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Communications:

Gelatin Production from Milkfish Bone (Chanos-chanos Forsk)

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Abstract: The milkfish bone is by product of fishery product and has not use optimally. To increase the economic value of milkfish bone, it can be used as an alternative basic material of gelatin to change *haram* usual basic material. Gelatins are produced from partial hydrolysis of collagen by hot water extraction combined with acid treatment and extraction time. This research aimed to study an alternative in making gelatin *halal* using milkfish bone by acid`s process, to know the optimum concentration of citric acid by variation 1%, 3%, 5%, 7% and 9%, to know optimum extraction time by variation time 12, 24, 36, 48 and 60 hours and to know the characteristics of produced gelatin. The group functional identification of gelatin is done at the best sample using spectroscope FT-IR. The optimum citric acid concentration for gelatin extraction is 9% for about 48 hours. resulted has the water content 6.68%, ash content 0.033%, protein 9.56%, melt point 71.83 ^{o}C, gel strength 38.72 mm/g.dt, color 4.23%, aroma 3.0 , taste 2.88 and the rendemen 9.74%. Based on the FT-IR spectra, the group functional wich can be identified at gelatin milkfish are group of O-H, N-H, C-H, C=O and C-H.

Keywords: *Acid treatment, Extraction. Gelatin, Milkfish bone, Time*

1. Introduction

The presence of food, especially for human life is very important. In medical foods and beverages that we consume can determine the growth and physical development. Someone will grow better depending on the food and drink that he consumed. Regarding food and beverages have been arranged as detailed and as selective as possible in the religion of Islam through his *halal* sources, al-Qur'an and al-Hadith. Islam teaches food or beverages that we consume everyday existence of the law must be either lawful or in *Hukmiyah dzatiyah* in addition shall contain the nutrients needed by the body (Anwar 2007).

In addition to food is often a matter of controversy for Muslims is the use of food additives. Food additives are a concern because the material is essentially using one item that has been forbidden and or processing process is not in accordance with the teachings of Islam. One of the food additive controversies still surrounds the gelatin (Anwar 2007).

Gelatin is a result of partial hydrolysis of collagen protein of bone and skin. The use of gelatin is very broad, especially in the fields of industry, both food and non food industry. Gelatin used in food industry as forming foam (whipping agent), binder agent, stabilizer , gelling agent ext. (Grosch and Belitz 1986). Gelatin production generally uses collagen derived from cattle bones and skin, which is beef and pork. The use of this material turned out to pose problems for its users. The use of cow bones and the skin will be a problem for the Hindus, Muslim and Jewish faiths. Another alternative is to use a source of fish collagen, skin and bones are actually a waste of fish processing industry. In the Islamic perspective, the use of bones and skin of the fish as raw material for the manufacture of gelatin can be used as an alternative to kosher gelatin.

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2. Materials and Methods

2.1. Determination of Optimum Concentration Citric Acid in Milkfish Bone Immersion

A total of 250 grams of dry bones soaked in a solution of 1% citric acid. With a weight ratio of sample and solvent volume is 1:3 with 24-hour soaking time. During the immersion done stirring. After the bones were washed and sprayed with water so the dirt and the citric acid solution attached to the bone removed. The treatment was repeated in triplo. Above treatment was repeated with the same procedure in citric acid 3%, 5%. 7% and 9%. Then proceed with the extraction of gelatin.

2.2. Extraction of Gelatin Fish Bone Milkfish

In bone gelatin extracted with hot water temperature of 50-80^{o}C. Extraction is done by soaking the bones in hot water three stages, namely:

2.2.1. Extraction of Gelatin at 50 ° C Temperature

A total of 250 grams of the submersion Bone with citric acid soaked in water temperature of 50°C for 4 hours. Every 250 grams of bone requires 750 liters of water marinade. During immersion, made stirring. Gelatin will dissolve into the water marinade. After soaking, bone removed, and the immersion liquid was transferred to the evaporation of a solution of gelatine containers. This viscous solution containing gelatin, gelatin solution and is called phase I.

2.2.2. Extraction of Gelatin at 65 °C Temperature

While doing the extraction at phase I, hot water with 65°C temperature was prepared Bone is removed from hot water at phase I, and immediately was put in hot water at 65°C temperature during the immersion done stirring. Immersion was done in 4 hours long. After soaking was completed, the bone immediately removed, and the marinade liquid was transferred to a container that has been evaporated by a solution containing gelatin at phase I.

2.2.3. Extraction of Gelatin at 80 °C Temperature

While performing the extraction at phase II, hot water with 80 °C was prepared. Bone is removed from hot water at phase II, directly inserted into hot water with 80°C during the immersion done stirring. Immersion was done in 4 hours long. After soaking is completed, the bone immediately removed, and the immersion liquid was transferred to a container that has been evaporated by a solution containing gelatin at phase I and II.

2.3. Evaporation Milkfish Bone Gelatin

Extraction results of gelatin solution were then evaporated using a rotary vacuum evaporator at 70 °C for 3 hours (until thick).

2.4. Drying Milkfish Bone Gelatin

Concentrated gelatin was put in stainless steel containers that have been covered with plastic and trim. Then it was left for dried by the sun for 8 hours.

2.5. Determination of Optimum Extraction Length for Milkfish Bone

A total of 250 grams of dried bones were soaked in a solution of citric acid with an optimum concentration treatment. Weight ratio of sample and solvent volume is 1:3 with 12-hour soaking time during the extraction done stirring. After the bones were washed and sprayed with water, the dirts and the citric acid solution attached to the bone will be removed. The treatment was repeated in three times using the above treatment with the same procedure on a 24-hours soaking time, 36 hours, 48 hours and 60 hours followed by the extraction of gelatin, evaporation and drying.

Characterization of Milkfish Fish Bone Gelatin was done by Organoleptic Test Milkfish Fish Bone Gelatin, Determination of Moisture in Thermogravimetric method, Determination of Ash Content (AOAC), Determination of Total Protein, Test Melting Point Milkfish Fish Bone Gelatin, Test on Gelatin Gel Strength Bone milkfish and Identification of Force Functions Gelatin Using Fourier Transform Infrared Spectroscopy (FT-IR).

3. Results and Discussion

3.1. Determination of Optimum Concentration Citric Acid in Milkfish Bone Immersion

The yield of gelatin produced in this process varies according to the concentration of citric acid used and the length of extraction.

Based on data in Table 1, it shows yield of gelatin obtained by varying the concentration range of citric acid from 1.85 to 8.39%. This shows influence of citric acid cconcentration on yield of gelatin.

Table 1: The analysis of yield of fish bone gelatin produced milkfish (based on the variation of solvent concentration of citric acid with 24 hours immersion time).

No	Citrid Acid Concentration (%)	Yield of Gelatin (%)
1	1	1.85
2	3	3.16
3	5	5.14
4	7	7.63
5	9	8.39

Table 2: The analysis of yield of fish bone gelatin produced milkfish (based on variations of length of extraction in 9% citric acid concentration.

No	Length of Extraction (hours)	Yield of Gelatin (%)
1	12	6.51
2	24	8.39
3	36	9.19
4	48	9.74
5	60	8.07

Table 3: Analysis Results of Objective and Subjective Parameters in Milkfish Fish Bone Gelatin Products

Parameters	Citric acid Concentration					
	1 %	3 %	5 %	7 %	9 %	Gelatin market
Objective Parameters						
Water content (%)	8.03	6.77	6.28	7.18	6.80	6.77
Ash content (%)	0.40	0.23	0.155	0.135	0.132	0
Protein (%)	2.75	5.09	6.79	8.35	8.92	10.35
Gel strength (mm/g.dt)	71.94	63.97	56.17	51.29	46.68	55.76
Melting point (°C)	90.83	85	82.5	80.83	76.17	56.5
Subjective Parameters						
Color	1.16	2.28	3.31	3.15	3.40	3.75
Aroma	1.11	1.80	2.05	2.23	2.96	3.75
Flavour	1.16	1.67	1.85	2.29	2.61	3.9

The use of citric acid concentration in the determination of this optimum concentration, suspended at a concentration of 9%. This is because the nature of the gelatin gel strength of fish bones milkfish with citric acid treatment of 9% stronger than the gelatin in the market. Because the gel strength of the main properties of gelatin in addition to determining the quality of the yield and protein content.

3.2. Determination of Optimum Length Milkfish Bone Extraction

The selection of the best treatment is performed in this study was determined using the method of De Garmo. The selection of the best treatment based on an analysis of some test

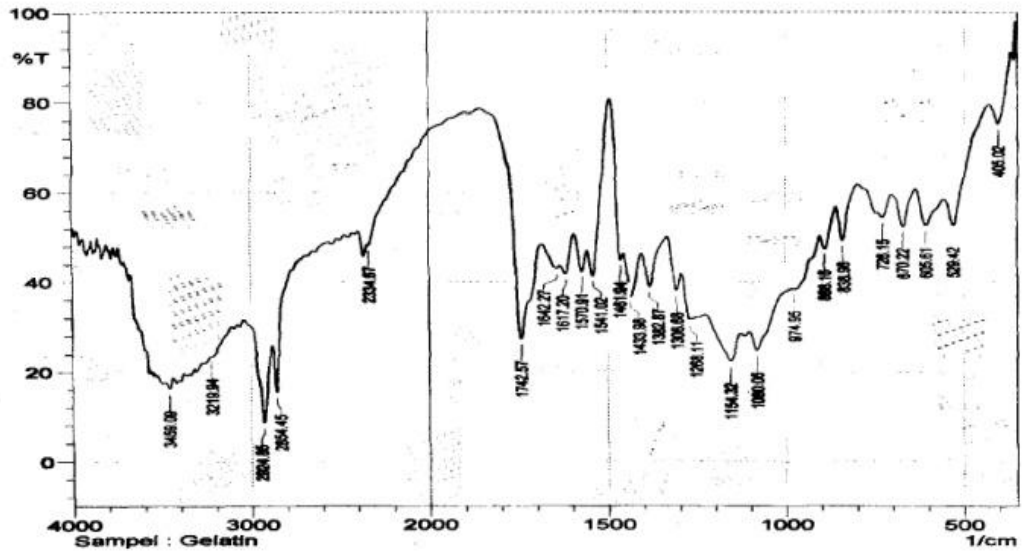

Fig. 2: Infrared spectra of milkfish fish bone gelatin (9% citric acid of exracted for 48 hours).

parameters, the objective parameters consisting of water content, ash content, protein content, gel strength, melting point, as well as subjective parameters, namely organoleptic consisting of color, aroma, and flavor. Based on objective and consisting of color, aroma, and flavor. Based on objective and subjective parameters of the best in the gelatin obtained by extraction time using citric acid concentration of 9% for 24 hours.

Table 4: The analysis of objective and subjective parameters in fish bone gelatin products milkfish (the variations of the length of extraction using citric acid 9%).

Parameters	**Length of extraction (hour)**					
	12	24	36	48	60	Gelatin market
Objective Parameters						
Water content (%)	9.11	6.80	7.63	6.68	6.09	6.77
Ash content (%)	0.199	0.132	0.098	0.033	0	0
Protein (%)	7.69	8.92	9.08	9.56	8.58	10.35
Gel strength (mm/g.dt)	55.83	46.68	41.74	38.72	40.08	55.76
Melting point (^oC)	88.83	76.17	74.67	71	71.83	56.5
Subjective Parameters						
Color	3.04	3.40	3.28	3.80	3.51	3.75
Aroma	2.36	2.96	2.99	3.00	3.03	3.75
Flavour	2.57	2.61	2.80	2.85	2.91	3.9

3.3. Identification of Gelatin with the FT-IR spectrophotometer

Identification of functional groups milkfish bone gelatin extracted was best done using FT-IR Spectroscopy.

Table 5: Interpretation of the spectra of bone gelatin Fish Milkfish 9%.

No	**Wave Length**	**Wave Length Reference (cm^{-1})***	The Intensity Reference	Reference Vibration
1.	3459.09	3550-3230	Medium-strong	strain O-H intermolecular
2.	3219.94	3220-3180	Weak to moderate strain	strain N-H symmetry of the primary amide
3.	2924.85	2975-2950	Strong	Strain C-H asymmetry of CH3
4.	2854.45	2870-2840	Strong	Strain C-H-CH_2-asymmetry of acyclic
5.	2334.67	2700-2250	Medium	Strain N-H $^+$ from the C = NH +
6.	1742.57	1750-1700	Strong	Strain C = O of secondary amide
7.	1642.27	1650-1580	Medium-strong	N-H bending of primary amine
8	1617.2	1625-1590	Variabel	Strain C = C aromatic
9.	1570.91	1570-1515	Strong	N-H bending of the secondary amide
10	1541.02			
11	1461.94	1465-1430	Variabel	Strain = C-H aromatic
12	1433.98	1440-1400	Weak	C-H bending of the secondary alcohol
13	1382.87	1370-1390	Medium	C-H bending of CH_3

14	1306.68	1350-1310	Weak to moderate	strain C-N of the secondary amides
15	1154.32	1160-1150	Strong	O-H bending of phenol
16	1080.06	1125-1085	Strong	Strain C-O of the secondary alcohol
17	974.95	~ 970	Medium	wobble C–C from CH_3
18	888.16	900-650	Weak to moderate	N-H bending is out of the field of primary amines
19	838.98	840-790	Weak	wobble of CH_3
20	726.15	725-720	Medium-strong	CC wobble of the - $(CH_2)_n$
21	670.22	700-600	Width	O-H bending out of the field
22	605.61	610-590	Medium-strong	bending of the secondary amides NCO

4. Conclusion

Based on the results obtained, it can be concluded that: the optimum concentration of citric acid citric acid used in the manufacture of bone gelatin Fish Milkfish is 9%. Optimum length of extraction in the manufacture of bone gelatin Fish Milkfish with citric acid concentration of 9% is 48 hours. Characteristics of milkfish fish bone gelatin with 9% citric acid treatment and duration of immersion of 48 hours (as the optimum treatment) is having water content of 6.68%, 0.033% ash content of 9.56% protein content, gel strength of 38.72 mm / gr. dt, the melting point of 71 ° C, 3.8 color (white), the smell of 3.00 (not rancid), flavors 2.85 (good). Functional groups can be identified from FT-IR spectra of Fish Milkfish bone gelatin including the C - N, N - H, C = O, and O - H.

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6. References

Anwar, A. (2007) *Pangan Dalam Pandangan Islam (Tinjauan Islam Terhadap Makanan dan Minuman)*. Accessed www.unpas.ac.id.

Denver, A.V. (2007) *Bahan Makanan Tambahan*, http://isakuniki.wordpress. com/tag /halal-guide.

Eastoe, J.E. (1957) The Amino Acid Composition Of Fish Collagen And Gelatin. *Biochemical Journal*, 65(2): 363-368.

Grosch, W., and Belitz, H.D. (1986) *Food Chemistry*. Spingers-Verlag., Berlin Heidenberg, New York.

Socrates, G. (1994) *Infra Red Caracteristic Group Frequencies Tables and Charts*. John Wiley and Sons Ltd. 2nd Edition, University Of West, London.