Indonesian Journal of Pharmaceutics
IdJP
ISSN : 2597-8748

Vol. 7, Issue 1, 2025 (46-52)
http://journal.unpad.ac.id/IdJP

Review: Isolation of Gelatin from Several Types of Fish

Ine Suharyani*, Lela Sulastri, Enih Nindi Astuti, Elis Delviyanti, Rima Yulia Senja, Tomi

Fakultas Farmasi, Universitas Muhammadiyah Ahmad Dahlan Cirebon, Kedawung, Cirebon 45153, Jawa Barat

Submitted: 22/10/2024, Revised: 06/01/2025, Accepted: 10/02/2025, Published: 26/07/2025

ABSTRACT

Indonesia is a country with the largest fishery waste, one of which is fish bones as a source of gelatin. Gelatin is the main protein that makes up skin and bone tissue in animals. This review was compiled to compare the results of isolating gelatin from bone waste in various types of fish. Articles were collected from the website https://scholar.google.co.id/ with "gelatin, gelatin content, gelatin in fish bones, viscosity, pH" in the 2015–2022 period, and 11 journals were obtained. In this literature study, a method for isolating gelatin from fish bone waste will be discussed, followed by an evaluation of the gelatin obtained, including its yield and its physical properties. It is hoped that the results of this review will provide information regarding a new source for gelatin isolation so that gelatin can be widely used by the food, pharmaceutical, cosmetic, and photographic industries, particularly in the pharmaceutical and food industries, which currently require gelatin as a stabilizer and emulsifier so that it can make and maintain the emulsion system.

Keywords: Gelatin, fish bones, yield, pH, viscosity,

*Corresponding author,
e-mail: inesuharyani25@gmail.com I. Suharyani)

https://doi.org/10.24198/idjp.v7i1.58575

1. Introduction

Indonesia is one of the countries with the largest fishery waste in the world. The fishery waste consists of heads, entrails, fins, skin, spines, and bones. Fish bones are one of the wastes that can be utilized because they produce gelatin. Ice cream is a food product that uses gelatin as a stabilizer. According to ice cream sales data, Aice PT. Rajawali Asia Bali in the June-October 2021 period experienced an average increase of 8%. Therefore, it is necessary to improve the quality of ice cream so that health problems do not occur due to excessive consumption of ice cream. In addition, quality improvement is also needed to keep ice cream sales stable. According to research conducted by Hidayah (2017), gelatin from African catfish bones can be used as a stabilizer for ice cream, and there is no difference in microstructural appearance compared to commercial ice cream. Based on this research, further research was carried out to determine the effect of using gelatin as a stabilizer for ice cream and optimization in the manufacture of gelatin itself [1].

Gelatin is widely used in various industries, namely the food and beverage industry, the photography industry, the pharmaceutical industry, the beauty industry, and other chemical industries because it has unique functional properties. In the food industry, gelatin is used as a stabilizer, gelling agent, binder agent, adhesive, emulsifier, and viscosity agent.

In the pharmaceutical industry, gelatin is often used as a plasma expander, binder for pastilles and tablets, surgical powder, capsule maker, and for microencapsulation. In certain countries, such as India, there are Hindus who forbid their people from consuming beef, while Muslims are prohibited from consuming pork. This condition opens up alternative raw materials for making gelatin using fish bones or skin [2].

One alternative to replacing bovine gelatin in the manufacture of capsule shells is fish gelatin. The use of fish gelatin in the food and pharmaceutical fields must meet the rheological properties that are appropriate for the intended use [3].

Making gelatin from fishery waste in the form of fish bones can reduce waste disposal and increase the added value of this waste [4]. This review provides several types of fish that are rich in gelatin (Fig. 2). The use of gelatin derived from fish bones will help to reduce waste in fisheries while also expanding its applications in the food and pharmaceutical industries.

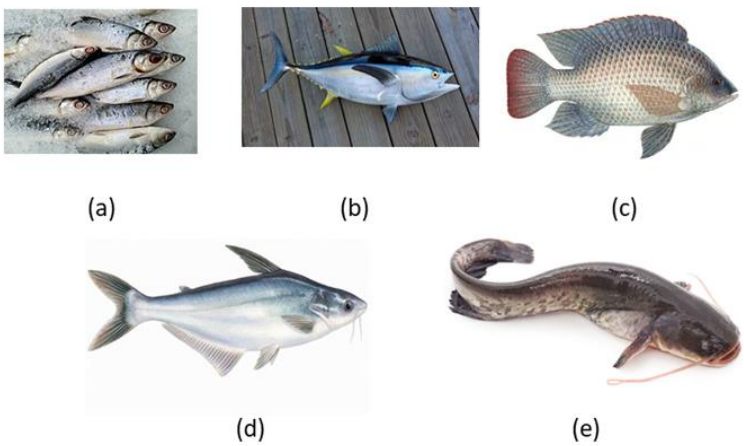

Figure 1. Several fish as gelatin source: Milkfish/Chanos chanos (a), Yellowfin Tuna /Thunnus albacares (b), Parrot Fish (c), Patin (d), and Lele (e)

2. Methods

The research method of these three journals was carried out descriptively within the 2015-2022 journal selection period. Journal searches were carried out through the website https://scholar.google.co.id/ with the keywords used were "gelatin, gelatin content in ice cream, gelatin in fish bones". Three journals were obtained with the following criteria:

1. Full text
2. Write in Indonesian and English languange.
3. Free journal

Gelatin

Gelatin is a protein-derived compound obtained by hydrolyzing collagen found in animal skin or bones. In its manufacture, gelatin is produced from the hydrolysis of collagen using acidic solvents, which can cause the hydrogen bonds between the three bonds of the tropocollagen chain to break. According to Panjaitan (2016), the highest yield of gelatin was produced from 3% hydrochloric acid solvent with 8.59% water content, 8.02% ash content, 0.27% fat content, and 80.2% protein content [5].

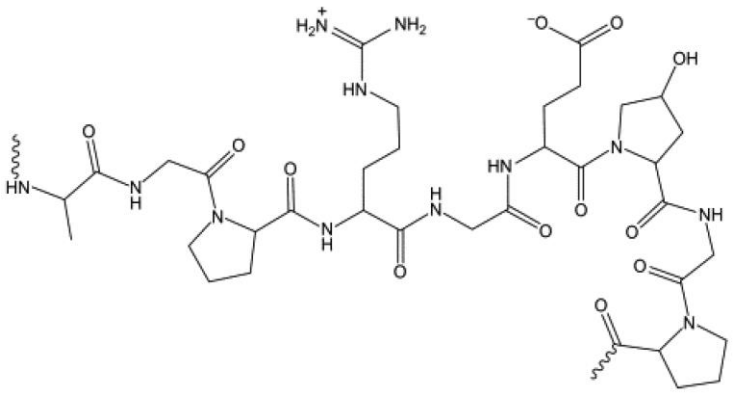

Figure 2. Gelatin structure

Collagen changes to gelatin with pre-treatment by acid or alkaline extraction. In the acid extraction process, type A gelatin is produced with an isoelectric point of pH 7-9; if done with an alkaline extraction process, it produces type B gelatin with an intermediate isoelectric point of pH 4.7-5.2 [5].

Isolation of gelatin from several fish

Gelatin is a product resulting from heat denaturation or breakdown of collagen. During heat denaturation and the process of hydrolysis of the triple collagen arrangement helix is joined by three peptides via covalent bond (Fig. 3). Gelatin is obtained through extraction and hydrolysis of collagen which is water insoluble [6], [7]. Gelatin is a substance decomposition process with how to add H_2O where the resulting ions H_2O decomposition is bound by collagen so that Gelatin is formed. Gelatin usually contains high protein between 22.6-26.2%.

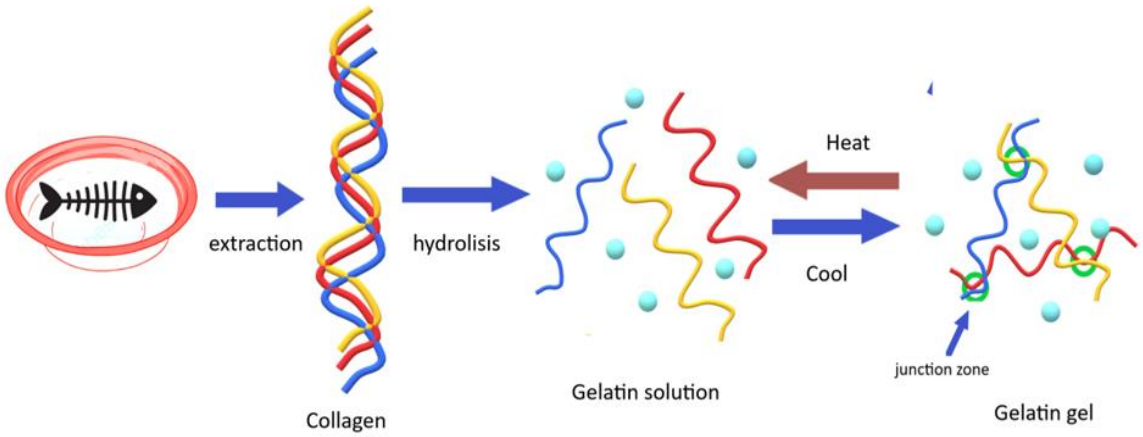

Figure 3. Fishbone as a source of gelatin

Gelatin from milkfish bones which is used as drug and food industries especially in syrups and medicinal preparations. Several recipes commonly use the same method of making gelatin, starting from the stages of washing, degreasing, and, adding 8-butanol, demineralization, rinsing ossein, extraction, drying, and grinding. The results of the extraction process are dried at 55°C until dry, then crushed using a blender to obtain milkfish bone gelatin powder. Testing the pH, viscosity, and gel strength before being applied to the product [8].

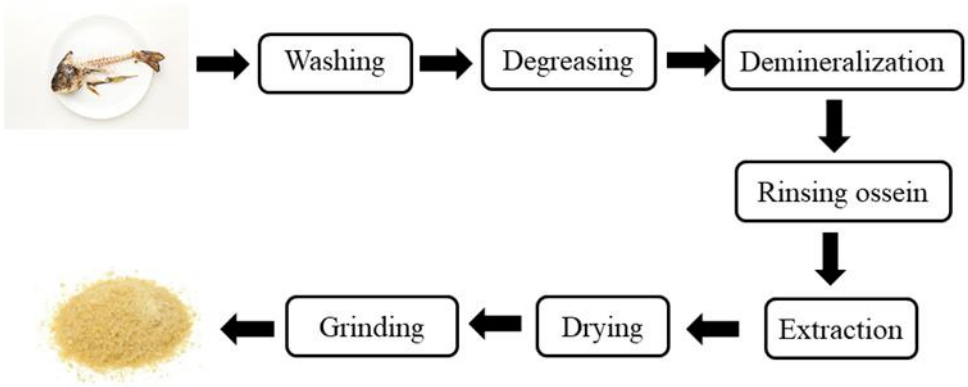

Figure 4. Isolation of gelatin from fishbone

Gelatin has characteristics physical properties such as gel strength, viscosity and very important melting point for food use. The pH of gelatin meets the Gelatin Manufacturers Institute of America (GMIA) standard, should in range 3.8–6.0 (GMIA, 2012). A pH value of 3-4 is classified as a low pH value where the pH meets standards, and a low pH is very good for application to products such as syrup, jelly, fruit juice, and others, while a neutral pH is good for meat products, pharmaceuticals, and others [8].

The viscosity standard for gelatin is in the range of 1.5–7.5 cP (GMIA, 2012). In milkfish, the viscosity value complies with GMIA standards, while in tuna fin gelatin, the viscosity value produced is greater than that of commercial gelatin,

the viscosity value produced is greater than that of commercial gelatin, which is 44.5 cP. The high viscosity value is due to the fact that gelatin contains amino acids (Nurilmala, Jacoeb, and Dzaky, 2017).

Gel strength is one of the aspects that underlying the quality of gelatin (Nurilmala, Jacoeb, and Dzaky, 2017). Gel strength was measured using a texture analyzer, and expressed in units of bloom and gram force (gf). In milkfish gelatin, the gel strength exceeds the GMIA standard, namely 50–300 blooms. The gel strength value of tuna fin gelatin exceeds that of commercial gelatin. The gel strength value is higher than commercial gelatin, which is 256.6 g/L (Nurilmala, Jacoeb, and Dzaky, 2017). The high gel strength value can be caused by the high extraction temperature; the higher the temperature rise up the gel strength of gelatin (Rahman, 2022).

Tabel 1. Physical characteristic of gelatin from fishbone

Study	Physical characteristic			
	pH	Viscosity (cP)	Gel strength (bloom)	Rendemen (%)
Milkfish [8]	4.55 ± 0.07	6,67 ± 0,00	493,25 ± 6,01	NA
Milkfish [9]	3,8-5,5	5,5-7	NA	5 - 7
Milkfish [2]	4,2	2,237	NA	0,23 – 2,43
Milkfish [10]	4,695-4,733	4,28-5,27	NA	5,52 ± 0,96
Milkfish [11]	5,98-6,07	2,520 cP	NA	NA
Yellowfin Tuna [12]	5,4 ± 0,13	104,2 – 128,5	1789,55-4131,1	55,65
Patin [13]	4.46	3.83±0.08	364.19±0.04	NA
Parrot fish [14]	4.5	NA	NA	3.84
Lele [15]	4	5.5	177	10.9

NA= Not Available

The addition of gelatin to dragon fruit juice can clarify the juice and increase the viscosity and pH of the juice . According to Franciskha Carolyn Panjaitan (2016), the highest yield of gelatin was produced by using 3% hydrochloric acid resulting 8.59% of water content, 8.02% of ash, 0.27% fat, and 80.2% protein. The results of this study can be used as a reference for optimizing the manufacture of gelatin from fish bones, which can be used as a stabilizer in food and pharmaceutical industries.

4. Acknowledgements

We would like to thank Universitas Muhammadiyah Ahmad Dahlan Cirebon (UMMADA) for supporting this study.

5. References

1. Jessica, Rijai L, Arifian H. Optimalisasi Basis Untuk Formulasi Sediaan Lip Cream. Proceeding Mulawarman Pharm Conf. 2018 Dec;8:260–6.
2. Kartika Sitorus A dan VED. Formulasi Sediaan Lipstik Ekstrak Etanol Buah Naga Merah (*Hylocereus polyrhizus*). J Pharm world. 2017;2(1):1–8.
3. Yulyuswarni Y. Formulasi Ekstrak Kulit Buah Naga Merah (*Hylocereus polyrhizus*) Sebagai Pewarna Alami Dalam Sediaan Lipstik. J Anal Kesehat. 2018;7(1):673.

4. Widianingsih M. Antioxidant Activity Extract Methanol of Red Dragon Fruit and Evaporation by Dry Air. 2016;146–50.
5. Helda RN. Aktivitas Antioksidan Ekstrak Etanol Kulit Buah Naga Merah Daerah Pelaihari , Kalimantan Selatan. 2016;03(02):36–42.
6. Suharyani I, Falya Y, Rindiyani, Nurmaya N, Afidah Y. Pengaruh Pelarut Polar terhadap Aktivitas Antioksidan Daging Buah Naga Merah (*Hylocereus Polyrhizus*) yang diekstraksi dengan Metode Microwave Assisted Extraction (MAE). 2022;5(2):237–48. Available from: https://e-journal.unper.ac.id/index.php/PHARMACOSCRIPT/article/view/1007
7. Yasa Q, Shiddiqi A, Apriyani RF, Kusuma D, Karisma AD. Anthocyanin Extraction from The Pericarp of Red Pitaya (*Hylocereus polyrhizus*) Using Microwave Assisted Hydrodistillation (MAHD) Method. 2021;05(200):30–7.
8. Dida Fitri Lanisthi, Lizma Febrina MAM. Analisis Senyawa Metabolit Sekunder Ekstrak Etanol dan Ekstrak Air Kulit Buah Naga Merah (*Hylocereus polyrhizus*). 2015;1–5.
9. Ningsih DR, Zusfahair, Mantari D. Ekstrak Daun Mangga (*Mangifera indica* L.) sebagai Antijamur terhadap Jamur Candida albicans dan Identifikassi Golongan Senyawanya. J Kim Ris. 2017;2(1).
10. Khalid S, Shahzad A, Basharat N, Abubakar M, Anwar P. Phytochemical Screening and Analysis of Selected Medicinal Plants in Gujrat. J Phytochem Biochem. 2018;2(1):2–4.
11. Meidayanti Putri N, Gunawan I, Suarsa I. Aktivitas Antioksidan Antosianin Dalam Ekstrak Etanol Kulit Buah Naga Super Merah (*Hylocereus Costaricensis*) Dan Analisis Kadar Totalnya. J Kim. 2015;9(2):243–51.
12. Mufidah KA, Mahmudah F, Rijai L. Formulasi Sediaan Lipcream Dengan Pewarna Alami Ekstrak Buah Senggani (*Melastoma Malabhatricum*). 2021;(April 2021):106–10.
13. Falya Y, Rizikiyan Y, Suharyani I, Amelia R, Yulia Senja R. Formulation and Evaluation of Lipstick with Braziline Pigment of *Caesalpinia sappan* L. J Farm Etam. 2022;1(2019):92–107.
14. Ambari Y, Hapsari FND, Ningsih AW, Nurrosyidah IH, Sinaga B. Studi Formulasi Sediaan Lip Balm Ekstrak Kayu Secang (*Caesalpinia sappan* L.) dengan Variasi Beeswax. J Islam Pharm. 2020;5(2):36–45.
15. Ahmed R, Tanvir EM, Hossen MS, Afroz R, Ahmmed I, Rumpa NEN, et al. Antioxidant properties and cardioprotective mechanism of Malaysian propolis in rats. Evidence-based Complement Altern Med. 2017;2017.
16. Hidayah T. Uji Stabilitas Pigmen dan Antioksidan Hasil Ekstraksi Zat Warna Alami dari Kulit Buah Naga (*Hylocereus undatus*). Fak Mat Dan Ilmu Pengetah Alam Univ Negeri Semarang. 2013;29(18):2616–27.
17. Wardaningrum R, Susilo J. Perbandingan Aktivitas Antioksidan Ekstrak Etanol Terpurifikasi Ubi Jalar Ungu (*Ipomoea batatas* L) Dengan Vitamin E. [Internet]. 2019.

Available from: http://repository2.unw.ac.id/696/

18. Nova C. Skrining Fitokimia Dan Uji Aktivitas Antioksidan Ekstrak Metanol Daun Sirih Lengkung (*Piper aduncum* L.). Universitas Sanata Dharma Yogyakarta; 2016.
19. Herdiani N, Putri EBP. Efek Antioksdian Ekstrak Buah Naga Merah (*Hylocereus polyrhizus*) Terhadap Makrofag Alveolar Tikus yang Dipapar Asap Rokok. Univ Widyagama Malang. 2018;(September):391–400.
20. Noviyanty A, Salingkat CA, Syamsiar S. Pengaruh Jenis Pelarut terhadap Ekstraksi dari Kulit Buah Naga Merah (*Hylocereus polyrhizus*). KOVALEN J Ris Kim. 2019;5(3):271–9.