector also linked with other sectors. The national resource-based fishing industry is also known as national resources based and Indonesia also has a high comparative advantage in the fisheries sector as reflected in the potential of existing resources [2].

Processed fishery products is very important in fish commodity sector. Fish is a commodity that rapidly decays (perishable food). Decay can be caused by enzymes, whether from the fish itself and microbes, and rancidity [3]. High numbers of fresh fish water accelerate the proliferation process of decomposition by the microorganisms contained in it. The low durability of fresh fish is an obstacle in
the effort to expand the market of fishery products. In fact, it is often causing large losses when there are abundant of fish available. Therefore, for a long time the community have tried to do various kinds of post-harvest fish processing to minimize these obstacles. One of strategies was making shredded tuna products [4].

Tuna is one of the highly potential fish species in Aceh, especially Lhokseumawe. Tuna is a saltwater fish that has thick flesh with a good flavour and contain 28 times more omega-3 than freshwater fish. Consumption of tuna for about 30 g a day can reduce the risk of heart disease by 50% [5]. Tuna is rich in protein, including many niacin, selenium, and tryptophan. Tuna is also rich in phosphorus, potassium, omega-3 fatty acids, magnesium, thiamine, and vitamin B6 which are well suited to be made into floss products because of their high nutritional content [6]. For this reason, this study aims to determine the effect of steaming temperature on the nutrient and organoleptic content of tuna fish floss, and to obtain the optimum temperature to produce tuna shredded fish with the best nutrient and organoleptic content.

2. Methodology
2.1. Materials
The tuna fish with weigh ± 1 kg each and length of ±30 cm are obtained from the Lhokseumawe Inpres Market, together with the additional ingredients which include shallots, garlic, coriander, coconut milk, beans soil, fermented bilimbi, sugar and salt. Other materials that are use for the analysis included aquades, label paper, Kjeldahl tablets, H2SO4, NaOH-thiosulfates, indicators of red metal, NaOH, n-hexane, and Na-K tartate.

2.2 Processing of Tuna Fish Floss
In general, the processing of tuna into floss includes several stages, which are the collection and selection of raw materials, separation of fish meat, making spices, boiling, cooking and packaging the processed floss. Initially tuna that were caught in the sea around Ujong Blang, Lhokseumawe were collected and sorted based on fish quality criteria, including freshness and size of fish. Freshness of the fish is determined based on the fresh colour of the fishes’ eyes instead of red eyes, the appearance of fish colour that is not pale, and the aroma of fresh fish. The raw tuna’s flesh is slice out from its stomach and head. Furthermore, the separation of flesh from the skin and bone is done by using a flesh separator. The flesh separator will separate the flesh from the skin and bones at low temperatures.

Afterwards, the tuna flesh is washed and cut, then the fish is boiled for about 20 minutes. The boiled tuna flesh is then drained from excess water. This is done in order to remove the excess moisture from the floss products as it will affect the durability of floss products. Fish flesh is ensured to have enough contact area of the meat with herbs so that the spices can penetrate into the flesh perfectly.

Meanwhile, shredded spices are prepared. This seasoning is the distinctive flavour of the Aceh region that will distinguish this product from other shredded tuna products. This spice consists of: onion, garlic, red chili, cayenne pepper, and fermented bilimbi. The use of this flavours makes the tuna floss product has a distinctive taste of the Aceh region. The people of Aceh always used various types of spices, which can also offer durable properties in food products. The spices are milled using a blender until smooth and evenly mixed. The spices are then cooked (sautéed) for about 15 minutes using oil until the spices are cooked and fragrant. Furthermore, tuna meat is mixed into the spices and cooked for 2 hours until the seasoning is absorbed. Floss is ready to be packaged. The tuna shreds produced were analysed chemically and undergo organoleptic tests.

2.3 Research Treatment
The treatment of this study using variations of steaming temperature which are as follows:

i. Steaming temperature A: 55.0 °C
ii. Steaming temperature B: 57.5 °C
iii. Steaming temperature C: 60.0 °C
iv. Steaming temperature D: 62.5 °C
The output parameters observed in this study were protein content, fat content, moisture content of ash content and organoleptic test (aroma, taste, colour, texture).

2.4 Data Analysis
Data processing in this study uses a simple Randomized Design (CRD) model with 3 replications. The data obtained were then analyzed using Analysis of Variance (ANOVA) and continued with the LSD test.

3. Result and Discussion
In this main study the treatment used was to use a different steaming temperature for making tuna shredded fish. The steaming temperature used is 55; 57.5; 60; 62.5 and 65°C. The maximum temperature in the main study is 65°C. this is because at a temperature of 70°C it has been damaged because the use of steaming temperature is too high which is then fried. The results of the study of the effect of steaming temperature on the nutrient and organoleptic content of tuna shredded consisted of chemical parameters (protein content, fat content, ash content, moisture content) and organoleptic parameters (aroma, color, texture, taste). The average value of the main research results with successive chemical and organoleptic parameters can be seen in table 1 and table 2.

Table 1. Main Research Results of Tuna Floss on Chemical Parameters

| Temperature (°C) | Protein Content (%) | Fat Content (%) | Moisture Content (%) | Ash Content (%) |
|------------------|---------------------|-----------------|-----------------------|-----------------|
| 55.0             | 8.9812              | 1.3871          | 4.9876                | 3.6543          |
| 57.5             | 7.1393              | 2.1543          | 4.9768                | 4.7839          |
| 60.0             | 6.8007              | 2.4763          | 5.6147                | 5.3195          |
| 62.5             | 6.9987              | 2.7629          | 5.8453                | 5.8253          |
| 65.0             | 5.9567              | 1.1819          | 4.2987                | 4.5524          |

Table 2. The Main Results of Tuna Floss on Organoleptic Parameters

| Temperature (°C) | Aroma | Organoleptic Parameters | Taste | Color | Texture |
|------------------|-------|-------------------------|-------|-------|---------|
| 55.0             | 9.0098| 8.9654                  | 8.8432| 8.8765|         |
| 57.5             | 8.6745| 8.6355                  | 8.7969| 8.5181|         |
| 60.0             | 8.5675| 8.2908                  | 8.6762| 8.4557|         |
| 62.5             | 8.6748| 8.6252                  | 8.6315| 8.8471|         |
| 65.0             | 8.6084| 8.6752                  | 8.9853| 8.6879|         |

3.1. Chemical Parameters
3.1.1 Protein Content. Proteins are macro molecules that have a molecular weight of between 5000 and several million. Proteins consist of long chains of amino acids, which are bound to one another in peptide bonds. Nitrogen is the main element of protein, because it is present in all proteins, which has a proportion of 16% of total protein [5].

The purpose of analyzing protein in food is to reduce the amount of protein in food ingredients; determine the level of protein quality in terms of nutrition; and examine protein as a chemical [7], the calculated protein content is the level of crude protein (crude protein). This is because nitrogen contained in food is not only derived from protein amino acids, but also from other nitrogen compounds that can / cannot be used as a source of nitrogen in the body. In fish, in one part of nitrogen there are free amino acids and peptides namely volatile nitrogen bases and amino-metal compounds.

The results of the protein content test on tuna floss ranged from 5.9567% to 8.9812%. The results of analysis of variance (ANOVA) showed that steaming treatment with different temperatures had a
very significant effect on protein content parameters. This can be seen from the F count > F table 5%, then to find out the differences from each treatment followed by the LSD test. The average protein content in tuna fillets can be seen in table 3.

### Table 3. Average Protein Content in Tuna Fish Floss

| No. | Temperature (°C) | Protein Content (%) | Notation |
|-----|-----------------|---------------------|----------|
| 1.  | 55.0            | 8.9812 ± 0.8892     | d        |
| 2.  | 57.5            | 7.1393 ± 0.6831     | c        |
| 3.  | 60.0            | 6.8007 ± 0.7526     | b        |
| 4.  | 62.5            | 6.9987 ± 0.6869     | a        |
| 5.  | 65.0            | 5.9567 ± 0.6163     | a        |

Based on the data in table 3 above, it can be seen that the highest protein content is found in treatment A, which is steaming at 55°C, which is 8.9182%, while the lowest protein content is in treatment E, which is steaming at 65°C which is 5.9567%. The higher the steaming temperature used, the lower the tuna protein content in tuna fish. In addition to the higher steaming temperature, a decrease in the amount of protein is also caused by the temperature of the frying pan. This is presumed, the protein content in the material is denatured due to repeated cooking, namely steaming and frying. processing protein foods that are not well controlled can cause a decrease in nutritional value. The most widely used processing is processing using heating such as sterilization, cooking and drying. Conversely, the lower the steaming temperature used, the higher the protein content in tuna fish floss.

The requirements for floss quality standards in general the value of protein content is at least 15%, and the highest protein content in tuna tuna is 8.9812% so that the protein content in tuna tuna has not met the requirements of floss quality standards. This is due to the repeated processing of heat, which is the steaming and frying process which causes damage to the protein in tuna meat.

#### 3.1.2 Fat Content

Fat is a food substance that is important for the health of the human body. In addition fat is also found in almost all food ingredients with different contents [8]. According to [9], fat consists of mixed triglycerides, which are esters of glycerol and long chain fatty acids. If the fat is hydrolyzed, it will produce 3 long chain fatty acid molecules and 1 glycerol molecule.

Determination of fat content of an ingredient can be done using the soxhlet apparatus. This method can be used for oil extraction from oil-containing materials [10], fat extraction from dry matter can be carried out intermittently or continuously.

The results of the fat content test on tuna floss ranged from 1.1819% to 2.1543%. The results of analysis of variance (ANOVA) showed that steaming treatment with different temperatures had a significant effect on fat content parameters. This can be seen from the value of F count > F table 5%, then to find out the differences of each treatment carried out LSD test. The average fat content in tuna fish shredded can be seen in table 4.

#### Table 4. Average Fat Content in Tuna Fish Floss

| No. | Temperature (°C) | Fat Content (%) | Notation |
|-----|-----------------|----------------|----------|
| 1.  | 55.0            | 1.3871 ± 0.1392 | b        |
| 2.  | 57.5            | 2.1543 ± 0.3543 | c        |
| 3.  | 60.0            | 2.4763 ± 0.4928 | c        |
| 4.  | 62.5            | 1.7629 ± 0.2839 | a        |
| 5.  | 65.0            | 1.1819 ± 0.1579 | a        |
Based on the data in Table 4 above, it can be seen that the highest fat content is B treatment with a steaming temperature of 60°C and an average fat content of 2.4763% while the lowest fat content is in treatment E with a steaming temperature of 65°C, the average value average fat content of 1.1819%. This shows a decrease in the value of the average fat content of the material. The decrease was caused by an increase in steaming temperature which caused fat to be damaged and the amount decreased. The level of fat damage varies depending on the temperature used and processing time [11]. The higher the temperature used, the fat damage will increase. Essential fatty acids are isomerized when heated in alkaline solutions and sensitive to light, temperature and oxygen. The process of fat oxidation can cause inactivation of its biological functions and can even be toxic. In addition to fat damaged by oxidation, fat can also be damaged by hydrolysis.

The requirements for floss quality standards in general are maximal fat content values of 30%, and the highest fat content values in tuna shredded fish are 2.4763% so that the fat content in tuna floss meets the requirements of floss quality standards.

### 3.1.3 Moisture Content

The principle of determining the water content by the Thermogravimetric method is to evaporate the water in the food by heating then weighing the material to a constant weight which means that all the water has been evaporated.

The water content test results on tuna fish floss ranged from 4.2987% to 5.8453%. While the results of analysis of variance (ANOVA) showed that steaming treatment with different temperatures did not have a significant effect on fat content parameters. This can be seen from the value of F count < F table 5%. The average water content in tuna fish floss can be seen in table 5.

| No. | Temperature (°C) | Protein Content (%) | Notation |
|-----|-----------------|---------------------|----------|
| 1   | 55.0            | 4.9876 ± 3.5879     | a        |
| 2   | 57.5            | 4.9768 ± 0.5601     | a        |
| 3   | 60.0            | 5.6147 ± 1.1752     | a        |
| 4   | 62.5            | 5.8453 ± 3.0837     | a        |
| 5   | 65.0            | 4.2987 ± 2.9593     | a        |

Based on the data in Table 6 above, it can be seen that at a temperature of 60°C the highest average water content is 5.8453%, and at a temperature of 65°C the lowest average water content is 4.2987%. The highest water content is found in treatment D with an average water content value of 5.8453%. This is due to the steaming process with higher temperatures causing bonds between broken food components such as carbohydrates, fats and proteins, so that the water will bind to the material and cause the water content to increase. While the lowest water content is at steaming temperature of 65°C, this is due to the higher steaming temperature used, the fish meat will be more mature and the shredding process will be easier and more perfect so that the resulting texture can be softer so that the frying process ingredients can evaporate perfectly.

The requirements for floss quality standards in general have a maximum water content value of 7%, and the highest water content value in tuna floss is 5.8453% so that the moisture content in cork floss meets the requirements of floss quality standards. The absorption of isothermic water content by materials is strongly influenced by the temperature when drying and the higher the drying temperature, the lower the ability to absorb water. Furthermore, it was found that heating at temperatures of 65, 80 and 90°C showed that the higher the heating temperature, the ability of sorbs decreased. In addition, an increase in processing temperature will reduce the ability to hold water which may be caused by changes due to heating that cannot return.

### 3.1.4 Ash Content

Ash is an inorganic substance left over from the combustion of an organic material. The ash content and composition depend on the type of material and the method of ignition.
Ash content has to do with minerals in a material. The purpose of determining total ash is to determine whether or not a processing process; to find out the type of material used and the determination of total ash useful as a parameter of the nutritional value of food ingredients.

The ash content test on tuna shredded fish ranged from 3.6290% to 5.5789%. While the results of analysis of variance (ANOVA) showed that the steaming treatment with different temperatures gave a very significant effect on the ash content parameters. This can be seen from the F count > F table 5%, then to find out the differences in each treatment carried out LSD test. The average ash content in floss from residual meat of cork fish albumin extraction can be seen in table 6.

| No. | Temperature (°C) | Protein Content (%) | No. |
|-----|------------------|---------------------|-----|
|     | Average ± St. Dev |                    |     |
| 1.  | 55.0             | 3.6543 ± 0.3055     | a   |
| 2.  | 57.5             | 4.7839 ± 0.2460     | d   |
| 3.  | 60.0             | 5.3195 ± 0.5054     | c   |
| 4.  | 62.5             | 5.8253 ± 0.0947     | a   |
| 5.  | 65.0             | 4.5524 ± 0.5086     | b   |

Based on the data in table 6 above, it can be seen that at a temperature of 62.5°C the highest average ash content was 5.8253%, and at 55°C the lowest average value of ash was 3.6543%. The highest ash content is in treatment D with steaming temperature 62.5°C with an average value of ash content of 5.8253%, this is thought to be a long floss frying process so that the water content in the shredded is low and leaves minerals in high floss so the ash content increases. While the lowest ash content is in treatment A with a temperature treatment of 55°C with an average value of ash content of 3.6543%. This is presumably due to the high moisture content in the ingredients and the floss texture that has not been smooth so that the ash content is low. The effect of processing on materials can affect the availability of minerals for the body. The use of water in the process of washing, soaking and boiling can reduce the availability of minerals because minerals will dissolve by the water used.

The requirements for floss quality standards in general the value of ash content is a maximum of 7%, and the highest ash content in tuna tuna is 5.8253% so that the ash content of tuna shredded meets floss quality standards.

3.2. Organoleptic Parameters

3.2.1 Aroma. The aroma of food that is in the mouth is captured by the sense of smell through a channel that connects the mouth and nose. The number of volatile components released by a product is influenced by the temperature and its natural components. Food that is brought to the mouth is felt by the senses of taste and smell which are then continued to be accepted and interpreted by the brain [10]. The results of the organoleptic scent on tuna fish floss ranged from 8.5675 to 9.0098. The average organoletic aroma results in tuna fish shredded can be seen in table 7.

| No. | Temperature (°C) | Average ± St. Dev |
|-----|------------------|-------------------|
| 1.  | 55.0             | 9.0098 ± 0.1453   |
| 2.  | 57.5             | 8.6745 ± 0.0694   |
| 3.  | 60.0             | 8.5675 ± 0.0962   |
| 4.  | 62.5             | 8.6748 ± 0.1347   |
| 5.  | 65.0             | 8.6084 ± 0.0385   |
Based on the data in table 7 above, it can be seen that at a temperature of 55°C the highest average organoleptic aroma value is 9.0098, and at a temperature of 60°C the lowest organoleptic aroma value is 8.5675. The highest organoleptic value of aroma is in treatment A, which is treatment with a steaming temperature of 55°C which is equal to 9.0098, this is presumably because it is influenced by the maturity level of steamed meat. So that the distinctive aroma of fish with spices is still felt. While the lowest aroma organoleptic value is in treatment C, which is treatment with steaming temperature of 60°C. This is suspected to be fish floss, no longer typical of floss odor.

Based on the calculation of consumer acceptance of the organoleptic aroma of tuna shredded showed that the best P value is in treatment A with a value of 9.0000 then rounded to 9. Descriptively, at this value it can be concluded that the aroma of cork fish on treatment A favored panelists.

3.2.2 Taste. Taste is something that is received by the tongue. In sensing the gecko is divided into four main gases, namely sweet, bitter, sour and salty and there is an additional response if done modification [11]. Taste is influenced by several components, namely chemical compounds, temperature, concentration and interaction with other taste components. The increase in temperature will increase the stimulation of sweet taste but will reduce the stimulation of salty and bitter taste [12]. The organoleptic test results of taste on tuna fish floss ranged from 8.2908 to 8.9654. The average yield of organoleptic taste in tuna fish floss can be seen in table 8.

| No. | Temperature (°C) | Average ± St. Dev  |
|-----|-----------------|---------------------|
| 1.  | 55.0            | 8.9654 ± 0.1347     |
| 2.  | 57.5            | 8.6355 ± 0.1678     |
| 3.  | 60.0            | 8.2908 ± 0.2457     |
| 4.  | 62.5            | 8.6252 ± 0.0509     |
| 5.  | 65.0            | 8.6752 ± 0.1018     |

Based on the data in table 8 above it can be seen that at a temperature of 55°C the highest organoleptic taste value was 8.9654, and at a temperature of 60°C it had the lowest organoleptic taste value of 8.2908. The organoleptic value of taste in tuna floss with different steaming does not give a different value. The resulting shred has almost the same value. This is because the formulation of making floss is used constantly, so that the taste produced is almost the same.

Based on the calculation of consumer acceptance of organoleptic taste shows that the best P value is in treatment A and E with a value of 8.9654 then rounded to 9. Descriptively, at this value it can be concluded that the tuna fish floss A and E are preferred by panelists.

3.2.3 Color. Color is one parameter besides taste, texture and nutritional value that determines consumer perceptions of a food ingredient. Consumer preferences are often determined based on the appearance of a food product. Bright food colors provide more appeal to consumers. Color in food products has several functions, among others, as an indicator of maturity, especially for fresh food products such as fruits, as an indicator of freshness for example in vegetable and meat products and as an indicator of perfection of food processing processes such as frying, brown used as the final indicator of food product maturity [12].

The color organoleptic test results on tuna fish floss ranged from 8.6315 to 8.9853. The average yield of color organoleptics in tuna fish floss can be seen in table 9.
Table 9. Average Color Organoleptic Test on Tuna Fish Floss

| No. | Temperature (°C) | Average ± St. Dev |
|-----|-----------------|-------------------|
| 1.  | 55.0            | 8.8432 ± 0.3533   |
| 2.  | 57.5            | 8.7949 ± 0.0192   |
| 3.  | 60.0            | 8.6762 ± 0.3977   |
| 4.  | 62.5            | 8.6315 ± 0.2589   |
| 5.  | 65.0            | 8.9853 ± 0.0667   |

Based on the data in table 9 above, it can be seen that at 65°C the highest color organoleptic value was 8.9853, and at 62.5°C the lowest color organoleptic value was 8.6315. The color organoleptic values of the tuna shredded with different broccoli do not give different values. The resulting shred has almost the same value.

Based on the calculation of consumer acceptance of the organoleptic color shows that the best P value is in treatment E and A with a value of 9.1000 then rounded to 9. Descriptively, at this value it can be concluded that the color of tuna fish floss E and A is preferred by panelists.

3.2.4 Texture. Observation of the texture of fish floss is very important. This is because texture is one of the things that distinguishes fish floss from other fishery products, namely soft fibers. The texture of meat is very influential on the final product produced and determines the level of consumer preference for the product [12].

The organoleptic test results of the texture on tuna fish floss ranged from 8.4557 to 8.8765. The average yield of organoleptic textures on tuna fish floss can be seen in table 10.

Table 10. Average Organoleptic Texture Test on Tuna Fish Floss

| No. | Temperature (°C) | Average ± St. Dev |
|-----|-----------------|-------------------|
| 1.  | 55.0            | 8.8765 ± 0.1202   |
| 2.  | 57.5            | 8.5181 ± 0.1732   |
| 3.  | 60.0            | 8.4557 ± 0.2143   |
| 4.  | 62.5            | 8.8471 ± 0.0509   |
| 5.  | 65.0            | 8.6879 ± 0.0770   |

Based on the data in Table 10 above, it can be seen that at a temperature of 55°C the highest average organoleptic texture value was 8.8765, and at a temperature of 60°C it had the lowest color organoleptic value of 8.4557.

Based on the calculation of consumer acceptance of organoleptic colors shows that the best P value is in treatment A with a value of 8.9000 then rounded to 9. Descriptively, at this value it can be concluded that the color of tuna fish floss A is favored by panellists.

4. Conclusion
From this study, we can conclude that different steaming temperatures had a significant effect on the nutritional and organoleptic content of shredded fish. The best treatment was obtained at a steaming temperature of 55°C (A) with an average protein content value of 8.9812%; fat content of 1.3871%; moisture content of 4.9876%; ash content 3.6543%; organoleptic value of aroma 9.0098; taste of organoleptic value 8.9654; color of organoleptic 8.8432 and organoleptic value of texture 8.8765.
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