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ARTICLE REVIEW : THE USE OF PLASTIC PACKAGING FOR VARIOUS PROCESSED FISH PRODUCTS

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ABSTRACT

This article aims to examine the use of polypropylene (PP) and polyethylene (PE) plastic packaging in various processed fish products. Based on the results of the literature study, information was obtained that the use of polypropylene plastic packaging in various processed fishery products can extend the shelf life of the packaged products compared to polyethylene plastic. Polypropylene plastic has low gas permeability and water-resistant properties so that it can inhibit the growth process of spoilage microbes so that it will slow down the process of decay in the products in it.

KeyWords
Fish crackers, fish floss, fish nuggets, organoleptic, processing.

INTRODUCTION

Fish are vertebrates that live in water and have gills. Fish is a very potential source of animal protein and has a fairly high fish protein content and is also composed of a number of amino acids that are very good for human needs. Behind the great potential possessed by fish, there are also obstacles, namely this fish is a type of food that quickly undergoes a process of decay. According to Winarno and Betty (1983), food damage can be caused by two things, namely damage by the natural nature of the product that takes place spontaneously, the second is damage due to environmental influences. Therefore, to inhibit the process of spoilage, it is very necessary to try to extend the shelf life of various processed fish products which aims to improve the quality of processed preservation so that the utilization of fish as a food with a high protein source is maximized.

Various kinds of processed fish products that are often found in Indonesia include fish nuggets, fish floss, fish crackers, fish sausages, and also fish satay. The five processed products are very easy to decrease in quality and shelf life. Efforts that can be made to extend the shelf life is to use plastic packaging. Some of the plastic packaging materials used include polypropylene (PP) and polyethylene plastic (PE). This article aims to examine the use of polypropylene (PP) and polyethylene (PE) plastic packaging in various processed fish products.

Processed Fish

Products There are many processed fish products that are currently popular among the people of Indonesia, but among the many processed products, there are five processed products that are easy to find, including fish nuggets, fish floss, fish crackers, fish sausage, and fish satay.

According to Ginting (2006), nuggets are processed animal meat in the form of a mixture of meat and other ingredients such as spices as spices, then made into a dough and placed on a baking sheet after being flattened with a thickness of 1 cm. Nugget is a type of fast food that usually comes from processed meat and flour which is compacted and then served by frying. Fish nuggets are processed products made from the main raw materials of fish and flour. The addition of fish aims to increase the taste of the nuggets and can increase the protein content of the nuggets (Achmad et al. 2016). However, the nutritional content of nuggets such as water and protein will easily invite pathogenic bacteria so as to damage the quality and nutritional content of the nuggets. Thus, further handling is needed, one of which is packaging. The types of plastic used as packaging for nuggets are usually Polyethylene (PE) and Polypropylene (PP) plastics.

Fish floss is one of the processed dry foods made from meat by boiling, slicing, frying and pressing then adding spices so that it has a distinctive taste. Fish floss is a type of food made from fish and processed by boiling then fried and then seasoned (Suryani et al, 2007). There are two things that cause food damage, namely damage caused by the natural nature of the product that takes place spontaneously and the second is caused by environmental influences. Packaging is very influential on the shelf life and quality of floss so that good packaging and storage must be carried out. According to Syarief et al. (1989), this is intended to maintain the product in good condition and provide protection to the product from physical damage such as water, oxygen, light, and other contaminants such as dirt. Floss packaging generally uses plastic packaging, namely polyethylene (PE) and polypropylene (PP) plastics.

Crackers are a typical Indonesian food and are well known by the wider community because they are a complementary ingredient to the main food and can even be used as a snack. Until now, various types of crackers with various flavors have been produced, one of which is atomic crackers with the main ingredient of fish. In the manufacture of atomic crackers, jelawat fish meat flour is added as a source of protein. According to Yasin, Desmelati, and Sumarto (2015), stated that atomic crackers with the addition of jelawat fish meat have nutritional values such as 7.30% water content, 21.53% protein content, 12.94% fat content and 3.12 ash content. %. In the cracker processed product, polyethylene plastic is used, where polyethylene is divided into two groups, namely HDPE Polyethylene with high density and LDPE Polyethylene with low density (Buchari and Karnila 2006).

Sausage processing is one of the processing of fish catches. Sausage products are increasingly popular in the market and are quite popular foods. Currently, with the development of technology followed by an abundance of fish catches, sausages have been made in a modern way with fish meat as raw materials, one of which is trash fish as the main ingredient. Trash fish is one of the sources of underutilized fish (IKD) with the greatest potential as bycatch (bycatch) in catching shrimp at sea, which consists of various types of demersal fish and a small portion of small pelagics. The packaging that is often used in the community is the type of polyethylene plastic and a combination of *wrapping plastic* with Styrofoam. In addition to being easy to obtain, the packaging has a relatively cheap price with almost the same physical properties and good protective ability.

Fish satay is a processed fish product in which the bones and spines are removed and then added with spices and heat treatment (Tim Yasa Boga 2000). Fish satay is a semi-wet product that is quickly damaged and has a shelf life of about 3 days. With the packaging of fish satay using certain packaging methods and types of packaging materials, it is hoped that it can extend the shelf life of fish satay and can increase marketing. The use of packaging materials must be in accordance with the nature of the packaged

materials. Polyethylene (PE) and polypropylene (PP) are flexible plastic packaging commonly used to package meat and fish products.

Use of Plastic Packaging

These processed fish products require packaging to limit food ingredients from the outside environment to prevent the process of damage or the growth of spoilage microbes so that these processed products have a longer shelf life for consumption. Packaging with good gas resistance and smaller surface area causes the product to have a longer shelf life (Buckle *et al.* 1987). Quality resistance and the quality of a food ingredient are influenced by environmental factors such as temperature, humidity, oxygen, and light (Hermanianto *et al.* 2000). The use of packaging materials must be in accordance with the nature of the packaged materials. The most appropriate plastic packaging used for processed fish products is polypropylene (PP) and polyethylene (PE) plastic packaging. This is because the characteristics of the packaging have a high density, are resistant to high temperatures, and have low water permeability so that they are able to protect the product (Ahmad *et al.* 2016). In addition, PP and PE plastics are cheaper and easy to find in the market. Polypropylene (PP) plastic has chemical properties, including: (1) difficult to penetrate by water vapor, (2) resistant to oil and grease, (3) low water vapor permeability, (4) stable at high temperatures, and has shiny surface. Pantastico (1997) added that one of the properties of polypropylene is that it can prevent contact between the material and oxygen and is able to protect the material from contamination. Meanwhile, polyethylene (PE) plastic has the following characteristics: (1) easy to form and weak, (2) resistant to bases, acids, alcohol, detergents, and other chemicals, (3) water and vapor resistance, (4) high tensile strength without tearing, and (5) easy to heat hem (Syarief *et al.* 1989). According to Hanlon (1984), polyethylene has a rather high permeability to oxygen so that it easily absorbs oxygen from the outside and causes the availability of sufficient oxygen to stimulate the growth of aerobic microbes. Polyethylene is divided into two groups, namely HDPE Polyethylene (high density polyethylene) and LDPE (low density polyethylene). Polypropylene (PP) is widely used as a meat wrapper with vacuum and gas packaging processes. Based on these characteristics, the most appropriate and safe for packaging processed fish products is to use polyethylene (PE) and polypropylene (PP) plastics. Therefore, the purpose of this study was to determine the best type of plastic packaging material and to determine the use of plastic packaging in extending the shelf life of processed fish products.

Chemical Analysis

Fish Nuggets

The type of plastic packaging showed a significant effect on the water content of fish nuggets, but the types of PE and PP packaging were not significantly different on the water content of nuggets. PP type plastic should be better in maintaining the moisture content of the nuggets because it has a lower water vapor permeability than PE. According to Mareta and Sofia (2011) that the permeability of polypropylene plastic is smaller than that of polyethylene plastic, it is more difficult for water vapor to penetrate polypropylene than polyethylene.

PP type plastic is better at maintaining protein content because PP plastic permeability to gas is lower than PE, thus causing fish nugget protein to decrease less than PE because it is able to withstand gas entering the storage media, thereby reducing the oxidation process that supports bacterial growth. . Fish nuggets without packaging lose more protein content due to the absence of a protective barrier that can inhibit bacterial growth.

Fish Floss

Fish floss packaged using PP packaging showed a smaller reduction in water content compared to PE packaging. According to Budiyanto (2012), this is due to the lower permeability to gas and water vapor in PP plastic compared to PE packaging so that gas and water vapor exchange is not easy to occur.

Based on the TBA number obtained, PP plastic increased slightly compared to PE packaging, this was due to PP packaging having better oxygen resistance than PE packaging. According to Budiyanto (2012), this is influenced by the density and permeability of each package. Packaging that has a high density indicates that the packaging has a closed structure, meaning that it is not easily penetrated by fluids and gases (Budiyanto 2012).

Fish Crackers

The water content value in fish crackers is at the highest value in fish crackers packaged with PE with LDPE plastic (low density), and the lowest water content in fish crackers packaged with a combination of HDPE plastic (high density) and aluminum foil. Measurement of the water content in each food ingredient is very important, high or low water content in food will determine the final quality of a product. The results of the analysis of variance showed that fish crackers with different types of packaging during storage at room temperature had a significant effect on the value of water content. Sukawati (2005), stated that the increase in the moisture content of packaged foodstuffs is influenced by water vapor permeability, moisture absorption properties of foodstuffs, and relative humidity around the packaging.

Judging from the fat content, fish crackers in PP and LDPE packaging have a shorter shelf life than combined packaging (HDPE and aluminum foil). This is in accordance with the opinion of Ketaren (2005), which states that plastic packaging can hold water, but cannot hold oxygen. Furthermore, according to Syarief and Irawati (1988) *in* Wiganti (2009), the disadvantages of polyethylene i.e. rather high oxygen permeability, and not resistant to oil. Fish crackers based on fat parameters showed that the combination packaging (HDPE and aluminum foil) was able to maintain fish crackers longer than PP and LDPE packaging. This is supported by the opinion of Syarief, Santausa, and Isyana (1989), which states that combination packaging is composed of metal materials that are hermetic, flexible, and impermeable to light so that they have high protective properties against water vapor, light, fat and gases.

Fish Sausages

During storage, the water content of fish sausages packaged using a combination of *plastic wrapping* and styrofoam was lower than that of polyethylene packaging. This difference is caused by the penetrating power and the ability to control the entry and exit of water vapor from the packaging used. *Wrapping plastic* is a type of low density polyethylene plastic. Although the permeability of styrofoam to H2O is higher, the ability of *wrapping plastic* in controlling the entry and exit of water vapor is better than polyethylene plastic (Buckle *et al*. 1987).

The average TVB content of fish sausage during storage had a lower value in the treatment of polyethylene plastic compared to the combination of *wrapping plastic* and styrofoam. This is because polyethylene plastic has properties that can be heat-sealed, resulting in tight closure or packaging conditions for the packaged product (Syarief *et al*. 1989).

Then there was an increase in the average TPC content of fish sausage during storage with a lower value in the combination packaging of *wrapping plastic* and styrofoam compared to polyethylene plastic. The increase in TPC content was in line with the increase in storage time, indicating that during storage, microbial activity continued. Pigott and Tucker (1990) stated that microbiological damage to fishery products is a key factor in determining the suitability of these products and their safety for consumption. The microbio-

logical quality of a food product is determined by the number and types of microbes present in it. The relatively high protein content of fish with a water content of up to 60% makes processed fish products very susceptible to microbiological damage (Heruwati 2002).

Fish Satay

Polyethylene and polypropylene packaging materials have good permeability to water vapor so that the transfer can be inhibited. The best water content is found in fish satay packaged using polyethylene because it has the lowest water content.

Based on TBN analysis, packaging using polypropylene is the best treatment because up to 12 days of storage it has lower TVN levels than other packaging. So it can be seen that the damage to processed fish satay products will be lower and have better quality compared to other treatments.

Fish satay packaged with polypropylene has lower total aerobic microbes than polyethylene because polypropylene has lower permeability to gas and water vapor so that it is better able to prevent microorganism contamination. Meanwhile, polyethylene has high gas transmission properties. Pantastico (1997) added that one of the properties of polypropylene is that it can prevent contact between the material and oxygen and is able to protect the material from contamination. According to Hanlon (1984), polyethylene has a rather high permeability to oxygen so that it easily absorbs oxygen from the outside and causes the availability of sufficient oxygen to stimulate the growth of aerobic microbes.

Organoleptic Test

Fish Nuggets

For taste test on PP plastic packaging, the taste was very good until day 5. On day 10 the fish nuggets started to experience damage where the taste began to change but in this condition the nuggets could still be consumed. The 15th day the nuggets were already damaged. Damage to PP plastic packaging is indicated by the salty taste of the nuggets starting to become sour. The treatment of PE nugget type plastic also suffered damage on the 10th day. The taste of the nuggets changed to a sour taste from the initially salty and soft taste. Damage also occurs in the aroma of nuggets. On day 10, the aroma of nuggets in PP or PE treatment changed. Damage to the aroma of nuggets is characterized by a change in the aroma from the typical fish-scented to rancid.

The texture of the nugget on the unpackaged treatment was very good on day 5. However, it began to show damage on day 10, namely the nugget began to harden on the surface, but was soft on the inside. Meanwhile, on the 15th day the nuggets started to harden. This change was due to the drastic decrease in the water content of fish nuggets. It was proven that on the 15-20th day the water content of fish nuggets was below 15% and in that condition the fish nuggets were not suitable for consumption. Meanwhile, in PP and PE packaging treatment, the nuggets had a very good texture until the 15th day, which was chewy and soft. On the 20th day of storage, the packaging was still able to maintain the texture well, but at this condition the PP fish nuggets had started to stick to the surface and the PE fish nuggets had started to grow mold on the surface of the nuggets.

Plastic packaging is proven to be able to maintain the color of the nuggets. Treatment of PE and PP packaging color remains bright until the 20th day, which is brown. Meanwhile, nuggets without packaging are less able to maintain the color of the nuggets. The color change experienced by nuggets without packaging is from brown to dark brown. The best packaging from the organoleptic test results on fish nuggets is with PP, PE plastic packaging, then the lowest is without packaging.

Fish Floss

The color value of fish floss packaged using PE packaging is higher or better than that of fish floss packaged in PP packaging. This is presumably because the air in the PE packaging may all come out, so that there is no oxygen interaction that can cause damage to the color of the fish floss due to the oxidation reaction.

According to Tridiyani (2012), changes in the aroma of fish floss due to increasing temperature and storage time cause an oxidation reaction in the material, resulting in a rancid smell in the fish floss. The aroma of fish floss is better by using PE packaging compared to fish floss packaged with PP.

The decrease in the texture of fish floss is related to the water content contained during storage. The decrease in water content during storage causes the fish floss produced to be coarser. The texture of fish floss shows the best in floss with PP plastic packaging compared to PE plastic packaging because PP plastic has lower water vapor permeability than PE so that it can maintain the water content in the product.

Fish Crackers

The highest taste value is found in fish crackers with combination packaging, namely PE plastic with HDPE type (high density) and aluminum foil, and the lowest value in PE packaging with LDPE type (low density), while PP packaging is in the middle value. PP and LDPE packaging have a short shelf life compared to combination packaging (HDPE with aluminum foil).

Based on the visual value, it shows the highest value in the combination packaging, namely PE plastic with HDPE (high density) and aluminum foil, and the lowest value in PE packaging with LDPE (low density), while PP packaging is in the middle value. Changes and organoleptic quality degradation of fish crackers seen from the visual value during storage is influenced by the use of the type of packaging. The packaging used for fish crackers is thought to be able to maintain changes in the water content of the product as a result of storage, which has implications for the appearance and texture of the product.

Based on the texture value, it shows the highest value in combination packaging, namely PE plastic with HDPE type (high density) and aluminum foil, and the lowest value in PE packaging with LDPE type (low density). The use of PP, LDPE, and combination packaging (HDPE and aluminum foil) on fish crackers is able to maintain quality (texture) for 30 days because it can protect the product from microorganism contamination and oxidation. Based on the average value, combination packaging (HDPE and aluminum foil) has the highest value, because the use of combination packaging can reduce O2 contamination and is harder/opaque.

Based on the aroma value, the highest value was found in HDPE (high density) PE plastic and aluminum foil, and the lowest value was in LDPE (low density) PE packaging, while PP packaging was in the middle value. Fish crackers with combination packaging (HDPE and aluminum foil) showed the highest aroma value with the criteria of delicious and very tasty. Aroma is one of the parameters that determine the delicious taste of a food product. According to Efriyani (2003), changes in aroma value are caused by changes in the properties of food ingredients which generally lead to a decrease in quality.

Fish Sausages

Changes in the appearance value (appearance) of fish sausage occurred on the 12th day of storage, both packaged with polyethylene and a combination (*wrapping plastic* and styrofoam), however, the appearance value of sausage packaged with polyethylene was better when compared to the combination (*wrapping plastic* and styrofoam). Changes in the appearance value are indicated by a change in color. The fish sausage produced is creamy white but with increasing storage time the color of the sausage becomes brownish white, but the surface of the sausage still looks smooth and attractive. Polyethylene plastic and combinations (*wrapping plastic* and styrofoam have the ability to maintain the stability of the packaged product, especially its appearance.

Changes in the texture value of sausages packaged with a combination of *wrapping plastic* and styrofoam are better when compared to polyethylene. Changes in the texture value of fish sausages are marked slightly soft. moist air, *wrapping plastic is* able to control the interaction of water vapor coming from outside and from inside the product even though the penetrating power of styrofoam to water and water vapor is higher than polyethylene plastic (Syarief *et al.* 1989), while condensation occurs in products packaged with polyethylene plastic. on the surface of the product in the container. Polyethylene plastic tends to be slower in controlling moisture from the inside out of the packaging because the density of polyethylene bags is higher than that of *wrapping plastic*. Therefore, fish sausages are packaged using combination packaging (*wrapping plasticplastic wrap)* and. tyrofoam is better than polyethylene plastic.

Polyethylene plastic provides a longer protection against the smell of fish sausage when compared to the combination packaging of *plasticwrapping* and styrofoam. Packaging that has good barrier properties will be able to maintain the aroma of the packaged product (Syarief *et al.* 1989). The density of polyethylene plastic is higher than that of *wrapping plastic*. The higher the density of plastic packaging, the lower the permeability of the odor produced by a product to interact outside (Shahidi and Botta 1994). Protection against odor values is intended so that unwanted odors cannot enter through the packaging and do not let the odor escape through the packaging. Therefore, the change in odor value occurs more quickly in the combination packaging (*wrapping plastic* and styrofoam) when compared to polyethylene plastic packaging.

Packaging *Wrapping plastic* has advantages and disadvantages, especially gas and water vapor permeability which can allow the movement of gas and water vapor molecules, the displacement of these compounds can cause various forms of organoleptic deviation (Winarno and Rahayu 1994). The protection power of polyethylene plastic against water vapor is quite good but not good for other gases such as O2, while styrofoam has a lower permeability when compared to polyethylene plastic (Syarief *et al.* 1989).

Fish Satay

Rahayu *et al.* (1992) explained that odor and aroma deviations that occur in fishery products are caused by the presence of enzymes and microorganisms. The stench occurs due to the activity of proteolytic bacteria that break down proteins into simple compounds such as polypeptides, amino acids, H2S, indole, and skatole. While the rancid odor is caused by lipolytic enzymes and oxygen. With the vacuum packaging and polypropylene plastic, the contact between the packaged product and the surrounding air can be reduced so that it can also reduce the number of microorganisms that develop and ultimately the decomposition process that causes aroma changes will be inhibited.

Fish satay packaged with polypropylene has a better texture than polyethylene because of it's better permeability to water vapor than polyethylene. According to Syarief *et al*. (1989), polypropylene has water and vapor-resistant properties.

Conclusion

Based on the results of the literature study, information was obtained that the use of polypropylene plastic packaging in various processed fishery products can extend the shelf life of the packaged products compared to polyethylene plastic. Polypropylene plastic has low gas permeability and water-resistant properties so that it can inhibit the growth process of spoilage microbes so that it will slow down the process of decay in the products in it.

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