PRODUCTION OF CORK FISH BONE GELATIN WITH PROTEIN A-CASEIN ADDITION

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Abstract. Various studies indicate that the gelatin from cork fish bones have a lower quality than the gelatin from cows and pigs. The fish gelatin has a gel strength values were low, physico-chemical properties of the gelatin is still lower than the gelatin produced from bones and skin of pigs and cows. This study aimed to determine the effect addition of α-casein and mixing temperature to physical and gelatin gel chemical from snakehead fish bones in order to qualify SNI. The method used in this study is produce gelatin from fish bones, making α-casein from extracted milk and mixing both of them with composition of the gelatin : α-casein (10 : 1; 10 : 2; 10 : 3) in various temperature (40, 50 and 60^{o}C). The parameters observed in this study which is the levels of proteins, gel strength, viscosity, pH, moisture content, ash content and yield. The results in this study is, gel strength, viscosity, water content, ash content and yield best at temperature 60^{o}C. while the protein content and gel strength of the optimum results obtained at composition gelatin 10 : 3

Keywords**:** Gelatin, Cork fish bone, α-kasein

I. INTRODUCTION

Gelatin is very important for Indonesia that the majority of its citizens are Muslims . This relates to the Islamic Shari'a law which requires followers to consume something clearly halal status . Gelatin is made from fish bones is guaranted halal while gelatin made from bones of mammals is doubtful either of its kind or halal slaughtering process. Other issues that may worried the use of gelatin from mammals , especially cattle is widespread news about mad cow disease. Gelatin from fish bones is processing a fish waste utilization.

One of the fish bones that could potentially used as raw material for fish gelatin is cork fish bone (Channa striata) . Potential gelatin from the bones and skin of cork fish with cork fish production in South Sumatra , which reached 5,702 tons in 2008 [2] . In South Sumatra cork fish widely used by industry crackers , kemplang and pempek , where the amount of the edible part (edible flesh) or meat that can be used is 65 % , meaning the waste from the fish is 35 % [6] , and 30 % of waste is skin and bones [5].

Various studies show that gelatin from fish bones have a lower quality than the gelatin from cows and pigs. One of the main reasons is the fish gelatin has a strength gel values were lower, while the reflection of gelatin good quality and can be used for pharmaceutical preparations is gelatin which has a high strength gel.

Gelatin is a protein obtained from the partial hydrolysis of collagen from the skin, white connective tissue and bones of animals. According to Saleh [10], gelatin is a hydrocolloid which can be used as a gelling, thickening (thickner) or stabilizer. Gelatin also has power gel formation quite high and it is heat reversible means that gel has been formed will be able to dissolve back on heating. and content of certain mineral elements in the gelatin can be used to assess the quality of gelatin and gelatin quality standards according to SNI (Indonesian National Standard) can be seen in Table 1 [12].

Table 1. Standard gelatin according to SNI No. 06-3735 : 1995 and British Standard : 757 : 1975

Characteristic	SNI	British
Colour	Colorless to yellowish	Pale yellow
	Normal	-
Odor, Taste	Maks 16 %	-
Ash Content	Maks 3,25 %	-
Water Content	-	-
Gel **Strenght**		50 – 300 bloom
Viskosity	-	15 – 70 mps or 1,5-7 cPs
pH	-	4,5 – 6,5
heavy metal	Maks 50 mg / kg	-
Arsen	Maks 2 mg / kg	-
Tembaga	Maks 30 mg / kg	-
Seng	Maks 100 mg / kg	-
Sulfit	Maks 1000 mg / kg	-

Based on the properties of the material are basically two processes hirdolisis processed collagen into gelatin [3]:

1. Acid Process (type A) that is often used is pig skin and fish skin and sometimes bone as raw material. It is based on where the collagen is acidified to pH about 4 and then heated gradually from 50 ° C to boiling change the nature and dissolve the collagen. After the collagen degrease or gelatin solution must be defatted, then filtered to clarity, concentrated by vacuum evaporation treatment or ultra filtration membrane, to get a high concentration of gelatin and then dried by passing dry air over the gel. The latter process one milling and mixing to the needs of

customers and packaging. Gelatin produced has ionic points from 7 to 9 based on violence and duration of acid treatment of collagen which causes limited hydrolysis of a chain of amino acids asparagine and glutamine.

2. The process of alkali (type B) used in cowhide and a source of collagen in which animals are relatively old in cuts. One process in which caustic soda delivered to the collagen or the calcification process long before extraction. Alkaline hydrolysis in the side chain of asparagine and glutamine for glutamic acid and aspartic relatively quickly, with the result that the gelatin has isoionik point is 4.8 to 5.2. However, the alkali treatment will be shortened (7 days or less) ionic values as high as 6 is produced. After the alkali treatment, collagen is washed free of alkali and then given treatment with acid by extracting the desired pH (which had a marked effect on the gel strength of the final product viscosity ratio). Collagen is then denatured and converted into gelatin by heating, because the acid process. Alkali treatment, it is often necessary to demineralization gelatin to remove the excessive amount of salt using ion exchange or ultrafiltration. After that process is the same as acid process - vacuum evaporation, filtration, gelatinization, drying, milling and mixing.

According Ismeri [7] economically, acid process are preferred over alkaline process. This is because immersion is done in the process of acid that is relatively shorter (3-4 weeks) compared with alkaline process (approximately 3 months). After experiencing immersion material is neutralized and then extracted and concentrated (evaporation). Materials that have experienced concentration dried to then undergo a process of grinding or destruction into smaller particles or in accordance with the standards. All gelatin has the same functional properties, only the difference between the type of gelatin type A and type B, which is important in the selection of appropriate to some specific uses and differences more physical properties are presented in Table 2.

Table 2. Gelatin Properties

Properties	Tipe A	Tipe B
Gel strenght (*bloom*)	50-300	50-300
pH	3,8-5,5	4,7-5,4
Isoeletrik point	7-9	4,7-5,4
Viskosity (mps)	15-75	20-75
Ash Content (%)	0,3-2	0,5-2

Sumber : GMIA [4]

II. RESEARCH METHODOLOGY

This research is experimental, which is divided into two ways, namely an experimental and the analysis. First way is includes the produce of cork fish bone gelatin, made α-casein by extracted milk protein , and mixing of α-casein on cork fish bone gelatin, the second way is yield, proximate and physicochemical characteristics analysis.

The process of hydrolysis collagen into gelatin used in this study using acid process , in addition to economical immersion process is performed is shorter than the process of alkali or alkaline , then mixing milk protein α - kassein on a fish bone gelatin cork . In this researchs study the variables remain determined NaCl concentration (in ratio) and mixing time, while the independent variable is the ratio of cork fish bone gelatin and casein and mixing temperature

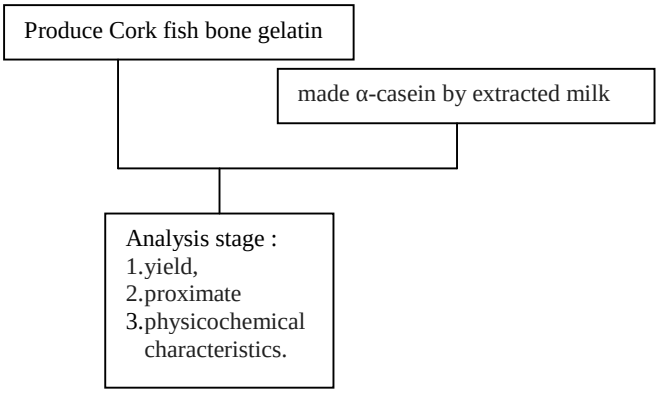

Figure 1. Experimental methods

III. RESULT AND DISCUSION

RESULT

Test Appearance In this study conducted organoleptic tests on odors and colors in which this is done for the reception worthy or not a fish bone gelatin cork products with the addition of casein by testing the 20 panelists. The results of organoleptic test color and smell of gelatin can be seen in Table 3

Table 3. Appearance Test Results Bone Fish Gelatin Cork

No	Sample		Colour	Smell
	Gelatin : kasein	Mixing Temperature (^oC)		
	Before Mixing	-	Brown	smelly
2		40	Beige	A bit smelly
3	10 : 1	50	Beige	A bit smelly
4		60	Beige	odorless
5		40	Beige	A bit smelly
6	10 : 2	50	Beige	A bit smelly
7		60	Beige	odorless
8		40	Beige	A bit smelly
9	10 : 3	50	Beige	odorless
10		60	Beige	odorless

Table 4. Test Characteristics Gelatin Gelatin Fish Bone And Fish Bone Gabus Gabus With Addition Casein

Gelatin : Kasein (ml)	Temp (°C)	pH	Water Cont (%)	Ash Cont (%)	Viskosity (cPs)	Gel Strenght (gBloom)	Protein Cont (%)
Before mixing	-	5	4,193	12,66	6,126	567,1748	77,89
	40	5	10,21	26,89	9,277	109,949	79,21
10 : 1	50	5	9,123	23,77	5,960	171,539	80,37
	60	5	6,71	21,16	5,802	199,113	80,72
	40	5	10,994	27,25	10,04	100,443	79,49
10 : 2	50	5	7,46	24,32	6,065	170,439	81,071
	60	5	5,4	22,34	5,918	192,865	81,77
	40	5	12,76	28,38	10,128	97,0658	79,84
10 : 3	50	5	8,57	24,22	6,807	202,295	82.12
	60	5	5,71	23,62	6,702	208,304	82,64

DISCUSSION

1. Test Appearance

The organoleptic test is a test conducted to provide an assessment of a product by using the senses. In this study conducted organoleptic tests on odors and colors, which is done for the reception worthy or not a fish bone gelatin cork products with the addition of casein by testing the 20 panelists. Opinion 5 from 20 panelists stated gelatin with casein odorless and colorless and 3 states that gelatin with casein bit smelly and dark, while 12 from 20 states that gelatin with casein bit smelly and plain so as to stated that the fish bone gelatin cork products with the addition of casein is not eligible SNI No. 06-3735 1995 and British Standard: 757 1975 stating that the gelatin is colorless and odorless (Normal). This happens because the smell contained in fish gelatin cork is caused by nitrogen attached to the amino acids of collagen.

2. Viscosity

Viscosity is the ability of a fluid to flow, the more viscous the greater force that liquid need to flow in a certain rate. In food and pharmaceutical industries , gelatin produced must suitable SNI No. 06-3735 1995 and British Standard : 757 1975. Based on the results of viscosity on a fish bone gelatin cork can be seen in Figure 2 .

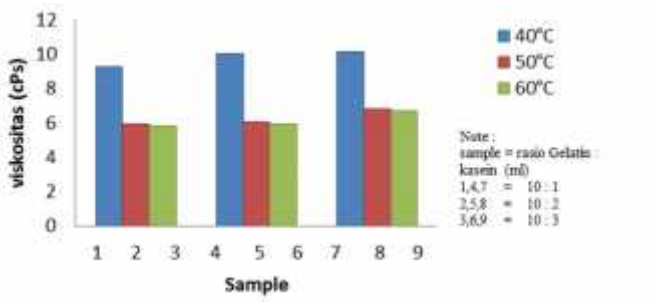

Figure 2. Effect of Temperature and Addition of Fish Bone Gelatin Casein Cork Against Viscosity

In Figure 2 it can be seen that the most optimal viscosity values on the sample 3 with a temperature of 60 °C. This means that this temperature is suitable to requirements of SNI. However, there are some samples that do not suitable to SNI. This happens because of viscosity is influenced by several factors, which one is the temperature. This means that the higher the temperature used, the lower the viscosity. It happens because of the movement of particle - fluid particles accelerated when the temperature was increased and the viscosity decreases. So that an increase temperature will lead to break the bond between the molecules forming solution units so that smaller shear force required to cause the shear rate will be smaller, so that the fluid flows more easily. According to the high viscosity grades the longer the chain of amino acids, the viscosity increases [15].

3. Water Content

The water content is also one very important characteristic in food because it can affect the appearance , texture and taste of food . The water content of the gelatin may affect the life time of gelatine as closely linked to the activity of microorganisms that grow over gelatin in store . In this study, the levels of water produced can be seen in Figure 3 .

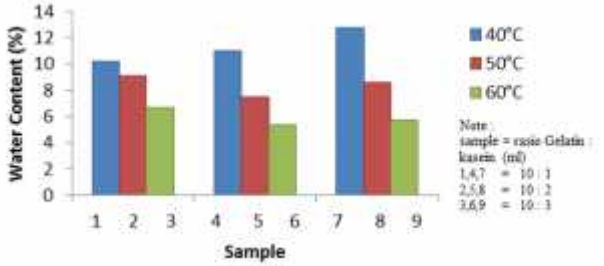

Figure 3. Effect of Temperature In addition Casein Gelatin Fish Bone Gabus With Against Moisture

In Figure 3 it can be seen that the water content obtained at the time of casein ranges between 5.4 to 12.76 % . This happens because of the influence of temperature so that the water content obtained decreases. While the addition of casein also affected because the more casein is added , the water content of the gelatin is increasing. On the water content of gelatin powder obtained without casein is 4.16% . The water content meets the standards gelatin according to

SNI No. 06-3735 1995 and British Standard : 757 1975 which has a maximum moisture content of 16 % .

3. Ash Content

The ash content is one of the important quality requirements gelatin [9] that does not exceed 5 % . It is seen that all the gelatin in this study do not meet the requirements of the ash content in gelatin , can be seen in Figure 4

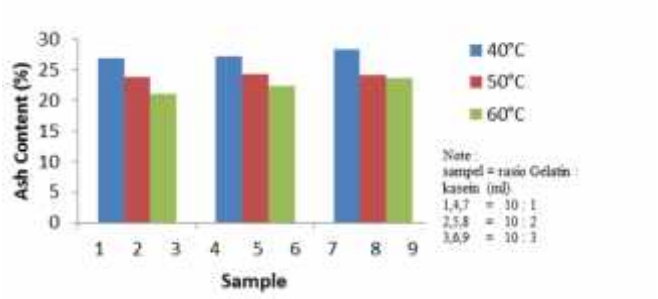

Figure 4. Effect of Temperature In addition α-Casein at cork fish bone gelatin Against Ash Content

In Figure 4 it can be seen that the ash content obtained ranged from 21.16 to 28.38%. the addition of casein ash content obtained in this study is 12.66%. This is because the organic material can be lost with reduced levels of water and the addition of casein also affect the ash content because the more casein is used then the ash content will increase. These results are consistent with studies [13] that the treatment temperature and heating time of fish skin can reduce the ash content. However, this study on the ash content not meet SNI which is below 5%.

5. Value Degrees of acidity (pH)

Measurement of pH values is important because gelatin solution gelatin solution pH affects other properties such as viscosity and gel strength [1] . In this study, the value obtained is 5 on each sample . This shows that after the process of mixing gelatin with the addition of the composition variation of α - casein which is 10 : 1 , 10 : 2 , 10 : 3 and the temperature does not affect the pH value which, after the process of mixing and heating the pH value remains the 5. Similarly, in commercial gelatin pH value is 5. These results are consistent with the results of acid process gelatin standard applied by GMIA [4] is 3.8 to 5.5 and according to Ward and the Courts [14] that the value of commercial gelatin pH range between 4-7,

6. Strength Gel

Strength gel is an important physical properties because of its connection with the application of the product. According Sartika [11], the gel strength characteristics associated with gelatin as a gelling agent. The gel formed by the hydrogen bonds between the molecules of gelatin [11]. Based on this study showed a mean value of fish bone gelatin gel strength with the addition of casein in the cork can be seen in Figure 5

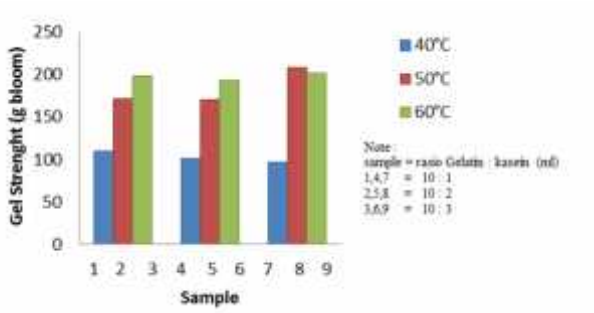

Figure 5. Effect of Temperature In Additions α-Casein At Cork Fish Bone Gelatin Against Gel Strength

In figure 5 shows that the most optimum gel strength lies in sample 9 with a temperature of 60^{o}C and composition of the casein 10: 3. Addition of casein in gelatin increase gel strength. the more casein addition the greater strenght gel. Accordance with the requirements into SNI No. 06-3735 1995 and British Standard: 757 1975 ie 50-300 gbloom. But in gelatin without casein gel strength exceeding SNI in gelatin without casein strength gel 567.1748gbloom. While temperatures provide no real effect on the fish bone gelatin gel cork.

7. Protein Content

The protein content in the results of this study can be seen in Table 4 levels of protein extraction results obtained cork fish bone that is 77.89 % . This means gelatin is approaching gelatin and commercial standards . However SNI does not require the levels of protein in gelatin but the higher levels of protein obtained the levels of protein in gelatin better and more pure . At a cork fish bone gelatin with casein obtained the following results :

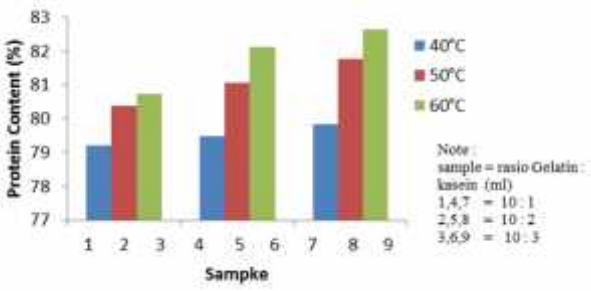

Figure 6. Effect of Temperature In Addition Casein At cork Fish Bone Gelatin Against protein content

In Figure 6 it can be seen that the levels of protein derived from fish gelatin cork with casein increased. the more casein is added, the protein content in gelatin will increase. While the temperature also affects the higher the temperature, the levels of protein obtained will be damaged. optimum levels of protein that is in the sample 9 with a temperature of 60^{o}C.

8. yield

The yield is the percentage of gelatin which is calculated based on a comparison between gelatin powder produced by the weight of the raw material (fish bones cork) that has been cleaned. The more the yield generated, the more efficient the treatment applied. Based on data from the research results obtained by the value of the yield (%) in

bone cork fish as many as 5.88%. With HCl concentration of 4% and a temperature of 80 °C. The temperature used is the temperature of the most optimal because at these temperatures the collagen fibers have been split into gelatin perfectly, causing the yield of gelatin bone cork fish is high, if the temperature used below 80^{o}C suspected of collagen fibers has not been split into gelatin perfectly, causing the yield of gelatin bone catfish low. This is supported by previous researchers that according Junianto, et al [8], the heating process for the extraction performed on collagen shrinkage temperature that is higher than the temperature of 60-70 ° C. If the temperature of the extraction is done at temperatures above the triple helical fibers are broken down into longer so that the collagen is converted into gelatin.

IV. CONCLUSIONS

In the research that has been done can be concluded that:

1. On the physical properties of cork fishbone gelatin organoleptic not meet SNI No. 06-3735 1995 and British Standard: 757 1975.
2. In its chemical properties such as gel strength, pH, viscosity and water content is suitable with ISO.
3. The results of the optimum gel strength is 208.304 gbloom Reviewed 9 samples casein ratio of 10: 3 and a temperature of 60 ^{O}C, the most optimum viscosity cPs 5.8026 on samples 7 to casein ratio of 10: 1 and a temperature of 60 ^{O}C, the most optimum water content 5.4% on 8 samples with less casein ratio of 10: 2 and a temperature of 60 ^{O}C, the ash content not meet SNI but the most optimum result ie 21.16% of the samples 7 to casein ratio of 10: 1 and a temperature of 60 ^{O}C, value pH obtained is 5 and the most optimum levels of protein contained in the sample 9 by comparison temperature and 60 ^{O}C

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