Global Scientific JOURNALS
GSJ: Volume 10, Issue 11, November 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

UTILIZATION OF FISH SKIN AS RAW MATERIAL FOR FOOD PRODUCTS, FOOD SUPPLEMENTARY AND FUNCTIONAL FOOD

Junianto[1], Thallita Nasywa Faddilah[2], Muhammad Erpan Saputra[2], Fadel Ogi Putra Ahmad[2], Sabrina Febriyanti[2], Maulana Dimas Firmansyah[2] and Muhammad Zoelva Dyazhari A[2].

1) Lecturer staff of the Fisheries Department_ Univeristas Padjadjaran

2) *Student of the Fisheries Department – Univeristas Padjadjaran*

Abstract

The utilization of fish skin as a raw material for food products, food additives, and functional food is an effort to encourage a blue economy in the fisheries sector. This article aims to inform the use of fish skin as a raw material for food products, food additives, and functional foods on a commercial scale and on a research scale conducted in Indonesia. A literature study revealed that fish skin and fish processing industry waste can be processed into food products, additives, and functional food. Commercial food products made from fish skin are fish crackers. The food additive made from fish skin is gelatin. Functional food made from fish skin is collagen. In Indonesia, gelatin and collagen made from fish skin are still on a research scale, not yet on a commercial scale.

Keywords : Product, Commercial, research, gelatin, collagen.

INTRODUCTION

Indonesia is a potential producer of fish and other fishery products. These fishery products are not only marketed in fresh form but are processed into products with higher added value. The fish processing industry produces a large amount of waste. Fish processing industrial waste is anything left and wasted from a fishery product processing activity. This waste, if not handled properly, can pollute the environment.

Waste in the fish processing industry can be classified into solid and liquid waste. Groups of solid waste include fish skin, fish heads, scales, bones, fins, fish innards, or fish meat residue

attached to bones. Liquid waste in the form of blood, mucus, and washing water in the processing process. The quantity of fish processing waste varies, depending on the type of fish being processed. Warinangin et al. (2005) reported that the waste from processing tuna consists of 4.9% skin, head 9.8%; bone 23.90%; and stomach contents 14.25% (Peranginangin et al., 2005). Syahrul and Dewita (2016) informed that catfish waste produced from the processing process was 20-50% in the form of heads, fins, fat meat, bones, entrails (offal), and belly fat.

This fish-processing industrial waste must be utilized or processed so as not to cause problems. According to Sutiyono and Yudo, various impacts of fish processing industrial waste pollution include environmental aesthetics, socio-economic conditions of the community, surface water quality, and aquatic biota along the waste disposal route.

Fish skin waste from the fish processing industry is significant to be processed. If thrown away, it can cause pollution because the protein content in fish skin is still relatively high and disturbs the beauty of the environment because of the smell it causes (Kristiningrum, et al. 2006). Fish skin contains 69.6% water, 26.9% protein, 2.5% ash and 0.7% fat.

According to (Nurilmala et al., 2021), the protein content of tilapia skin (88.79 ± 1.5%) was greater than that of catfish skin (80.17 ± 1.7%) and tuna skin (75.29±1.7%). Fish skin consists of two main layers, namely the epidermis and dermis. The dermis layer is a relatively thick connective tissue that contains some collagen fibers.

Based on the chemical compounds contained in fish skin, the fish skin can be processed into food products, food additives, or functional food. This article aims to inform the use of fish skin as a raw material for food products, food additives, and functional foods on a commercial scale and on a research scale conducted in Indonesia.

Fish skin is processed into crackers

Fish skin from almost all fish types can be used to make fish skin crackers. Generally, fish skins for crackers in Indonesia are mackerel, snapper, stingray, catfish, catfish milkfish, tuna, tilapia, and valid. These types of fish are often processed into fillet and mashed meat products.

According to Kristiningrum et al. (2006), the requirements for fish skin to be able to make crackers are a) fresh, b) tough/not easily torn, c) having a minimum thickness of 0.5 mm (after cleaning) and d) intense, not easily destroyed. Fresh and large fish (at least 250 g per head) generally have a skin that meets the requirements for making crackers.

Fish skin crackers in Indonesia are used as a snack. This product is widely traded in tourist attractions. Centers for skin cracker products in Indonesia are often found in Indramayu, Pangandaran, Sukabumi, Palembang, and other areas. Fish skin crackers have a distinctive, delicious, and savory taste and contain a relatively high nutritional value.

According to Noviani and Wahyuni (2019), the business field of processing fish skin into crackers also has good prospects, considering that the raw materials needed are very cheap and the tools used are straightforward. The fish crackers produced have a relatively high economic value and a wide market among middle- and high-income people.

The tools used in making fish skin crackers include scales, scissors, pans, plastic, basins, and others. Additional ingredients include garlic, salt, lime, quicklime, vinegar, turmeric, and aquades. The procedure for making fish skin crackers (Safitri et al., 2019) consists of two stages, namely, material preparation and processing.

The stages of material preparation are carried out as follows: a) Betel lime or limestone or quicklime used as a fish skin hardener is dissolved in water for seven days to become a soft lime slurry. b) The fish's skin is cleaned of other adhering parts such as scales, fins, or fish flesh. Then the fish skin is washed with water. After that, the fish skin is drained. c). The clean fish skin is hardened with a lime solution for 1-2 hours so that the fish crackers will have a stiff, crispy texture and are not quickly mushy. For 10 liters of immersion water, ten spoons of whiting water are needed. The ratio between fish skin and the lime solution is 1: 4 (weight/volume). d) After the soaking process in the lime solution, the fish skin is washed with water until the lime sticking to the fish skin is completely gone and drained. e) The next step is to re-soak the fish skin in a solution of acetic acid (vinegar) for 3 hours. Then the skin is rinsed three times until the sour smell is gone and drained. f) After that, the skin of the fish is dried. Dried fish skin is ready to be processed.

The processing steps are carried out as follows: a) The dried fish skin is cut with scissors to uniform its shape and size, as well as to separate other parts of the fish that may still be included, such as the fins and tail. b) Soaked in the seasoning solution for 5-10 minutes, then removed and drained. c) Fish skin that has been seasoned is dried in the sun until completely dry. At the time of drying should be back and forth so that it dries entirely evenly. After drying, it can be directly fried or stored in a plastic bag.

The added value of fish skin obtained when processed into crackers is very high, above 40%. Added value is the addition of commodity value caused by the functional input factor of the

commodity (Hayami et al., 1987). Labor benefits and processing profits are obtained from the added value (Suhardi & Subari, 2020). According to Wulandari and Rum (2021), the added value ratio of milkfish skin processed into skin crackers is 63.5%. Supriadi et al (2021) also informed that the added value ratio of processing fish skin crackers was 45.85%.

Extraction of Collagen from Fish Skin for Functional Food

Collagen is a protein widely found in animals' skin and bone tissue, including fish. The amino acids that make up collagen are alanine, arginine, lysine, glycine, proline, and hydroxyproline (Nurjanah et al., 2021). The characteristics of collagen include easy absorption in the body, non-toxic, high water affinity, biocompatible, biodegradable, relatively stable, easy to form, and can be dissolved so that its use in the industrial sector is growing rapidly.

The use of collagen is generally an additional ingredient in the manufacture of cosmetic products such as hair, face, and body treatments (Peranginangin et al. 2005). Collagen can also be used as a functional food ingredient. According to Abbas (2020), available food is processed with one or more functional components that, based on scientific studies, have specific physiological functions and are proven harmless and beneficial to health.

According to Destina and Sari (2018), collagen is essential in angiogenesis, tissue bending, tissue morphogenesis, tissue repair, cell proliferation, cell adhesion, and cell migration. Diseases related to the breakdown of collagen tissue can be prevented and overcome by fulfilling the nutrients needed for collagen synthesis or consuming foods high in collagen. A number of studies show that people with diabetes are often followed by a very rapid breakdown of collagen tissue. Damage to collagen tissue in diabetics can be repaired by providing collagen intake because of the high content of the amino acid glycine in collagen protein.

Collagen intake into the body can be through drinks in which collagen powder is added. Another way is to make a supplement capsule, put collagen powder into the capsule, and the capsule is swallowed by mouth into the body. Collagen beverage products have been widely produced and marketed in Indonesia. On a research scale, collagen has been added to guava juice, as Wijaya et al. (2021) reported. His research showed that the collagen concentration added to guava juice affected the response to taste, aroma, viscosity, and protein content. However, the collagen concentration added to guava juice did not affect the drink's color.

Extraction of collagen from fish skin can be done as follows (Putra et al., 2013): After washing the fish skin, it is cut into pieces with a size of 1cm x 1cm. Then soaked in 0.1 M NaOH

solution for 24 hours with a ratio of skin weight and volume of solution 1:20, this immersion aims to remove non-collagen proteins. In the next stage, the fish skin is washed with distilled water until the pH of the washing water is close to 7 (neutral). Afterward, the collagen extraction process was carried out using CH3 COOH with a concentration of 0.75 M (w/v 1:10) for 16 hours. The extraction result was filtered with a cloth to separate the residue and extract (supernatant). The supernatant was precipitated by adding NaCl until the final concentration of the solution reached 0.9 mol dm3 to obtain a collagen precipitate (salting-out). The residue was left for 24 hours in cold conditions, then centrifuged at a speed of 3500 rpm and a temperature of 4o C for 20 minutes. The centrifuge results were dialyzed by dissolving collagen in 0.5 M (w/v: 1:10) acetic acid solution, then inserted into the cellophane membrane. The collagen-containing membrane was immersed in 0.1 M acetic acid solution (repeated three times with fresh acetic acid solution). After two replacements of the acetic acid solution, the membrane containing collagen was immersed in distilled water which was changed every 3 hours until the pH of the water was five or more. Postdialysis collagen, lyophilized (freeze drying) for 12 hours in separate, easy-to-dry containers.

The amount of collagen produced from fish skin extraction varies, depending on the type of fish. Jamilah et al. (2013) reported that snapper skin extracted with acetic acid yielded 8.1% (wk). The yield of yellow tail fish skin collagen is 4% (wk) (Paudi et al. 2020). Putra et al. (2013) reported that the skin of black tilapia (*Oreochromis niloticus*) extracted using acetic acid had a yield of 5.96% (wk).

Extraction of Gelatin from Fish Skin for Food Additives

Gelatin is a protein obtained from the denaturation process of collagen found in fish skin, bones, and scales (Febryana et al., 2018). Gelatin is light, brittle, slightly yellowish to clear, and odorless. The essential amino acids that makeup gelatin are leucine, cysteine, methionine, phinylalanine, Sirin, valine, threonine, isolysin, and tyrosine. According to Agustin (2013), gelatin is used as a food additive as a foam-former, stabilizer, gelling agent, and thickener. Food industries that require gelatin include the jelly product industry, the dairy industry, ice cream, chocolate, and food supplements.

The gelatin in the manufacture of ice cream is used as a stabilizer. Stabilizer in making ice cream plays a role in trapping air to prevent the formation of large ice crystals so that the ice cream becomes softer. According to Hidayah et al. (2017), the advantages of gelatin from other stabilizers

are that it is more easily dispersed in mixing, does not cause liquid separation in the mixture or foaming, can prevent the formation of ice crystals, melts in the mouth and is a good stabilizer.

According to (Moranda et al., 2018), there are two ways of making gelatin: using an acid and a base. The difference lies in the immersion stage. The selection of stages of the acid, alkaline process, or other extraction methods will affect the gelatin results to be obtained, and this also applies to the choice of treatments at the time of extraction, such as the selection of the extraction time/duration of the hydrolysis process, the use of pH, the concentration level and type of solvent as well as the temperature at the time of extraction. It will affect the hydrolysis reaction that occurs.

Extraction of gelatin from fish skin generally uses the acid method, according to Samosir et al. (2018), stating that acid can convert triple helical collagen fibers into single chains so that the amount of collagen hydrolyzed by acid solution is more than in alkaline solution.

The procedure for extracting gelatin from fish skin is as follows (Febryana et al. 2018): The fish skin is cleaned of still attached dirt, then immersed in a solution of acetic acid (CH3COOH) with a concentration of 0.5%. For 24 hours. After that, the soft fish skin was washed with water until the pH was neutral (6-7). Furthermore, the fish skin was extracted using aquadest with a ratio of 1: 2 (w/w). In a water bath, the extraction was carried out at 600C for 3 hours. Then filtered using a filter cloth to separate the filtrate from the residue. The gelatin filtrate obtained from the extraction was poured into a tray and dried in an oven at 600C to form gelatin sheets. The gelatin sheets were cut into small pieces, then mashed with a blender to form gelatin powder.

The yield of gelatin extracted from fish skin depends on the type of fish. Febryana et al. (2018) reported that gelatin yield from the extraction of belida fish skin with the acetic acid method was obtained at 3.296%. The yield of gelatin from catfish skin extraction is 9.63% (Paranginangin et al., 2004). Moranda et al. (2018) also reported that the yield of yellowfin tuna (Thunnus albacares) skin gelatin extracted using the acid method was 7.93%.

Conclusion

Fish skin and fish processing industry waste can be processed into food products, additives and functional food. Commercial food products made from fish skin are fish crackers. The food additive made from fish skin is gelatin. Functional food made from fish skin is collagen. In Indonesia, gelatin and collagen made from fish skin are still on a research scale, not yet on a commercial scale.

REFERENCES

Abbas. 2020. Potensi Pangan Fungsional dan Perananna dalam Meningkatkan Kesehatan Manusia yang Semakin Rentan-Mini Riview. Jurnal Teknosains, Vol. 14, No.2 : 176–186.

Agustin AG. 2013. Gelatin Ikan : Sumber, Komposisi Kimia dan Potensi Pemanfaatannya. Jurnal Media Teknologi Hasil Perikanan, Vol 1, No. 2 : 44-46.

Destiana A.L and Sari S.H. 2018. Collagen Extraction of Manyung and Snapper Fish as Collagen Alternatives. Bio-site, Vol. 04 No. 2 : 48 – 52.

Febryana W, Idiawati N and Wibowo M.A. 2018. Ekstraksi Gelatin dari Kulit Ikan Belida (*Chitala lopis*) Pada Proses Perlakuan Asam Asetat. 2018. Jurnal Kimia Khatulistiwa, Vol. 7 No. 4: 93-102 .

Hayami, Kawage, & Marooka. (1987). Agricultural Marketing and Processing In Upland Java. A Perspective From A Sunda Village. Bogor: CGPRT.

Hidayah UN, Affandi DR and Sari AM. 2017. Microstructure, Physical and Sensory Characteristic of Ice Cream With Dumbo Catfish Bone Gelatin (Clarias gariepinus sp) As Stabilizer. Jurnal Teknologi Hasil Pertanian, Vol. X, No. 2 : 89-98.

Jamilah B, Hartina MRU, Hashim M, Sazili AQ. 2013. Properties of collagen from barramundi (Lates calcarifer) skin. International Food Research Journal. Vol 20, No.2: 835-842.

Kristianingrum S, Arianingrum R and Sulastri S. 2006. Pemanfaatan Limbah Kulit Ikan Menjadi Kerupuk. Inotek, Vol.10, No. l : 13-24.

Moranda DP, Handayani L and Nazlia S. 2018. The utilization of yellow fin tuna *(Thunnus albacares*) skin as gelatin: hydrolyzed with different of HCl concentrations. Aquatic Sciences Journal, Vol. 5, No.2 : 81-87.

Noviani, N., and Wahyuni, S. 2019. Utilization of tilapia skin as processed crackers in Pematang Johar Village Labuhan Deli District Deli Serdang Regency). *Prosiding Seminar Nasional Hasil Pengabdian*, Vol.*2, No.* 1 : 522–525.

Nurilmala, M., Nasirullah, M. T., Nurhayati, T., and Darmawan, N. (2021). Karakteristik Fisik-Kimia Gelatin dari Kulit Ikan Patin, Ikan Nila, dan Ikan Tuna. Jurnal Perikanan Universitas Gadjah Mada, Vol. 23, No. 1: 71-82.

Nurjanah, Baharuddin T.I and Nurhayati T. 2021. Ekstraksi Kolagen Kulit Ikan Tuna Sirip Kuning (*Thunnus albacares*) Mengunakan Enzim Pepsin dan Papain. JPHPI, Vol.24, No. 2: 174 -187.

Paudi R, Sulistijowati R and Mile L. 2020. Rendemen Kolagen Kulit Ikan Bandeng (Chanos chanos) Segar Hasil Ekstraksi Asam Asetat. Jambura Fish Processing Journal, Vol. 2 No.1 : 21-27.

Peranginangin, R., Ma'ruf, W.F., Tazwir, Hak, N., Suryanti, Ayudiarti, D.L., Maraskuranto, E., dan Haryanto. 2005. *Riset optimasi pemanfaatan limbah perikanan tulang dan kulit ikan*. Laporan Teknis Penelitian Pengolahan Produk. Balai Besar Riset Pengolahan Produk dan Bioteknologi Kelautan dan Perikanan. Jakarta.

Putra ABN., Sahubawa L and Ekantari N. 2013. Extraction and Characterization of Collagen from Black Tylapia Skin (Oreochromis niloticus). JPB Perikanan Vol. 8 No. 2 : 171–180.

Safitri D.N., Sumardianto and Fahmi A.S. 2019. Effects of Immersion in Different Lime Water Concentration on Characteristics of Tilapia Skin Crackers. Jurnal Ilmu dan Teknologi Perikanan Vol 1, No 1 : 34-45.

Samosir AS.K, Idiawati N and Destiarti L. 2018. Ekstraksi Gelatin dari Kulit Ikan Toman (*Channa micropelthes*) Dengan Variasi Konsentrasi Dari Asam Asetat. Jurnal Kimia Khatulistiwa, Vol. 7, No. 3 :104-108.

Suhardi, & Subari, S. 2020. Analisis Usaha dan Nilai Tambah Kopi Cabe Jamu di Kabupaten Sumenep (Studi Kasus CV. Alifa Jaya, Kecamatan Bluto). Agiscience, Vol. 1 No.3 : 200–218.

Supriadi D, Nugraha E.H., Widayaka R and Rena. 2021. Analisis Nilai Tambah Usaha Pemasaran dan Pengolahan Hasil Perikanan di Kota Cirebon. Jurnal Investasi, Vol. 1 No.1 : 1-12.

Syahrul and Dewita. 2016. Upaya Minimalisasi Dampak Pencemaran Lingkungan dari Limbah Padat Pengolahan Fillet Ikan Patin di Desa Koto Mesjid Kabupaten Kampar. Prosiding Seminar Nasional "Pelestarian Lingkungan & Mitigasi Bencana" Pekanbaru, :. 17 -25.

Wijaya W.P., Gazali T and Septiadji M.R. 2021. Penambahan Kolagen Sisik dan Tulang Ikan Gurame (Osphronemusgoramy) Pada Minuman Jus Jambu Biji. Pasundan Food Technology Journal, Vol.8 No.1 : 1-8.

Wulandari I.T. and Rum.M. 2021. Analisis Nilai Tambah dan Risiko Pendapatan Usaha Kerupuk Ikan Bandeng (Studi Kasus: UMKM Sumber Jokotole, Kecamatan Socah, Kabupaten Bangkalan) Agriscience, Vol.2 No.2: 58-65.