# CHARACTERISTICS OF MALONG (*Muraenesox cinereus*) AND KEMBUNG (*Rastrelliger brachysoma*) AS SURIMI RAW MATERIAL

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Abstract

*The use of fish as raw material for surimi continued to grow along with the increasing demand for surimi-based processed products. The fish used from marine fish to freshwater fish. The use of fresh fish as raw material greatly affected the quality of surimi. The morphological characteristics of fish raw materials affected the yield of fish meat, this can be seen in the yield of each fish. This research used two types of fish, namely Malong / Daggertooth pike conger fish (Muraenesox cinereus) and Kembung / Mackerel fish (Rastrelliger brachysoma). In general, the results of the proximate test showed that the protein levels in the fish used were not significant. Malong fish was very potential to be used as raw material for surimi because it produced the highest yield, which was 66.67% with 62.44% myofibril and 25.6% sarcoplasm. Kembung/Mackerel fish in this study resulted in the lowest yield of 37.00% with 59.69% of myofibril and 46.6% of sarcoplasm. Gel formation in surimi was strongly influenced by myofibril and sarcoplasmic proteins. Gel formation in fish meat was strongly influenced by the presence of salt-soluble proteins in the form of myofibrils (actin and myosin). On the other hand, if fish meat contained more water-soluble protein (sarcoplasm), it would be relatively reduce its gel formation ability.*

**Keywords:** *raw materials, fish, surimi, myofibrils, sarcoplasm*

## Introduction

The surimi industry in Indonesia from 2005 to 2016 experienced a significant increase from 8 industrial units to around 16 industries. The existence of a ban on cantrang fishing gear based on government regulations through the Ministry of Maritime Affairs and Fisheries No. 2 of 2014 stipulates regulations prohibiting the use of trawl fishing gear including Cantrang / dogol (trawling) fishing gear. This also has an impact on the supply of raw materials for the surimi industry, although it is currently starting to be relaxed. Facing industrial conditions, implementing several strategies, including the adoption of raw materials, the use of other types of fish, and building a logistics chain for fish raw materials from Eastern Indonesia as a capture fisheries production center (Mariza et al. 2016; Hikamayani et al. 2017 and SEASOFIA 2017). The diversity of fish species in Indonesia also requires the development of alternative uses of other potential fish species as raw materials for surimi. The type of fish as raw material for surimi itself requires a white flesh color and high gel strength. Surimi is an intermediate product in the form of a wet concentrate of myofibril protein made by repeated washing of fish meat using cold water. Fish meat washed with cold water is useful for dissolving sarcoplasmic proteins and other materials such as fat. It is intended that the resulting producat is tasteless and blended. This step will usually remove 40-50 g/100 g of meat during the washing process (Bourtoom et al. 2009). Further Ramirez et al. (2011) explained that washing plays a role in removing water-soluble sarcoplasmic proteins, affecting organoleptic reception, and increasing the amount of water-insoluble myofibril proteins, such as myosin, actin, and actomyosin complex.

The main factor that determines the quality of surimi is the strength of the gel produced from the fish raw materials used. The gelling ability of fish meat is strongly influenced by salt-soluble proteins (myofibrils) and transglutamine (TGase) enzymes. The characterization of myofibrils and sarcoplasm of fish meat as raw materials was carried out to see their proportions in fish meat so as to provide information related to their properties and abilities in texture formation. The shape and type of fish greatly affect the characteristics of the meat yield, myofibrils and the amount of sarcoplasm. Fish with compressed body shapes such as mackerel, kurisi, yellow tail, gulamah, and lemuru are very different compared to fish with depressed shapes such as catfish, catfish, malong and others. The differences can be in the amount of myofibril protein, sarcoplasm, gel strength, meat color and endogenous transglutamine. This study aims to determine the characteristics of puffer fish and malong fish meat as raw materials in processing surimi.

**Material and Methods**

**a.) Research Materials and Tools**

The main ingredients in this study were Malong Fish and Kembung/Mackerel Fish. Additional materials and materials for testing include aquadest, hydrochloric acid (HCl), potassium sulfate (K3SO4), magnesium sulfate (MgSO4), sodium hydroxide (NaOH), benzoic acid (H3BO4), ether, benzene, methyl red, bromo cresol green and acetone. The equipment used in this study included meat separator, meat grinder, oven, ashing furnace, micropipette (Socorex Calibra 832; 1-10 mL, Gilson; 1000 L, Transferpette; 10-100 L), analytical balance (Mettler AE 100). , vortex (Maxi Mix Plus, Thermolyne/Barnstead), Whatman 1 paper, cold centrifuge (Beckman Coulter, Rotor F2415P), refrigerator (Sharp/ SJ-D55G-GY), Soxlet extraction, destruction tube, desiccator.

**b.) Research Method**

This study used two types of fish, namely malong fish and kembung/mackerel fish. Tests were carried out to determine the characteristics of the fish meat which included proximate parameters (protein content, water content, fat content, ash content and carbohydrate content (by different) (AOAC, 2005)), fish meat yield, total myofibrils and sarcoplasmic. The fish meat yield (Yied) was calculated based on the total amount of fish meat without skin, bones, entrails and head compared to the total weight of the whole fish.

Fish meat myofibril analysis based on the method of Benjakul et al. (2011) which modified fish meat that had been separated from the skin and bones as much as 100 g was added to a solution of 0.6 M KCl pH 7.5 as much as 10 times the weight of the meat and then homogenized for 10 minutes gradually. The mixture is then stirred at a cold temperature (with ice) for 10 minutes to increase its solubility. The homogenate was centrifuged at 5 000 x g for 30 minutes at 4 oC, then added 10 parts of cold deionized water to precipitate natural actomyosin (NAM) then centrifuged again at 5 000 x g for 20 minutes at 4oC. The resulting pellet (myofibril) and supernatant (sarcoplasm) were weighed to calculate the percentage based on the total fish meat.

**1. Result and Discussion**

**a.) Fish Morphology**

The use of fish as raw material for surimi continues to grow along with the increasing demand for surimi-based processed products. The fish used range from marine fish to freshwater fish. Several studies used various types of fish as raw materials for surimi, including: Sahlan et al (2018) examined the characteristics of kamaboko produced from several types of freshwater and seawater fish, namely surimi tilapia, milkfish and red snapper. Sarie et al. (2018) studied the characteristics of surimi gel derived from belida fish, tilapia, jackfruit seed fish and milkfish. Kurniasih et al. (2019) examines the use of surimi derived from freshwater fish, namely tilapia which is cultivated. The shape and appearance of the fish used in this study are presented in Figure 1.


**Figure 1.** Fish body shape which were used in this research
(A = Malong; B = Kembung Fish)

The raw material for Malong fish used in this research was an average length of 100 cm and an average weight of 1700 g. The size of the Malong fish can reach 200 cm, but generally around 150 cm. The distribution of Malong fish starts from the Red Sea, to the northern Indian Ocean, the Indian coast, Burma (Myanmar) and Malaysia to the north of Hong Kong and Japan (FAO, 2001). The body of this elongated Malong fish generally has a relatively higher amount of meat than fish with a compressed form. The meat of Malong fish (*M. cinerus*) has an average yield of 62.89±2.23% with the dominant component of water being 80.49% and protein 12.27%. The dominant amino acids are glutamic acid 2.68%, lisinine 1.57%, leucine 1.25%, aspartic acid 1.54% and arginine 1.04%. Minerals Potassium (K) 170,20 mg/100g, Ca 90,75 mg/100g, and Na 80,15 mg/100g. Types of essential fatty acids EPA 0.6%, DHA 0.9%, linoleic fatty acids 0.2%, oleic 1.4% and 1.0% linolenic. (Laksono et al, 2019).

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Kembung fish (*Rastrelliger* sp.) used in this research had an average length of 18.5 cm and an average weight of 190 g. Kembung was an epipelagic and neritic species in coastal and marine waters. Mackerel body length wasn't more than 30 cm (average 15-20 cm) with the largest weight of about 300 g (Vaniz et al. 1990).

**b.) Proximate**

The results of the proximate test consisted of protein, water, fat, ash, and carbohydrate content (by different) in Malong and Kembung fish can be seen in Table 1.

**Table 1.** Proximate test result of fish raw materials

| Proximate parameter | Type of Fish | |
|---|---|---|
| | Malong | Kembung |
| Protein content | 17,23 | 18,88 |
| Water content | 77,18 | 76,14 |
| Fat content | 3,26 | 2,42 |
| Ash content | 1,29 | 1,76 |
| Carbohydrate content (by | 1,05 | 0,8 |

different)

In general, the results of the proximate test showed that the protein levels in the fish used were not significant. Kusnandar (2010), explained that gel strength was a criterion which was often used to evaluate food protein. Several factors that affected the capacity of protein gels, one of them protein concentration. Gel strength increased with increasing protein concentration. The protein concentration required for gel formation depended on the type of protein. Fish proteins were generally divided into 3 classifications, namely myofibril proteins (65-75%), sarcoplasmic (20-30%) and stromal proteins (1-3%). Sarcoplasmic protein in the manufacture of surimi would be removed during the washing process because it didn't play a role in gel formation and inhibit myosin cross-linking in the gel formation process (Haard et al., 1994).

Parameters of fat content that had a high enough amount were found in Malong fish which reached the range of 3%. The fat content of the fish raw materials used for making surimi can be reduced by washing in the surimi made process. This was corroborated by the results of research by Hossain et al. (2004) showed that mashed meat that had been washed (surimi) decreased in fat content from 3.1% to 0.63% in carp and 6.8% to 0.59% in catfish. The value of protein and fat was an important parameter in processing fish into surimi. This was because the surimi processing would be separate the protein and fat components as well as the sarcoplasm present in the fish meat.

**c.) Yield, Myofibrils and Sarcoplasm**

The yield, myofibril and sarcoplasmic were resulted from the meat test of the three fish raw materials (Malong and Kembung) can be seen in Table 2.

**Table 2.** Total yield of fish meat, myofibril proteins, sarcoplasmic proteins of Malong and Kembung

| Type of Fish | Yield (%) | Myofibril (%) | Sarcoplasm (%) |
|---|---|---|---|
| Malong | 66,67 | 62,44 | 25,6 |
| Kembung | 37,00 | 59,69 | 46,6 |

Malong fish with a body shape that tends to be round and elongated (defressed) had a relatively higher yield than fish with a compressed (Figure 1). The yield of Kembung is 37%, smaller than that of Malong, which is 66.67%, because the morphological shape of Kembung is smaller than that of Malong. Besides that, the texture of the meat of the Malong fish is thicker than that of the Kembung fish. Based on the description above, Malong fish is very potential to be used as raw material for surimi because it produces the highest yield. The potential of this meat is supported by the amount of myofibril protein present in Malong Fish of 62.44%. The myofibril value of Malong Fish was greater than that of pufferfish myofibril by 59.69%.

Myofibril protein was a protein that able to form a gel. Gel formation in fish meat was strongly influenced by the presence of salt-soluble proteins in the form of myofibrils (actin and myosin). Myofibril proteins consisted of myosin, actin and actomyosin proteins (Shahidi, 1994).

Based on Table 2, the highest sarcoplasm was found in Kembung fish, which was 46.6%. The high sarcoplasm in Kembung was because the scromboid group of fish, included Kembung, had a fairly high amount of red meat. This was also evidenced by the color of the Kembung meat after grinding which had a rather dark dull color. Sarcoplasmic proteins had physical and chemical properties, for example, most sarcoplasmic proteins had relatively low molecular weights, high isoelectric pH, and spherical structures. This physical characteristic was responsible for its high solubility in water. One of the most important types of sarcoplasmic protein in terms of meat quality was myoglobin. This protein was responsible for giving red color in fresh meat (Park 2005). In addition, if fish meat contained more water-soluble protein (sarcoplasm), it would be relatively reduce its gel-forming ability.

**Conclusions**

Based on the characteristics of the two types of fish (Malong and Kembung) the highest protein content is Kembung fish. Gel formation in fish is strongly influenced by the presence of salt-soluble proteins in the form of myofibrils. Based on the myofibril content of the two types of fish, the best potential for gel formation is Malong fish. Malong fish also have the highest amount of yield because of their long and depressed with whiter so that it has potential as raw material for surimi.

**References**

[AOAC] Association of Official Analytical Chemist. 2005. Official Methods of Analysis (18 Edn). Association of Official Analytical Chemist Inc. Mayland. USA.

Benjakul S dan Visessanguan W. 2003. Transglutaminase-mediated setting in bigeye snapper Surimi. Journal Food Research International. 36(3): 253–266

[FAO] Food and Agriculture Organization. 2001. A world overview of species of interest to fisheries. Chapter: *Muraenesox cinereus*. Retrieved on 15 June 2005. from www. fao.org/figis/ servlet/species? fid=2205. 2p. FIGIS Species Fact Sheets. Species Identification and Data Programme-SIDP. FAO-FIGIS

Kurniasih RA, Darmanto YS, Herawati VE. 2019. Characteristics of surimi gelform *Oreochromis mossambicus* in different aquaculture area. IOP Conference Series: Eart and Environmental Science 260: 1-8

Laksono UT, Nurhayati T, Suptijah P, Nur'aenah N, Nugroho TS. 2019. Karakteristik ikan malong (*Muraenesox cinerus*) sebagai bahan baku pengembangan produk diversifikasi. Jurnal Pengolahan Hasil Perikanan Indonesia. 22(1): 60-70.

Park JW. 2005. Surimi and Surimi Seafood. Second Edition. CRC Press.

Sahlan S, Liviawati E, Rostini I, Pratama RI. 2018. Perbedaan jenis ikan sebagai bahan baku terhadap tingkat kesukaan kamaboko. Jurnal perikanan dan kelautan 9(1): 129-133

Sarie OT, Asikin AN, Kusumaningrum I. 2018. Pengaruh perbedaan jenis ikan terhadap karakeristik gel surimi. Jurnal Ziraa'ah 43(3): 266-272.

[SEAFDEC] South East Asian Fsiheries Development Center. 2007. Trend of Surimi Raw Material in Southeast Asia. SEAFDEC/ Training Departemen: 1-16.

Siagian, G., H. Wahyuningsih dan T. Barus. 2017. Struktur Populasi Ikan Gulamah (*Johnius Trachycephalus* P.) di Sungai Barumun Kabupaten Labuhan Batu Sumatera Utara. 3(2). ISSN:2460-6804.