



GSJ: Volume 10, Issue 10, October 2022, Online: ISSN 2320-9186

www.globalscientificjournal.com

ARTICLE REVIEW: UTILIZATION OF FISH HEADS INTO NON-FOOD PRODUCTS

Junianto¹, Hafsoh Nur Muthmainnah², Andini Elpania Diyobel Purba², Balqis Aliya Zain²,
Achmad Syauqibik², Siti Rizka Anggraeni² and Mayang Cariesta Lavintanza²

¹Lecturer at Fisheries Science Department Padjadjaran University, Indonesia

²Bachelor Student at Fisheries Science Department Padjadjaran University, Indonesia

ABSTRACT

Fish head is a waste generated from various activities of the fish processing industry . Utilization of fish heads into certain products, it is important to do. This article aims to review research conducted in Indonesia on the use of fish heads into non-food products. The use of fish heads into non-food products from various studies that have been carried out in Indonesia is the processing of fish heads into flour for feed ingredients, the use of fish heads for organic gair fertilizer, the extraction of oil from fish heads for biocells and soap, the use of fish heads into peptones, e gelatin extraction from fish heads for masks (cosmetics). The utilization of fish heads into non-food products is aimed at increasing the added value of fish heads and reducing the negative impact of fish processing waste.

Keywords: *biodesel, gelatin, liquid organic fertilizer, mask, oil.*

INTRODUCTION

Fish head is a waste generated from various activities of the fish processing industry such as the fillet industry, lumat meat and fish canning. This fish processing industry is widely available and operates in Indonesia both on a household, small and medium-sized industrial scale. In general, the waste generated from fish processing industry activities has not been optimally utilized.

Utilization of fish heads into certain products, it is important to do. The advantages obtained from the processing of fish heads into a product are to increase the added value of fish heads, reduce the negative impact on the environment and support the blue economy. According to Athirafitri *et al.* (2021), the negative impact of processing industry waste is that it has the potential to cause the effects of greenhouse gases (GHG), acidification, and eutrophication. Greenhouse gases (GHGs) produce emissions in the form of Hybrid Fiber Coaxial

(HFC), carbon dioxide (CO₂), and methane (CH₄). Acidification produces emissions in the form of chlorine dioxide (SO₂), ammonia (NH₃), and NO_x as a result of combustion which can increase the content of acid released into the atmosphere. Meanwhile, eutrophication produces emissions in the form of phosphates (PO₄³⁻) and Nitrates (NO₃) derived from liquid waste produced from production processes (Sofiah *et al.* 2017).

The material on the fish head is meat that is between the bones of the fish skull, skull bones, skin, gills and fins and scales. Based on these materials, fish heads can be utilized and processed into non-food products. This article aims to review research conducted in Indonesia on the use of fish heads into non-food products.

Processing Fish Heads into Flour for Feed Ingredients

Artificial feed in aquaculture activities, especially enlargement, has an important role in business success. Artificial feed given to fish farming affects fish growth (Ali *et al.* 2015). Good quality feed will promote the growth of fish.

One of the factors that need to be considered in the manufacture of artificial feed is the source of protein. Protein sources obtained from materials that are high or expensive cause the price of feed to be high or expensive as well. Therefore, it is necessary to obtain protein source materials in the manufacture of cheap and high-quality feed. The source material for protein in the manufacture of such relatively cheap feed is fish heads.

According to Ali *et al.* (2015) and Manullang *et al.* (2018), fish heads can be used as a source of protein in artificial feed. The reason is that the protein content in fish heads is relatively high. Fish heads in order to be used as an ingredient in the manufacture of feed must be processed into the form of flour. According to Manullang *et al.* (2018), how to bend fish heads can be done as follows: Fish heads are washed thoroughly and then boiled for 10-15 minutes. The following stage is to be dried in the oven for 2 – 3 hours at a temperature of 60 – 70° C. Next, grind using a sheathing machine into flour, then filtered and packed with plastic until it is ready for use.

Various researches on the use of fish head flour as a feed ingredient have been widely carried out in Indonesia. Utomo *et al.* (2013) have informed the use of cob fish head flour for feed ingredients. The feed it produces is given to sangkuriang catfish for 44 days. The result is the survival and daily growth rate of sangkuriang catfish and feed conversion as follows: 98.89±1.92%; 4.30±0.25%/day and 2.79±0.38%, respectively. The results of other research were also informed by Ali *et al.* (2015), the use of anchovy head flour as an artificial feed ingredient used for the maintenance of GIFT tilapia tilapia fry with an average weight of 2 gr per head for 50 days. The result was obtained the growth of tilapia fry with an average absolute weight of 16.25 grams per head at the end of maintenance, Protein Retention of 67.8%, Feed Conversion Ratio of 1.01 and Survival Rate of 100%.

Utilization of Fish Heads for Liquid Organic Fertilizer

Fertilizer is a material that is indispensable for various types of plants, especially for the growth of stems, roots, leaves, flowers and fruits. Fish heads can be used as raw materials for making liquid organic fertilizers. According to Haspari and Welasih (2013), liquid fertilizer obtained from the utilization of fish heads has a nitrogen content of 5–9%, phosphorus 2–4%, potassium 2–7% and other microelements (Haspari and Welasih 2013).

N (Nitrogen) nutrients are needed by plants for the preparation of proteins, chlorophyll and play a role in photosynthesis. Nitrogen deficiency causes the leaves to turn yellow and inhibit growth. Nutrient P (Phosphate) is needed by plants to stimulate the growth of roots and young plants, accelerate flowering, ripening of fruits, seeds and the preparation of fats and proteins. Nutrient K (Potassium) is needed by plants to accelerate the process of carbohydrate assimilation, root and stem growth, lack of potassium nutrients results in spots on leaves or wrinkled leaves and eventually the leaves will dry out (Haspari and Welasih 2013).

According to Hadisuwito (2012) and Astuti *et al.* (2021) the process of making liquid organic fertilizer from fish heads can be done as follows: The fish head is blended and then put into a drum. Next to the drum is added water proportional to the weight of the fish head porridge. The next stage is added decomposing microbes such as yeast, *lactobacillus* sp or EM4 (Effective Microorganism 4). After that to the drum is added rice washing water and brown sugar. Next, the mixture contained in the drum is stirred until homogeneous. Then the drum is tightly closed and stored for 3 weeks and once every week it is stirred by opening the lid of the drum first. The final stage is to separate the liquid from the solids, the ciaran obtained is packaged in bottles or other packaging to be ready for use.

Extraction of Oil from Fish Heads for Biocells and Soaps

Fish oil can be extracted from the fish head because there is meat on the head of the fish. The fat content in fish meat varies between 5 to 15%, depending on the type of fish. Fish heads that can be extracted for oil are derived from mackerel, tuna, cobs, snapper, catfish, catfish, catfish, gold and tilapia.

According to Putri *et al.* (2020), oil extraction from fish heads can be done by dry or wet rendering methods. The wet rendering method is more widely used because the quality and quantity of the oil produced is better than the dry rendering method.

The extraction of oil from fish heads using the wet rendering method by steaming (Karmini *et al.* 2016) is as follows: The fish head is cleaned, cut with a size of 0.5x0.5x1 cm. After that it is steamed in a saucepan for 1 hour. The steamed fish head is then pressed. The liquid obtained was then centrifuged at a speed of 10,000 rpm for 10 minutes.

The fish oil obtained can be further processed into biodiesel or can be used for soap making materials. According to Widiyanto and Utomo (2010), several studies related to the manufacture of biodiesel from fish oil have been carried out, including the manufacture of biodiesel from salmon oil which produces an amendment of up to 99%, and the manufacture of biodiesel from lemuru fish oil through an esterification reaction and continued transesterification. The biodiesel produced has quality according to the required SNI 04-7128-2006 biodiesel standard. The data on the quality of the lemuru oil biodiesel is presented in Table 1.

According to Wahyudi *et al.* (2016) the technique of making biodiesel from fish oil is as follows: Fish oil is put into the dryer and then the heater and temperature control are passed and followed by turning on the circulation pump and vacuum pump. Fish oil that has been reduced in moisture content is entered into the degumming reactor. The heater and stirrer are turned on. After the temperature reaches 90° C the time begins to be calculated and the process is stopped after 20 minutes. The result of the gumming process is continued with the esterification process. The esterification process lasts for 60 minutes with a temperature of 70° C, with a sulfuric acid catalyst. The results of the esterification process are continued with the trans-esterification process using a KOH catalyst at a temperature of 60° C for 60 minutes. The biodiesel obtained is then purified in a vacuum dryer.

Table 1. Quality of Lemuru Fish Oil Biodiesel Compared to SNI Standard 04-7128-2006

Test Parameter	Result	Standard	Unit
Density at 40° C	0,8735	0,850 – 0,900	g/mL
Water and sediment	< 0,05	Maks. 0,05	% v
Saponification	182,16	-	Mg KOH/g
Total acid	0,188	Maks. 0,8	Mg KOH/g
Glycerol-free	0,0051	Maks. 0,02	% w
Total glycerol	0,138	Maks. 0,24	% w
Ester	98,51	Min. 95	% w
Flash point	166	Min. 100	°C

Source : Utomo *et al.* (2009) in Widiyanto & Utomo (2010).

Biodiesel can be applied as a substitute for environmentally friendly fuels. This fuel can be used directly in diesel engines with less pollution than other fuels.

According to Ibrahim et al (2005), fish oil can be used for soap making. If fat is mixed with alkaline compounds, a saponification reaction will occur and produce soap bubbles (Maghami *et al.* 2015)

How to make soap products from fish oil is carried out with the following stages (Aprianti *et al.* 2019): Fish oil is mixed with a solution of Potassium hydroxide (KOH) with a mixture ratio of 1: 3. The mixture is

then heated for 15 minutes at a temperature of 70° C and stirred evenly continuously. The soap that is formed is then separated and shaped according to the cooled one.

Utilization of Fish Heads into Peptons

Pepton is a material used as a source of nitrogen in microbial growth media (Saputra and Nurhayati 2013). Pepton is extracted by hydrolysis of proteins from foodstuffs. The need for pepton in Indonesia averages 5 million kg per year, with a value of USD 20 million. Pepton is used in laboratories and biotechnology industries, such as food, pharmaceuticals, and medicines. The need for peptones is met through imports at very expensive prices and tends to increase every year (Atma *et al.* 2018).

The protein contained in fish heads varies in quantity depending on the type of fish. The protein contained in the fish head can be hydrolyzed into peptones.

According to Shirahigue *et al.* (2018), the manufacture of peptones from the head of fish is carried out as follows: Kepala fish is mashed and then put into beaker glass. After that, 10% of aqueous is added followed by the addition of 5% propionic acid until a pH value of 4 is obtained. Next stirred until homogeneous. The next treatment is incubation at a temperature of 40° C using waterbath for 120 hours. After the incubation period is over, it is then censored at a speed of 5000 rpm for 20 minutes. The centrifuge results obtained 3 sample phases, namely solid phase, aqueous phase and oil phase. The sample taken is aqueous phase, then dried with a spray dry to obtain peptone powder.

The results of research by Pratomo *et al.* (2020) showed that peptones obtained from the head of kurisi fish (*Nemipterus* sp.) have a total protein value of 8.12%, a total N value of 1.3% and dissolved protein of 3.68 g / L. To produce 1 kg of peptones, 70 kg of kurisi fish head waste is needed hydrolyzed using propionic acid.

Extracting Gelatin from Fish Heads for Masks (Cosmetics)

Gelatin is a polypeptide obtained naturally from the process of heat denaturation and collagen hydrolysis of skin, bone and fish tissue (Bhernama *et al.* 2020). Collagen is a protein found in the skin, bones and scales of fish. According to Jaya *et al.* (2022), gelatin is a water-soluble polymer, able to form colloids and thicken the solution so that it can be used as a gelling and stabilizer.

The head of the fish consists mainly of muscle tissue (meat), bones, gills, skin and eyes. The bones or tengkorak of the fish's head can be extracted for gelatin. The use of fish heads as raw materials for making gelatin can effectively increase the selling value of waste and can reduce the impact of environmental pollution due to the disposal of fish processing waste.

Extraction of gelatin from fish heads can be done as follows (Mardiyah 2017): Fish heads are degreased using hot water at a temperature of 80° C for 20 minutes. The degreased fish head is separated by the meat part, so that all components of the fish head except the meat can be extruded. It was then soaked into a 3% HCl for

48 hours at a ratio of 1:3 (w/v). Then filtering is carried out using a filter cloth, and the residue (ossein) obtained is washed to a neutral pH. Furthermore, ossein is weighed and added 1:3 (w/v) aqueducts for the gelatin extraction process. Gelatin extraction was performed on a waterbath with a temperature of 75 °C for 5 hours. Then filtering is carried out, the obtained filtrate is dried in a cabinet dryer at a temperature of 40 °C for 48 hours. Furthermore, the obtained gelatin is starched and packaged until it is ready for use.

Various studies on the extraction of gelatin from fish heads have been widely carried out. Mardiyah (2017) has distracted the gelatin of the head of the kurisi fish through an acidic process. The results of his research obtained gelatin amendments from kurisi fish heads by 4.92%, water content of 8.23%, ash content of 0.85%, protein content of 88.54%, fat content of 0.13%, gel strength of 311.01 g.bloom, viscosity of 5 cP, pH of 5.43, gel temperature of 10.12 °C and melting temperature of 20.37 °C. Arnesen and Gildberg (2006) reported that cod liver heads have the potential to be used as raw materials for making gelatin because they have a fairly high amount of amendments of 12%. Khairi *et al.* (2011) informed that the gelatin yield produced from catfish and mackerel heads was 8.4% and 3.7%, respectively.

The application of gelatin in the non-food industry is very wide, one of which is being a cosmetic ingredient such as masks. Gelatin has the physical properties of being transparent, tasteless and solid in shape so it is very suitable for use as a basic material in making masks (Suryati *et al.* 2017).

Masks are beauty products that function to keep facial skin healthy and moisturized. Face masks circulating in the market are available in various types, namely powder masks, cream masks, gel masks (peel off), paper masks, homemade masks (Mardhiyani and Islami 2022). Gel mask (peel off) is a type of mask that is currently widely used because it is in accordance with the times, which is not "complicated" to use (Jaya *et al.* 2022).

Peel off face mask is a type of mask that consists of an elastic material so that it is easy to use and the process of removing it. This peel off mask is applied to the face by applying it so that it forms a thin layer, namely a transparent film layer. The mask can be peeled off after 15-30 minutes of use. The use of natural ingredients in the manufacture of peel off masks can have a positive effect on facial skin compared to the use of synthetic materials that allow causing side effects on facial skin (Sulastri & Chaerunisaa 2018).

The formulation of the peel off face mask is as follows: Fish gelatin 2 grams, corn starch 1.5 grams, polyvinyl alcohol (PVA) 2 grams, propillin glycol 2 grams, niapagin 0.04 grams, ethanol 96% 2.5 grams and aquadest 20 grams. The ingredients are mixed until a homogeneous mixture is obtained.

CONCLUSION

The use of fish heads into non-food products from various studies that have been carried out in Indonesia is the processing of fish heads into flour for feed ingredients, the use of fish heads for organic water, the extraction of oil from fish heads for biodiesel and soap, the use of fish heads into peptones, e gelatin extraction from fish heads for masks (cosmetics). The utilization of fish heads into non-food products is aimed at increasing the added value of fish heads and reducing the negative impact of fish processing waste.

References

- [1] Ali, M., Santoso, L. & Fransiska, D. 2015, The Substitution of Fish Meal by Using Ancovies Head Waste to Increase The Growth of Tilapia (*Oreochromis* sp). *Maspari Journal*, 7(1): 63 – 70.
- [2] Aprianti, N., Nurhayati, S., & Moeksin, R. 2019. Liquid Soap Production from Catfish (*Pangasius Hypophthalmus*) Fat Waste. *Indonesian Journal of Fundamental and Applied Chemistry*, 4(2): 77 – 81.
- [3] Arnesen, Arne, J., and Gildberg, A. 2006. Extraction of Muscle Proteins and Gelatine from Cod Head. *Process Biochemistry*, 41(3) : 697 – 700.
- [4] Astuti, Y., Setyaningsih, Lestari, S. &Anugrah, D. 2015. Pelatihan Pembuatan Pupuk Cair Organik (POC) Sebagai Alternatif Penggati AB Mix pada Perangkat Hidrolponik di SMA Kebangsaan Pondok Aren. *Jurnal ABDI*, 7(1): 6 – 11.
- [5] Athirafitri, N., Indrasti, N. S., & Ismayana. 2021. Impact Analysis of Fishery Processing Using Cycle Assesment (LCA) Method: A Literature Review. *Jurnal Teknologi Industri Pertanian*, 31(3): 274 – 282.
- [6] Atma, Y., Taufik, M. dan Seftiono, H., 2018. Identifikasi Resiko Titik Kritis Kehalalan Produk Pangan: Studi Produk Bioteknologi. *Jurnal Teknologi*, 10(1): 59 – 66.
- [7] Hadisuwito. 2012. *Membuat Pupuk Organik Cair*. Jakarta: Agromedia Pustaka.
- [8] Hapsari, N., & Welasih, T. 2013. Pemanfaatan Limbah Ikan Menjadi Pupuk Organik. *Envirotek: Jurnal Ilmiah Teknik Lingkungan*, 2(1): 1 – 6.
- [9] Ibrahim, B., Suptijah, P., & Hermanto, S. 2005. Penggunaan Bentonit dalam Pembuatan Sabun dari Limbah Netralisasi Minyak Ikan Lemuru (*Sardinella* sp). *Buletin Teknologi Hasil Perikanan*, 8(2): 1 – 14.
- [10] Kamini, Suptijah, P., Santoso, J., & Suseno. S. H. 2016. Extraction by Dry Rendering Methode and Characterization Fish Oil of Catfish Viscera Fat by Product of Smoked Fish Processing. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 19(3): 196 – 205.
- [11] Khiari, Z., Martin-Diana, A. B., Rico, D., & Ryan, C. B. 2011. The Extraction of Gelatine from Mackerel (*Scomber scombrus*) Heads With The Use of Different Organic Acids. *Journal of Fisheries Science*, 5(1), 52–63.

- [12] Maghami, M., Sadrameli, S. M., & Ghobadian, B. 2015. Production of Biodiesel from Fishmeal Plant Waste using Ultrasonic and Conventional Methods. *Appl. Therm. Eng.* Vol. 75: 575-579.
- [13] Manullang, Y., Santoso, L. & Tarsim. 2018. The Effect of Substitution of Fish Meal with Patin Fish Head Meal (*Pangasius sp*) on the Growth of Catfish (*Clarias sp*). *Jurnal Akuakultur Rawa Indonesia*, 6(2): 129 – 140.
- [14] Mardiyah, U. 2017. Extractions of Pink Perch (*Nemipterus bathybius*) Head's Gelatin with Acid Treatment. *Samakia: Jurnal Ilmu Perikanan*, 8(2): 23 – 27.
- [15] Mardhiyani, D., & Islami, M. 2022. Formulation Gel Peel-Off Mask Bidara Leaf Extract (*Ziziphus SpinaChristi L.*) and Chia Seed (*Salvia Hispanica*) as Antioxidants. *Jurnal Farmasi Tinctura*, 3(2): 42 – 55.
- [16] Pratomo, M. D. *et al.* 2020. Karakteristik Pepton dari Limbah Ikan Kurisi (*Nemipterus sp.*) sebagai Media Pertumbuhan Bakteri yang Terjamin Halal. *Journal of Aquaculture and Fish Health*, 9(2): 23 – 30.
- [17] Putri, D. N., Maulidhia, Y., Wibowo, N., Santoso, E. N., & Romadhan, P. 2020. Sifat Fisikokimia dan Profil Asam Lemak Minyak Ikan dari Kepala Kakap Merah (*Lutjanus malabaricus*). *AgriTECH*, 40(1): 31-38.
- [18] Saputra, D. & Nurhayati, T. 2013. Produksi dan Aplikasi Pepton Ikan Selar untuk Media Pertumbuhan Bakteri. *Jurnal Pengolahan Hasil Perikanan Indonesia*, 16(3): 215 – 223.
- [19] Shirahigue, L. D., Ribeiro, I. S., Sucasas, L. F. D. A., Anbe, L., Vaz-Pires, P. & Oetterer, M. 2018. Peptones in Silage from Tilapia (*Oreochromis niloticus*) and Cobia (*Rachycentron canadum*) Waste as a Culture Medium for Bioprocesses. *Journal of Aquatic Food Product Technology*, 27(6): 712 – 721.
- [20] Sofiah, I., Yani, M., & Ismayana, A. 2017. Dampak Pemanasan Global Pengolahan Hasil Perikanan Menggunakan Metode *Life Cycle Assessment* (LCA): Analisis *Gate-to-Gate*. *Jurnal Teknologi Industri Pertanian*, 28(1): 1 – 11.
- [21] Sulastri, A., & Chaerunisaa, A. Y. 2018. Formulasi Masker Gel *Peel Off* untuk Perawatan Kulit Wajah. *Farmaka*, 14(3): 17 – 26.
- [22] Suryati, S., ZA, N., Meriatna, M., & Suryani, S. 2017. Pembuatan dan Karakterisasi Gelatin dari Ceker Ayam dengan Proses Hidrolisis. *Jurnal Teknologi Kimia Unimal*, 4(2): 66 – 75.
- [23] Susan, & Setiawati M. 2013. Peran Tepung Ikan dari Berbagai Bahan Baku terhadap Pertumbuhan Lele Sangkuriang *Clarias sp*. *Jurnal Akuakultur Indonesia*, 12(2): 158 – 168.

- [25] Wahyudi, B., Triana, N.W., & Mulyadi, E. 2016. Biodiesel dari Minyak Ikan. *Jurnal Teknik Kimia*, 11(1): 11 – 18.
- [26] Widiyanto, T. N., & Utomo, B. S. B. 2010. Pemanfaatan Minyak Ikan untuk Produksi Biodiesel. *Squalen*, 5(1): 15–22.

© GSJ