# Chemistry and Physic Characterization of Milkfish (*Chanos chanos*) Gelatin from Tarakan, North Borneo, Indonesia

*Tri Paus Hasiholan* Hutapea[1*], Rukisah[2], Muliyadi[3], *Kartika A.* Madurani[4], Suprapto[4], and *Fredy* Kurniawan[4,5]

[1]Fisheries Product Technology Department, Faculty of Fishery and Marine Science, University of Borneo Tarakan, North Borneo, Indonesia
[2]Aquaculture Department, Faculty of Fishery and Marine Science, University of Borneo Tarakan, North Borneo, Indonesia.
[3]Elctrical Engineering Department, Faculty of Engineering, University of Borneo Tarakan, North Borneo, Indonesia.
[4]Chemistry Department, Faculty of Science, Institut Teknologi Sepuluh Nopember, Surabaya, East Java, Indonesia.
[5]ITS Halal Center, Institute of Research and Community Service, Institut Teknologi Sepuluh Nopember, Surabaya, East Java, Indonesia

**Abstract.** Gelatin of milkfish (Chanos chanos) from Tarakan, North Borneo, Indonesia has been extracted successfully. The gelatin was extracted from the milkfish bone. In prior to extracting, the bone was cleaned with demineralized water and then dried at room temperature. The extraction process was done in several procedures. The first procedure has immersed the bone in 0.1 M NaOH for 48 hours. After that, it was washed until it reached neutral conditions and continued with immersing it in 0.1 M HCl for 72 hours and then washed it to get the neutral condition. The next procedure is the extraction process. It was using water solvents with a ratio of milkfish bone and water is 1: 3. The extraction process was carried out at 55ºC for 4 hours. The obtained gelatin was characterized. The results showed that moisture content 6.39%; ash content 1.92%; pH 6.1; viscosity 5.39 cP; and color 75 PtCo. This result was proved that the gelatin extraction successful.

## 1 Introduction

Gelatin is a type of protein taken (extraction) from animal collagen tissue which is generally found in cartilage, skin and connective tissue which has characteristics of solid, colorless, brittle (if dry) colorless and tasteless [1]–[5]. Gelatin can usually be obtained from the hydrolysis of animal collagen found in bones and skin and is a compound whose formation does not occur naturally [6]–[8]. Gelatin extraction from freshwater fish skin has

*Corresponding author: hutapea2606@gmail.com

characteristics that are in accordance with commercial gelatin and potentially as alternative gelatin [4], [5], [9]–[12]. The benefits of gelatin are so great that gelatin is increasingly in demand to produce it. Various methods can be applied to produce gelatin, one of which is through partial hydrolysis of native collagen using dilute or alkaline acids which results in the breakdown of part of the structure. Extracting gelatin from various types of marine fish skin using the acid method [11]. The results obtained have similarities with previous gelatin production. The resulting gelatin is white like snow and has a crystal and light texture. In this study, the extraction of *Chanos chanos* produced by Tarakan, North Kalimantan, Indonesia will be extracted.

## 2 Experimental

### 2.1 Materials and chemicals

In this research, fishbones are used for fishbone production in Tarakan, North Kalimantan, Indonesia. Sodium hydroxide, demineralized water, and chloric acid, were purchased from local suppliers. All chemicals used were of analytical grade.

### 2.2 Gelatin extraction

Extraction is done in several stages. The first stage was done soaking the fishbone that had been cleaned into 0.1 M NaOH for 48 hours. After that, it was washed to neutral pH and continued soaking with 0.1 M HCl for 72 hours. Then washed to neutral pH and extraction process using water solvent with a ratio of milkfish and water is 1: 3. The extraction process was carried out in stages at a temperature of 55ºC for 4 hours. To get solid gelatin, the results of the extraction process were dried using an oven at 50 $^0$C. The obtained gelatin was characterized by moisture content, ash content, pH, viscosity and color. Moisture content testing is done by weighing gelatin before and after heating 110 $^0$C for 1 hours. Weighing results are entered into the formula

$$\text{Moisture Content} = \frac{A}{B}\ x\ 100\% \qquad (1)$$

A = final weight and B = initial weight. Ash content testing is done by burning 2 grams of gelatin at 600 $^0$C. then the ash produced is weighed. Ash content is calculated using the formula

$$\text{Ash Content} = \frac{A}{B}\ x\ 100\% \qquad (2)$$

A = ash weight and B = sample weight. pH measurement using a pH meter while viscosity measurement using the Ostwald viscometer.

## 3 Result and discussion

Utilization of milkfish bone waste from milkfish production in Tarakan City, North Kalimantan, Indonesia. Milkfish bone is prepared to produce gelatin. The first step is demineralization. The demineralization process produces ossein or soft bone and then extracted using a water solvent. The extraction results in gelatin which is clear yellowish

like glass (Figure 1). In this study, the gelatin produced was characterized by moisture content, ash content, pH, viscosity and color.

**Fig. 1.** The milkfish gelatin from the extraction process.

Based on the chemical and physical characteristics of gelatin, the test results show that gelatin produced from milkfish (*Chanos chanos*) like the standards as gelatin. The result of gelatin color is yellowish. Based on the requirements of the Indonesian National Standard, the color of gelatin is clear to yellowish. The viscosity of gelatin produced was 5.39 cP. This viscosity value complies with the standard. Gelatin has a viscosity of between 0 to 7 cP because if dissolved in water, gelatin has a viscosity value to form a gel. The result pH value is 6.1. Gelatin pH required is in the pH value between 4.5 - 6.5. Gelatin made from milkfish bones has fulfilled the requirements as gelatin. Moisture content produced is 6.39%. This value certainly meets the requirements specified as standard gelatin. High water content in gelatin causes a decrease in the quality of gelatin. Water will interfere with the gelatin-forming structure. Ash content from gelatin is 1.92%. The required gelatin must have ash levels below 16%. This shows that the level of gelatin ash has been below the standard of gelatin. Determination of ash content to determine the mineral content of gelatin. High mineral content in gelatin will reduce the quality of gelatin. All values of the chemical and physical parameters of gelatin-like a standard, it can be said that the extraction of gelatin was successful.

**Table 1.** Gelatin Analysis Results

| Parameter | Milkfish gelatin | SNI [13] | British Standart 757 [14] |
|---|---|---|---|
| Color | yellowish | yellowish | yellowish |
| Viscocity (cP) | 5.39 | - | 1,5 - 7 |
| pH | 6.1 | - | 4,5 – 6,5 |
| Moisture Content (%) | 6.39 | Max. 16 | - |
| Ash Content (%) | 1.92 | Max. 3,25 | - |

## 4 Conclusion

Gelatin extraction from chanos chanos produced by Tarakan City, North Kalimantan, Indonesia showed results that were in accordance with gelatin in general. Gelatin has a characteristic like clear yellow crystals and soluble in water. The results showed that moisture content 6.39%; ash content 1.92%; pH 6.1 and viscosity 5.39 cP.

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## References

1. Z. A. N. Hanani, Y. H. Roos, J. P. Kerry, Food Hydrocolloids **29(1)**, 144–151 (2012)
2. M. Sompie, S. E. Surtijono, J. H. W. Pontoh, N. N. Lontaan, Procedia Food Science **3**, 383–388 (2015)
3. R. Hafidz, C. M. Yaakob, I. Amin, A. Noorfaizan, International Food Research Journal **18**, 813–817 (2011)
4. Z. A. N. Hanani, *Encyclopedia of Food and Health* (Oxford: Academic Press, 2016)
5. S. Benjakul P. Kittiphattanabawon, Elsevier (2018)
6. A. Duconseille, T. Astruc, N. Quintana, F. Meersman, V. Sante-Lhoutellier, Food Hydrocolloids **43**, 360–376 (2015)
7. H. I. Abdullah Amqizal, H. A. Al-Kahtani, E. A. Ismail, K. Hayat, I. Jaswir, Food Control **78**, 297–303 (2017)
8. D. Pradini, H. Juwono, K. A. Madurani, F. Kurniawan, Malaysian Journal of Fundamental and Applied Sciences **14(3)**, 325–330 (2018)
9. A. A. Mariod H. Fadul, Acta Scientiarum Polonorum Technologia Alimentaria **12(2)**, 135–147 (2013)
10. L. Lin, J. M. Regenstein, S. Lv, J. Lu, S. Jiang, Trends in Food Science & Technology **68**, 102–112 (2017)
11. Y. Pranoto, C. M. Lee, H. J. Park, LWT - Food Science and Technology **40(5)**, 766–774 (2007)
12. D. D. Altan Kamer, I. Palabiyik, N. O. Işık, F. Akyuz, A. S. Demirci, T. Gumus, LWT (2018)
13. Badan Standarisasi Nasional, *Mutu dan Uji Gelatin Standar Nasional Indonesia* (Badan Standarisasi Nasional, Jakarta, 1995)
14. BS 757*, Methods for sampling and testing gelatine (physical and chemical methods)* (BSI, 1975)