Innovation Technology on Catfish Fillet By-Product as Raw Materials for Food Industry

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Abstract. Kampar Regency is one of the national catfish cultivation development clusters, and there are many catfish processing industries, especially fish fillet processing. The processing of catfish fillets always left by-products in the form of small pieces of meat, skin, bones, and abdominal fat, which amounts to around 50% – 60%. The by-products are mostly disposed to the environment around the industry, causing pungent odor pollution, as the by-products contain protein, fat, minerals and crude enzymes which are suitable habitat for the growth of spoilage microbes. Therefore, it is very possible for these by-products to be processed further in order to obtain new products in the form of industrial raw materials that have economic added value. The objectives of this research are (1) Optimizing the utilization of by-products from fish fillet processing starch into raw materials for food industry that have economic value; and (2) understanding the characteristics of organoleptic quality and the proximate composition of the food industry raw materials produced. The research method used is an experimental method, namely experiments on processing by-products into raw materials for the food industry in the form of fish meal, fish oil and bone meal. The results showed that the number of by-products produced from processing the catfish fillets was around 60% with, consisted of head, tailbone and fins by 37%, small pieces of meat 5%, viscera 10% and abdominal fat 8%. Furthermore, that raw materials having organoleptic quality and proximate composition that meet the SNI standards.

1. Introduction

Based on data from the Riau Marine And Fisheries Ministry of National catfish production in 2018 was 391,151 tons, an increase of 22.25% from 319,966 tons in 2017[1]. In addition the village of Koto Masjid, District XIII of Koto Kampar, Kampar Regency, Riau Province is also known as the country of catfish, because most of its residents carry out the business of cultivating catfish in ponds. Therefore, Kampar district is one of the largest catfish producers in Riau province, so there are many catfish processing industries. Based on the results of interviews with catfish processing partners, the amount of by-products of the catfish processing industry ranges from 4.8 to 14.4 tons per month. The by-products of processing catfish, especially fish fillets in the form of heads, swallow meat, bones, entrails and skin, the amount is around 20% -50% of the weight of fresh whole catfish [2,3]. These by-products are still not been utilized and most of them are dumped into the river
environment and unused land. The by-product is the organic matter that cause odor pollution due to the formation of gaseous acid sulfide (H₂S), ammonia (NH₃), methane (CH₄), and CO₂, life, especially the general public's environmental health and others.

Actually, the by-product of catfish processing has economic value, because the waste material contains protein, fat, minerals and crude enzymes which if further processed have better benefits because they have added value. Therefore, the by-product is very possible to be processed in order to obtain new products in the form of raw materials for food industry which have economic value. The use of these by-products will directly reduce or minimize the occurrence of by-products [4]. With the activity of utilizing by-products, it is hoped that it will increase the added value of the product, thereby increasing income or income, business efficiency and environmental health [5].

Based on the problems mentioned above, a study is needed to utilize the by-products of catfish processing produced to be further processed into raw materials for the food industry. Therefore, in the current era of modern technology, what innovations can be done so that these by-products can be used as raw materials for the food industry and its derivatives [6]. Thus, this study aimed to optimize the utilization of by-products from processing catfish for raw materials for the food industry that have added value.

2. Methodology

2.1. Materials and Methods

The main raw materials used in this study are by-products of catfish processing in the form of solid materials such as bone, abdominal fat and small pieces of meat that is attached to the ribs obtained at fish processing centers in Kampar district, especially in the village of Koto Mesjid, as well as materials for product quality analysis, namely chemicals commonly used for quality analysis in the laboratory. This research was conducted using an experimental method, by conducting experiments on processing the raw materials (fish concentrate, fish oil, and bone meal).

Research activities include: (1) Handling by-products in the form of abdominal fats, small pieces of meat and bones; (2) Processing by-products into raw materials for the food industry; and (3) Determining organoleptic characteristics (taste, odor, texture, and color) and proximate composition (protein, fat, ash and water) in the resulting raw materials.

2.1.1. Handling the by-products. The by-products used are the by-products of the catfish processing (fillet and smoked catfish) in the fish processing center of Koto Mesjid village. The stages of the by-product handling process are washing, sorting or sorting and weighing. The results of weeding from this process are fish bones (head, tail and fins), abdominal fat, and leftover meat that is still attached to the bones and then swallowed. Then the by-product is stored in a cooler at 5°C until used.

2.1.2. By-product processing [6]. As explained above, the by-products of processing catfish are small pieces of meat, fish bones, and belly fat. The processing process of each of these by-products can be explained as follows.

2.1.3. Leftover Meat [7]. Leftover meat is meat obtained by grinding or scraping the remaining meat that are attached to the fish bones from the filleting process. The minced meat obtained was washed thoroughly with running water, then drained and immediately dried in a dryer for 2-3 days. After drying, the meat is ground and floured so that the raw material for fish meal is obtained.

2.1.4. Fishbone. Fish bones are obtained from the results of milling and scraping or cutting the meat that is still attached to the bone. According [8] the procedure for processing fish bone meal is as follows: (1) Fish bones were cleaned and cut into small pieces, then boiled for 60 minutes at 800°C and then was put into an autoclave at 1200°C for 30 minutes; (2) After cooling, they are washed clean with running water then drained to dry and then soaked in 1.5 N NaOH solution for 2 hours and
drained; and (3) Then dried in a drying apparatus until the water content is less than 10% and then floured with a 60 mesh filter, so that the raw material is obtained bone meal.

2.1.5. Abdominal fat. Abdominal fat is a by-product of processing smoked fish. Abdominal fat that has been collected, then put into a large cauldron to be roasted (cooking) until it becomes oil. The oil produced is crude, so it still needs to be refined or purified again. The stages of crude oil refining include: degumming, neutralization and bleaching.

2.2. Measurement Parameter of Quality Product
The product quality parameters analyzed include organoleptic testing and proximate composition.

2.3. Observation Analysis
The data obtained were processed qualitatively and quantitatively, especially data regarding the results of the organoleptic preference test and proximate composition. Furthermore, the data were homogenized and tabulated, then analyzed descriptively.

3. Results and discussion

3.1. Handling By-products
The catfish processing industry (smoking and fillet) in the process always leaves side products in the form of bone, abdominal fat, small pieces of meat and offal. Among the by-products that have the potential to be used as raw materials for the food industry are bones, belly fat, and meat of swallowing. Most of these by-products have not been utilized by the catfish processing industry players, so most of these by-products are disposed of into the environment around the industry. This has a negative impact on the environment, because it causes a pungent stench considering that the by-product contains organic matter as a medium for microbial growth [9].

Therefore, the handling of these by-products can be done by processing them into raw materials. Handling of by-products carried out is sorting and cleaning through washing. The results of the handling obtained details, namely: fish bones (head, tail bone and fins) 35%, abdominal (stomach) fat 7%, trimming leftover meat (meat left over from filleting meat) 6% and entrails or offal (11%). Thus the amount of by-product produced from fillet processing is 59%; while the handling for smoked fish obtained about 18% (abdominal (stomach) fat 7% and entrails or offal 11%).

3.2. By-product Processing
From the handling of by-products described previously, that by-products cat fish that can be further processed into raw materials for the food industry are bone, belly fat, and swallow meat. The processing of each side can be explained as follows.

3.3. Leftover Meat
The by-product of leftover meat can be made into fish meal, where this small pieces of meat meat comes from meat that is attached to the bones resulting from the pelleting. Small pieces of meat meat is removed some of the water and fat to obtain a dry product (fish meal) with a high protein content. Fish meal can be used as food [10]. Furthermore, the results of the analysis carried out on the catfish flour produced can be seen in Table 1 below.
Table 1. Proximate composition of catfish meal.

| Composition Proximate | Amount (%) |
|-----------------------|------------|
| Protein               | 57.68      |
| Fat                   | 9.84       |
| Ash                   | 21         |
| Fiber                 | 3.92       |
| Water                 | 7.56       |

Table 1 above shows that catfish flour contains quite high protein with low water and fat content. Thus the fish meal produced can be used as a food raw material.

3.4. Abdominal fat
The fat content of by-products ranges from 7-20% depending on the size of the fish. The results of the analysis carried out on the fat content of the catfish produced can be seen in Table 2 below.

Table 2. Chemical composition of fish oil from by-products catfish abdominal fat.

| Chemical composition     | Result | Units           |
|--------------------------|--------|-----------------|
| Acid Number              | 0.47   | mgKOH/g fat     |
| Peroxide number          | 7.35   | meq/kg          |
| Iodine number            | 4.86   | g/100g          |
| FFA                      | 0.85   | %w/w            |
| Saponification Number    | 180.4  | mgKOH/g fat     |

The number of peroxides and free fatty acids (FFA) (Table 2) produced catfish oil is still low, meaning that it still meets the permitted quality standards. Accordingly, the standard fish oil set by the [11] is for a peroxide value of 10-20 meq/kg and a free fatty acid content of below 7% [12]. Thus the fish oil produced is still good and meets SNI standards.

3.5. Catfish Bones
The by-product of fish bones is obtained from catfish fillets processing, because the milling process will leave the tailbone and fins. The use of fish bone is done to obtain raw material for bone meal [13] [14]. As with the by-products of offal, fish bones cannot be used for food products, but if further processed it can be used as a source of gelatin raw materials. This flouring process includes washing, boiling, pressing, drying and flouring. The results of the proximate analysis of bone meal can be seen in Table 3.

Table 3. Proximate composition of bone meal from by-product of catfish fillet Raw material.

| Raw Material | Water (%) | Ash (%) | Fat (%) | Protein (%) | Calcium (%) |
|--------------|-----------|---------|---------|-------------|-------------|
| Bone meal    | 6.43      | 66.80   | 2.16    | 12.08       | 12.53       |
4. Conclusion
Based on the results of the research that has been done, it can be concluded as follows: (1) Fish processing activities (fillet and smoking) especially catfish in the Postharvest processing Center in Koto Mesjid village, Kampar Regency produce solid by-products in the form of small pieces of meat, fish bones, offal and belly fat with a total of 20% - 60%; (2) Utilization of solid by-products from processing catfish using clean production methods can produce raw materials for the food industry such as fish meal, bone meal, and fish oil.

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