

Quality Assessment of Fish Protein Concentrate from catfish (Pangasius hypophthalmus) During Storage at Room Temperature

Dewita dan Syahrul

Department of Fisheries Processing Technology, Faculty of Fisheries and Marine Science, University of Riau

Abstract: Fish protein concentrate (FPC) from catfish (*Pangasius hypophthalmus*) is one of alternative ways to overcome malnutritional problems. Therefore, processing of FPC is well recognized as a protein source for supplying high protein of raw material food especially from fish. The aim of this research was to determine proper technology for processing of FPC from patin fish (*Pangasius hypophthalmus*) and to analyze its nutrition content (proximate and amino acid profile) as a substituted raw material for high protein products. This research also aims to study storing effect on peroxide and water content of patin fish (*Pangasius hypophthalmus*) protein concentrate under aluminum foil, capsule and glass bottle packaging. The research was conducted with the following stages: 1) In the first stage that is Fish Protein Concentrate Processing was processed by two methods (steam and without steam) in combination with packaging material consists of three types of aluminum foil, glass bottles, and the capsule. There were four observation time, namely 0, 15, 30 and 45 days. The research reveal that steam method was determined as the best method for processing FPC from patin fish (*Pangasius hypophthalmus*) which produced 12% of yield, 75.31% of protein content and 45 days long lasting in aluminum packaging

Keyword : catfish, protein content, steam and non steam method, processing fish protein concentrate

I. Introduction

In Indonesia, protein energy malnutrition is still a big problem. Therefore, government of Indonesia has continued to make different attempts to resolve the issue through various programs which include supplementary feeding for children under five among others (Diskes, 2014; Oomen 1953). For government efforts to succeed in this perspective, much and further researches are required for the purpose of creating high quality product, especially in the area of nutritional value of protein (Diskes, 2014). However, utilization of fishery resources in Indonesia is still at minimum level (Diskes, 2014; Wibawa et al., 2014). One of the freshwater fishery commodities in Indonesia, especially in Riau Province is catfish (*Pangasius hypophthalmus*) which is relatively inexpensive and has a high protein content but has not been widely used (Dewita, 2010; Diskanla, 2013).

In Kampar regency Riau Province, the cultivation of fresh water fish, especially catfish (*Pangasius hypophthalmus*) has been progressing rapidly, and almost every year catfish production in this area is also on the increase (Diskanla, 2013). According to the Kampar District (2013) current production of catfish per day in Kampar district is 63 tons. High rate of production is very promising because it can be used as a source of nutrition (Dewita, 2011). However, it is ironic that the people in Kampar regency are still suffering from malnutrition despite high rate of catfish production (Diskes, 2014). In 2006 for instance, 19.27 percent of the population experienced malnutrition and this mostly occurred among the children under five years for Kampar while the percentage has increased to 22.94 percent (Diskes, 2014). This figure has not changed much until 2009. Therefore, these activities are taking place in order to take advantage of catfish production in Kampar district and to increase the value added, reduce the risk of price fluctuations and to overcome malnutritions through diversification of post-harvest handling of catfish-based products, particularly fish protein concentrate (Syahrul et al, 2013).

Global food and agriculture Organization (FAO) has defined Fish protein concentrate as a product of flour for human consumption made from whole fish flesh, by eliminating most of the fat and water content, so that the percentage of obtained protein content is higher than the original raw material (Syahrul et al, 2013). Hence, it is very suitable to serve as sources of raw materials in the processing of fish protein concentrate and subsequently used in the manufacturing of high protein snack foods in order to support the government's efforts to reduce protein energy malnutrition problems. Hutapea, (2004) used FPC as a fortification and supplements such as the manufacture of ice cream, jelly, emulsifiers, developers and fillers. Ibrahim (2009) utilized a special diet of fish protein concentrates, such as cases of pancreatitis, syndrome and constipation, and food allergies as well.

In addition, Fish protein concentrate has advantages when compared to other fisheries processed products, which can be stored over a long time at room temperature without undergoing many changes (Dewita, 2013; Medwadowski et al., 1971). In Indonesia, fish protein concentrate for food is under produced and its utilization is still lacking (Dewita, 2013). It is therefore necessary to utilize fish protein concentrate in the manufacturing of snack foods.

Because of its important roles as a source of protein, the processing of fish protein needs to be handled properly by investigating the best method (Dewita, 2013; Lawler, 1970; khoshkoo et al., 2010). This research therefore aims to determine the best method to be used in processing fish protein concentrate made from raw local catfish by analyzing its nutritional contents (proximate composition) and the amino acid profile, as well as studying the effect of storage in different sources namely aluminum foil packaging, glass bottles of capsules and nutrient content. The benefit that may be derived from the results of this study may include increase in the level of the quality of fish protein concentrate from catfish as a raw material for the manufacturing of food products with the purpose of overcoming malnutrition problems.

II. Materials And Method

The materials used in processing of FPC were catfish (*Pangasius hypophthalmus*), 0.5N NaHCO₃, 70% isopropyl alcohol (food grade), and packaging materials (aluminum foil, glass bottles and capsules). In addition, series of materials were equipped for proximate analysis, amino acid profile and rancidity test. The equipments for FPC processing were analytical balance, balance tables, food processor, heater, magnetic stirrer, refrigerator, filter cloth, cabinet dryer, dryblender, and 60 mesh size of sieve. Moreover, equipments for analysis were analytical balance, desiccator, furnaces, ovens, dish, evaporation dish, tables, scales, and tools of Kjeldhal.

The method that was applied in this study was experimental method. It is related to the experiments for processing and utilization of fish protein concentrates from catfish. The research was conducted through the following stages: 1) In the first stage, the Fish Protein Concentrate was processed by two methods (steam and without steam) in combination with packaging material which consists of three types of aluminum foil, glass bottles, and the capsule. There were four observations time, namely 0, 15, 30 and 45 days.

Making Fish Protein Concentrate (Dewita 1999 in Astawan, 2011) was conducted as follows: Fresh catfish with the size of 1-1.5 kg were transported to the laboratory of Fisheries Technology Faculty of Fisheries and Marine Science, University of Riau. In the laboratory, fish was killed and skin removed and followed by cut into small pieces and grounded with a meat grinder (food processor) with the addition of 0.5% saline. Furthermore, steam meat was pulverized for 30 minutes for treatment 1 and without steam for treatment 2, and then pressed to remove some water. After then, a solution of 0.5N NaHCO₃ was added to pH and the isoelectric form a paste. Solvent extraction was performed using isopropyl alcohol (1: 3) and extracted for 10 hours, forming a precipitate or residue. Then it was dried at 40°C for 15 hours in the dryer (cabinet dryer).

In the preliminary study catfish of Fish Protein Concentrate was obtained to determine its chemical composition as the proximate composition (moisture content, protein, fat and ash), and amino acid profile. Data obtained from the tabulated results was analyzed descriptively and statistically to obtain conclusions.

III. Results And Discussion

Proximate of FPC from catfish

Processing of FPC is based on a combination of steam treatment (steaming) with boiling water and extraction stages. Determination of the best methods is based on the criteria parameters which are high levels of protein, low fat content, organoleptic test and high yield. Proximate composition of protein concentrates produced from catfish turned out differently based on the manufacturing process. More details about the proximate composition can be seen in the following table.

Table 1. Proximate Composition of Catfish Protein Concentrate (%)

Treatment	Water	Protein	Fat	Ash	Yield
Steam (A)	6,39	75,31	2,79	2,14	12
Without Steam (B)	7,20	69,29	2,90	2,54	10

As can be seen in Table 1, the highest number of proximate composition and yield indicates steam method (12 %), whereas the non-steam method produced yield of 10 %. It can be concluded that steam method performed better than another method (non steam).

According to Dubrow, (1972), fish concentrate protein was grouped into three types namely type A, B and C. Type A and B consist of fat that is lower than 3 % compared to another type, while type C has fat content between 3 to 10 %. Based on this theory, the fish protein concentrate from catfish is classified as type A or B which therefore implies that it can be consumed by human being.

Isopropanol solvent may reduce the fat content from approximately 5.8 to 2.79%. Hence, half of fat total can be isolated from its solvent. Proximate analysis results show that protein and fat content are influenced by preference on methods of FPC processing (steam and non steam method). Processing FPC by steam method owned higher protein content compared to non steam method. However, FPC processing by steam method produced lower fat content. This result was obtained as the response of each method was to aggregate protein and extract water in different capability. Consequently, there were different percentage of protein and fat that are produced by each method. The higher of extraction level on the water and fat, the lower protein will be

produced and inversely, the fat content tends to decrease. Du, et al., (1997) studied fish flour processing or fish concentrate protein at the cooking stage by using steam method and confirmed that as the best method because the material (fish) may not contact water directly, so the protein content may not decline.

Shelf life of FPC from catfish

This study further examined of FPC from catfish (*Pangasius hypophthalmus*) during storage in different packaging. Packaging was undergone to provide homogeneous conditions on the catfish FPC products that aimed to minimize environmental impact during storage. There are four observation points, namely 15, 30 and 45 days, and the catfish FPC packaged in aluminum foil, glassbottles and capsules. This study analyzes alteration of the product during storage at room temperature based on the value of water content and peroxide number. The results of measurements of water content and peroxide number for both types of catfish FPC steam and without steam treatment during storage can be seen in the Table 2.

Table 2. Water content average (%) dan peroxide number (meq/1000 gr) of Catfish FPC during storage in different packaging

Type of Packeging	Duration of storing (Day)	Treatment			
		FPC Steam		FPC Without Steam	
		Water Content (%)	Peroxide (meq/1000 g)	Water Content (%)	Peroxide (meq/1000 g)
Aluminum paper	0	5,90	nd	6,04	nd
	15	6,22	2,43	6,34	3,52
	30	7,11	5,10	7,64	5,73
	45	8,24	7,51	8,52	8,38
Glass Bottle	0	5,95	nd	6,05	nd
	15	6,32	3,43	6,40	3,52
	30	7,61	5,14	7,72	5,73
	45	8,54	8,51	9,60	9,28
Capsule	0	5,92	nd	6,03	nd
	15	6,25	3,48	6,44	3,56
	30	7,80	5,60	7,82	6,70
	45	8,73	8,81	9,74	9,35

According to Table 2, the lowest water content occurred in 45 day of period reseach as many as 8.24 % and 9.74 %, for steam and non-steam method, respectively. It means that the water content that is generated from non steam method was higher than that of steam method.

Water content from catfish FPC from both methods tend to increase during storage time. The water contents increased because FPC of catfish was defined as dry product, therefore, absorption of water vapor from sourrounding air make the product turn into moist or there is a surge level of water content. This finding is similiar to findings of Syarief and Halid (1993). They reported that decreasing or increasing of water content during storage time are caused by vapor processing and then, absorption on food source as the effect of air condition. Moreover, producing water content in this process was still below the quality standard guideline for fish protein concentrate. It may be concluded that during 45 days of storage, FPC from catfish was acceptable to consume. Based on National Standarized Board (1992), the maximum water contents for FPC is 10 %. However, proximate analysis informed that there was alteration on peroxide number of catfish FPC from both methods. In early storage time, there was no peroxide number in FPC that processing from both methods. However, long time storage number of peroxide of FPC. This condition occured because there was reaction between fat and water inside FPC. It triggered rotten smell that may generate peroxide. According to Ketaren (1986), the rotten smell will rise in line with growth of free fat acid and peroxide number which depends on brightness, oxygen, UV light, and presence of anti-oxidant. Furthermore, number of peroxide in FPC catfish for both method during 45 days storage time was unacceptable. The products which has peroxide number of 10 med/1000 gr is confirmed as rejected product (McPhee & Dubrow,1972)

IV. Conclusion

Fish Protein Concentrate from catfish that was processed by steam method produced protein content around 75.31 %. Based on water content and peroxide number, FPC of catfish with alluminium foil packaging was determined as the best method during 45 days of storage time.

Acknowledgements

This work was financially supported by Directorate of Higher Education, Ministry of Research, Technology and Higher Education Republic of Indonesia. The author also thank University of Riau for the research facilities.

References

- [1]. Anonimus. 2008. Hariau Riau Pos Bulan Maret. Media Riau Group. Pekanbaru.
- [2]. Bertomuliawibawa, ujangsumarwan &Febriantindewi (2014), customer satisfaction analysis for hydrovac Vaccine (case study on catfish farmers in kabupatenbogor). International journal of business &management , vol.2 issue 11.
- [3]. OOMEN, H.A.P., (1953), infant malnutrition in Indonesia, world health org, bull.Org.mond. Santé Bull. 9,371-384
- [4]. Dewita, Sukmiwati M, Syahrul. 2010. Pengaruh Perbandingan Kombinasi Tepung Rumput Laut (Keragenan) dan Terigu dalam Pembuatan Produk cracker. Jurnal Penelitian Pertanian BERNAS 6(1): 25-32.
- [5]. Dewita dan Syahrul. 2013. Diversifikasi Produk Snack Tortila Dengan Fortifikasi Konsentrat Protein Ikan Patin (Pangasius Hypophthalmus) Dan Aplikasinya Pada
- [6]. Anak Balita. Prosiding Semnas MPHPI ke-5 2013 Semarang.
- [7]. Diskes, 2014. Laporan Tahunan Dinas Kesehatan Provinsi Riau.
- [8]. Disikanla, 2013. Laporan Tahunan Dinas Perikanan dan Kelautan Provinsi Riau Du, 1997. Retention Of Oxytetracycline Residues In Cooked Channel Catfish Fillets. Volume 62, No. 1. Journal of Food Science 119 – 122. www.ift.org
- [9]. Huda, N., P. Santana, R. Abdullah, and T.A. Yang. 2012. Effect of different dryoprotectant on funtio-nal properties of thredfin bream surimi powder. J. Fisheries Aquatic Sciences, 7(3):215-223.
- [10]. Hutapea, E. B., Parkanyiova, L. Parkanyiova, J., Miyahara, M., Sakurai, H. dan Pokorny, J. 2004. "Browning Reactions between Oxidised Vegetable Oils and Amino Acids Journal of Food Science Vol.22 : 99-107.
- [11]. Ibrahim, M.S. 2009. Evaluation of production and quality of salt-biscuits supplemented with fish protein concentrate. World J. Dairy Food Sciences,4(1):28-31.
- [12]. Ketaren, S., 1986, Pengantar Teknologi Minyak dan Lemak Pangan, UI-Press, Jakarta.
- [13]. Khoshkhoo, Z., Motalebi, A., Khanipour, A. A., Karimi Firozjaee, H., Nazemi, M. and Mahdabi, M. 2010. Study on changes of protein and lipid of Fish Protein Concentrate (FPC) produced from Kilka in VP and MAP packages at light and darkness condition during six months. International Journal of Environmental Science and Development 1 (1): 101-106.
- [14]. Lawler F. K. 1970. Pure fish protein. Food engineering 42 (8): 61-65. Fao.org
- [15]. Medwadowski, B., Haley, A., and Van Der Veen, J. (1971). Effect of storage on lipids of fish protein concentrate. Journal of American Oil Chemists Society, 48, 782-783.
- [16]. McPhee, A.D. dan Dubrow, D. L. 1972. "Application of Ternary Equilibrium Data to The Production of Fish Protein Concentrate." Journal of The American Oil Chemist's Society Vol.49 : 501-504.
- [17]. Nation Standarized Board (1992), Badan Standardisasi Nasional Indonesia.
- [18]. Pires,C., S. Costa, A.P. Batista, M.C. Nunes, A. Raymundo, and I. Batista. 2012. Properties of protein powder prepared from Cape hake by-products. J. Food Engineering, 08:268–275.
- [19]. Syahrul, Dewita, Mus S. 2010. Kajian Tingkat Penerimaan Konsumen Terhadap Mutu Sasate Ikan Patin (Pangasius hypophthalmus). Jurnal Berkala Perikanan TERUBUK 39(2):12-23
- [20]. Wibawa, G., Hendratno, S., Van Noordwijk, M., (2005). Permanent smallholder rubber agroforestry systems in Sumatra, Indonesia. In: Palm, C., Vosti, S.,