The Effect of Soy Protein Isolate Addition on Gel Strenght of Ariid Catfish (*Arius thalassinus)* Surimi

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ABSTRACT

The objectives of this research were to identify the best concentration of the addition of soy protein isolate on the strength of surimi ariid catfish surimi. This research was carried out in July 2019 at the Fishery Products Processing Laboratory, FPIK Unpad. The method used in this research was an experimental method with five treatments adding different concentrations of soy protein isolate to ariid catfish surimi by 0%, 8%, 10% 12%, and 15% and 15 panelists as tests. Observations were made based on organoleptic tests which included folding test and teeth-cutting test by semi-trained panelists, gel strength test, water content test, protein test, and pH test. The results showed that the addition of 10% soy protein isolate got the best results with an average folding test of 3.86, teeth-cutting test of 6.99, gel strength 912.65 gForce, water content 76.50%, protein content 18.53%, and pH 6,78.

Keyword: - *catfish, gel strenght, soy protein isolate, surimi*

1. INTRODUCTION

Fish, apart from being a source of protein, is also known as a functional food which has important meaning for health because it contains OMEGA-3 unsaturated fatty acids that are very popular for maintaining and lowering cholesterol levels and contain vitamins and minerals.

Ariid Catfish are a fish that commonly found in Java Sea. As demersal fish, Ariid Catfish are the largest in size so they are excellent good as consumption fish. According to production data obtained from the Department of Fisheries and Maritime Affairs, Indramayu Regency, in 2019 the production of catfish in Indramayu Regency reached an average of 500 tons/year.

Fish is a food that is easily damaged both biologically and chemically. Therefore, efforts to increase shelf life through processing and preservation need to be done. Efforts that can be done are to prepare fish raw materials in the form of intermediate products such as mashed meat, fillet meat, and surimi. Surimi is a intermediate product that made from fish that has been separated from the bones, washed with ice water then get mixed with cryoprotectant to get good shelf life during frozen storage [1].

The main attribute in determining the functional characteristics of surimi that affect the final quality of surimi-based food products is gel strength. Gel strength is an important factor in determining the quality of surimi. The ability of gel formation is influenced by the actomyosin component contained in myofibril proteins. Myofibril protein in fish meat ranges from 66-77% of the total protein and plays an important role in gel formation when meat is processed [2].

Efforts that can be made after washing with cold water are the use of other additives that have the ability to form a gel to increase the strength of the surimi gel. The addition of food additives such as soy protein isolate is expected to help improve the quality of the gel in surimi with the ability of additional ingredients as binding agents and proteinase inhibitors. Proteinase inhibitors are used to control proteolytic activity in the process of making surimi so that they can improve the strength of the surimi gel [3].

The use of soy protein isolate additives in the development of surimi is expected to be an alternative to improve the quality and gel strength of catfish surimi. Therefore, it is necessary to test the effect of adding soy protein isolate to the strength of the ariid catfish surimi gel.

2. MATERIAL AND RESEARCH METHOD

2.1 Material and Tool

The materials used in this study were *Ariid* Catfish, ice, salt, and soy protein isolate. The tools are used are fillet knife, food processor, gauze, basin, stove, thermometer, scale, plastic wrap, cellulose case, and pot.

2.2 Research Method

The research method used is an experimental method, with 5 treatments adding soy protein isolate to catfish surimi with 15 semi-trained panelists as replicates. Panelists in this study were students of the Faculty of Fisheries and Marine Sciences who had experience in organoleptic assessment and were familiar with the product being tested. The results of the organoleptic test with the best concentration treatment and control treatment will be tested for gel strength, protein content, water content, and pH.

This research used 5 additional treatments of soy protein isolate with different concentrations. The addition of soy protein isolate concentration in catfish surimi can be seen as follow:

Treament A = Without the addition of Soy Protein Isolate as a control
Treatment B = 8% Soy Protein Isolate Concentration
Treatment C = 10% Soy Protein Isolate Concentration
Treatment D = 12% Soy Protein Isolate Concentration
Treatment E = 14% Soy Protein Isolate Concentration

2.3 Research Procedure

The procedure carried out in this study consisted of several stages which included making ariid catfish surimi and surimi gel preparation.

2.3.1 Making *Ariid* Catfish Surimi

- Catfish is washed with running water until it clean
- Fish are placed in a transverse position and filet using a knife. The fish is sliced crosswise from the head along the back until the meat is separated from the bone. This is then repeated on the other side
- The skin of the fish is removed from the meat
- The meat of the fish is cut and ground using a food processor
- Mince is washed with ice water at temperature of $1^0 – 5^0$C with a volume of cold water 4 times the weight of the mince meat. During washing, the minced meat is stirred for 10-15 minutes.\
- The washed mince meat is filtered using gauze and manually pressed by hand to remove water.
- The second wash uses ice water that has been added with 0.2-0.3% salt. The volume of ice water is 4 times the weight of the mince meat. The mince meat is stirred for 10-15 minutes.
- Do the filtering again using gauze and manually pressed by hand to remove water.
- Straining is carried out to remove the remnants of scales, fine spines, and remaining fibers
- Surimi is stored in plastic packaging and stored at -15°C until the surimi gel preparation process will be carried out.

2.3.2 Surimi Gel Preparation

- Surimi is cut to a size of 2×2×2 cm^3. Store at room temperature for 90 minutes until the surimi is not frozen.
- Surimi is homogenized using a food processor with a temperature setting of $4 – 10^0$C using 80ml/100g of ice water.
- Add 2.5% salt and soy protein isolate (according to concentration) into a food processor while the surimi is homogenized.
- The homogenized surimi paste was then put into a cellulose casing with a diameter of 30 mm and a length of 200 mm
- The surimi gel that has been inserted into the cellulose casing is then heated on the stove with a pot. Heating was carried out at a setting temperature of 40ºC for 30 minutes followed by a temperature of 90ºC for 20 minutes.
- After heating, all samples were immediately cooled with ice water at 5ºC for 30 minutes.

- Samples are stored in the refrigerator for 24 hours at a temperature of 4oC for further testing.

2.3.4 Data Observation

Observation of organoleptic test on surimi catfish using folding test and teeth cutting test. The purpose of organoleptic test is to determine the panelists' preference value. The best concentration treatment based on the results of organoleptic scores and control treatment will be tested for gel strength, protein content, water content, and pH.

2. RESULT AND DISCUSSION

3.1 The Result of Organoleptic Test

3.1.1 Folding Test

The folding test is often carried out to test the quality of surimi gel formation. The folding test carried out can describe the gel strength of kamaboko prepared from surimi [4]. The results of Friedman's statistical test showed that there was a significant difference in the results of the catfish surimi folding test with the addition of soy protein isolate. The results of the folding test scoring are presented in Table 1.

Table -1: Average Value of Folding Test

Soy Protein Isolate Concentration (%)	Median	Average
0%	1	1,33[a]
8%	3	3,06[b]
10%	4	3,86[b]
12%	2	2,26[bc]
14%	2	2,06[bc]

Note: The average value followed by the same letter shows no significant difference at the 5%

The results of statistical tests showed that there was a significant difference between treatments, where the addition of soy protein isolate concentration could have a different effect on the folding test results. Based on the data obtained, the 10% treatment got the highest result with a median of 4 and an average value of 3.86.

The folding test had a positive correlation with gel strength, an increase in gel strength was followed by an increase in the folding test value [5]. Soy protein isolate has an important role in the process of surimi gel formation and can inhibit the release of water. The more compact the texture of the surimi, the better the folding test produced. The increase in gel occurs due to the hydration properties of water which can attract water molecules in the mashed meat matrix environment so as to form a more elastic mass [6].

The excessive addition of soy protein isolate will cause cross-linking inhibition of myofibril proteins so that the gel strength decreases. The addition of soy protein isolate can increase gel strength, but if too much can reduce gel strength [7].

3.1.2 Teeth Cutting Test

The results of Friedman's statistical test showed that there was a significant difference in the results of the catfish surimi teeth cutting test with the addition of soy protein isolate. The results of the teeth cutting test scoring are presented in Table 2.

Table -2: Average Value of Teeth Cutting Test

Soy Protein Isolate Concentration (%)	Median	Average
0%	4	3,11[a]
8%	6	6,33[b]
10%	7	6,99[b]
12%	6	6,16[bc]
14%	6	5,27[bc]

Note: The average value followed by the same letter shows no significant difference at the 5%

The results of statistical tests showed that there was a significant difference between treatments, where the addition of soy protein isolate concentration could have a different effect on the folding test results. The results of the analysis showed that the treatment of 8% and 10% was significantly different from the treatment of 0. Based on the data obtained, the 10% treatment got the highest results with a median of 7 and an average value of 6.99. The addition of soy protein isolate was able to increase the gel strength, fold test result and teeth cutting test result because all three had a positive correlation.

The addition of a binder has an effect on increasing protein levels in surimi which makes catfish surimi have a chewy texture. Myofibril protein has the ability to bind water so that it plays an important role in gel formation and increasing the elasticity of processed meat products [8]. The additional 10% soy protein isolate treatment got a median value of 7, which has a fairly strong level of elasticity according to the teeth cutting test score. The protein content in pulverized meat plays an important role in the formation of gel elasticity, especially during the bite test. In addition, elasticity is an important parameter of surimi quality [9].

3.2 Gel Strenght

The treatment with the best test value according to the organoleptic test results and the control treatment were tested for gel strength using Stable Micro Systems Texture Analysers. The samples tested were surimi without the addition of soy protein isolate and surimi with the addition of soy protein isolate with a concentration of 10%. The gel strength test results are presented in Table 3.

Table -3: Gel Strenght Test Value

No	Soy Protein Isolate	Gel Strenght (gForce)
1	0%	514,13
2	10%	912,65

Based on the data obtained, there was an increase in gel strength in surimi with the addition of soy protein isolate compared to surimi without the addition of soy protein isolate. This is because soy protein isolate has high protein polarity and is able to make a strong matrix when it binds to water, so the gel can become strong [10]. The increase in the value of gel strength in surimi is thought to be due to the addition of IPK which has properties as a proteinase inhibitor, proteinase inhibitors will inhibit the degradation of myofibrils, so that it has an impact on increasing their gelling ability [11].

3.3 Water Content

The results of the analysis of the moisture content of the sample showed that the water content of the surimi gel without the addition of soy protein isolate was 76.90% and the water content of the soy protein isolate with the addition of 10% soy protein isolate was 76.50%. The results of the water content test are presented in Table 4

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Table -4: Water Content Value

No	Soy Protein Isolate	Water Content (%)
1	0%	76,90
2	10%	76,50

The ability to bind water in fish meat is caused by actomyosin which is the main component of myofibrils. The amount of water content in the product is influenced by the protein content of the raw materials used. The water binding capacity is stronger when the amount of myofibril proteins (actin and myosin) is also greater[12].
The polar groups in proteins interact with hydrogen ions from water which are also polar. The interaction between protein-protein and protein-water forms a rigid three-dimensional network capable of trapping a large amount of water. The higher the protein content, the more water is bound and will increase the strength of the gel [13].

Based on the results obtained, it shows that the water content value of 76.90% in surimi gel without additives and 76.50% in surimi gel with additives shows that this catfish surimi material has a fairly good quality. According to Indonesia National Standard No. 01-2694-2013 regarding quality and safety requirements, surimi requires that the maximum water content in surimi is 80%. Low water content in a fishery product is highly desirable because it can reduce the growth of bacteria and microbiological spoilage in the product. Moisture content also affects the durability of a material and shows the stability and quality index of foodstuffs. Materials with high water content will be more easily damaged than materials with low water content [14].

3.4 Protein Content

The results of the analysis of protein content in surimi gel samples without the addition of soy protein isolate showed a yield of 17.06% and surimi gel with the addition of 10% soy protein isolate was 18.53%. The results of the protein content test are presented in Table 5. Based on the data obtained, the protein value in surimi has met the requirements of good surimi. According to Indonesia National Standard 01-2694-2013 regarding quality and safety requirements, surimi requires that the minimum protein content in surimi is 12%.

Table -5: Protein Content Value

No	Soy Protein Isolate	Protein Content (%)
1	0%	17,06
2	10%	18,53

Surimi with the addition of soy protein isolate showed higher protein content, this was influenced by additional ingredients containing high protein. Protein isolate has a minimum protein content of 90% of dry matter. Protein isolate was almost free from carbohydrates, fiber, and fat so that its functional properties were much better than protein concentrates or soy flour [15].

3.5 pH Value

The results of the analysis of the pH value on the surimi gel sample without the addition of soy protein isolate showed a pH value of 5.22 and the surimi gel with the addition of 10% soy protein isolate showed a pH value of 6.78.

Table -6: pH Test Value

No	Soy Protein Isolate	pH
1	0%	5,22
2	10%	6,78

The increase in the pH value of surimi with the addition of soy protein isolate was due to the extraction of soy protein isolate with a dilute base (pH 7-9) so that if surimi was added to soy protein isolate, the surimi would have a higher pH value than surimi without the addition of soy protein isolate. The principle used to isolate soybean protein is the deposition of all proteins at the isoelectric point, namely the pH at which all proteins coagulate [16].

4. CONCLUSIONS

Based on the results of the study it can be concluded that the addition of soy protein isolate can increase the gel strength of catfish surimi. Surimi with the addition of 10% soy protein isolate was the sample that had the highest score with an average folding test value of 3.27, an average teeth cutting test value of 6.94, gel strength of 912.65 gForce, water content of 76 .50%, protein content of 18.53%, and pH with a value of 6.78.

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