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Review Article: Comparison of Vacuum And Non-Vacuum Packaging To The Shelf Life of Processed Fish

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ABSTRACT

Fish is one of the most popular foods in Indonesia. Fish is usually used as raw material for processed foods such as pesmol fish, pindang fish, fish paste, pempek, and even processed into frozen food. Frozen food is a processed food product in semi-finished form that is preserved until the food is ready to eat. One of the processed frozen food products is fish nuggets, tilapia fillets, fish balls, etc. Usually frozen food is packaged in plastic packaging that is vacuumed or not. Vacuum and non-vacuum packaging can affect the quality of processed fish, including its shelf life. This article review compared the advantages and disadvantages of using vacuum and non-vacuum packaging on the shelf life and quality of the processed fish. The results showed that processed fish packaged using vacuum packaging had a longer shelf life than processed fish using non-vacuum packaging.

KeyWords

Vacuum Packaging, Non-Vacuum Packaging, Packaged Fish, Frozen Food, Shelf Life.

INTRODUCTION

Packaging is one of the product strategies used by companies to make products more attractive in terms of shape, color, and can help prevent or reduce damage, protect the products in it, protect from the dangers of pollution and physical disturbances. According to Kotler (2003) packaging is the activity of designing and making a container or wrapper as a product. Packing a product is also a human effort to collect messy things into one container and protect it from weather disturbances (Wdiat-moko in Dwi Arum, 2013). Packaging is also one of the important things that must be considered in a product because packaging is not only used as a protector of the product, but the packaging is also used as a promotional medium to attract and provide information about a product to consumers.

In addition to attracting consumers, packaging is also useful for protecting products from the growth of microbes. Therefore packaging can also determine the shelf life of a product. Good quality packaging commonly used in the packaging of 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 (Ah-

mad et al., 2016). In addition, PP and PE plastics are cheaper and easy to find in the market. In addition to the type of packaging, packaging techniques such as vacuum and non-vacuum packaging also greatly affect the length of the shelf life of a product.

As a maritime country, of course, Indonesia has a high potential for fisheries resources. Therefore, the fisheries sector is one of the factors that can advance the economy in Indonesia. Fish is also one of the most popular foods in Indonesia. In addition to its delicious taste, fish also contains many nutrients including essential amino acids needed by the body, omega-3 fatty acids needed for brain growth, high protein, vitamin D, calcium minerals and phosphorus minerals. Besides that, the biological value of fish reaches 90% with little binding tissue so it is easy to digest, and also the price is much cheaper than other protein sources (Adawyah, 2007). Fish is usually used as raw material for processed foods such as pesmol fish, pindang fish, fish paste, pempek, and even processed into frozen food. Frozen food is a food product that has been packaged and stored frozen in the freezer so that it is ready to be cooked and consumed at a certain time (Anggraini, 2010). Frozen food is a type of ready-to-serve food, namely food that has been cooked and stored using preservatives or with various storage methods (MMI, 2009). Examples of processed fish products of frozen food are fish nuggets, tilapia fillets, fish balls, etc. Currently, many consumers prefer frozen food to other processed fish because it is more practical, economical, and easy to prepare.

Fish is one of the foodstuffs that easily experience quality deterioration. The deterioration of fish quality is caused by enzymatic action and bacterial action. These two actions break down the components that make up fish body tissues so as to produce physical changes such as soft fish meat and chemical changes that produce volatile compounds and have a foul smell (Murniati, 2000). Processed fish can experience a decrease in quality, including an increase in pH, an increase in water content, a dull color, an unpleasant smell, etc. According to Fardiaz (1982) a good pH for preserved fish is between 2.0-5.5, while a pH between 6.0-8.0 is a good medium for the growth of microorganisms. In addition, increasing water content also greatly affects microbial growth in packaged processed fish. According to Buckle et al. (1987) that the effect of water content is very important in determining the durability of a food material because the water content affects the physical properties (organoleptic), chemical properties and spoilage by microorganisms. One solution to inhibit the decline in the quality of processed fish and the growth of microbes in processed fish is to package the processed fish. Product damage during storage can be minimized by selecting the appropriate type of packaging material. In addition to the type of packaging/packaging quality, vacuum and non-vacuum packaging techniques can affect the durability and shelf life of processed fish products. Packaging using a vacuum can inhibit the growth of aerobic bacteria. Therefore, in this journal, we will compare which packaging technique is more efficient to increase the shelf life of processed fish products.

REVIEW METHOD

The tools used in this research are autoclave, petri dish, test tube, pH meter. While the materials used include samples of frozen food processed fish in vacuum packaging, samples of frozen food processed fish in non-vacuum packaging, PCA (Plates Count Agar) agar media, Aquadest, NaCl, and Alcohol. The method used is microbiological analysis, free water activity analysis, pH analysis, and organoleptic test.

- **Microbiological analysis**

  Microbiological analysis was carried out at room temperature (± 30 o C). The test results are recorded and the test is carried out in duplicate.

- **Free water activity analysis (Aw)**

  Aw measurements were carried out at room temperature (± 30 o C). The measurement results are recorded and measurements are carried out in triplicate.

- **Protein Analysis**

  Protein analysis was carried out at room temperature (± 30 o C). The test results are recorded and the test is carried out in triplicate

- **pH Analysis**

  Measurement of pH was carried out for all treatments at room temperature (± 30 o C). The measurement results were recorded and measurements were made in triplicate.

- **Organoleptic Test**

  Parameters measured were appearance, smell, taste, texture and mucus.

Table 1. TPC Value of Processed Carp (*C. Carpio*) during Storage at Room Temperature.

Storage Time (Week)	TPC (log CFU/g)	
	Non-Vacuum	Vacuum
0	5,14 ± 0,07^{d}	4,92 ± 0,10^{d}
1	5,54 ± 0,17^{c}	5,19 ± 0,03^{d}
2	7,08 ± 0,13^{b}	5,52 ± 0,04^{c}
3	7,32 ± 0,09^{a}	6,84 ± 0,09^{b}

The total bacteria in processed fish with non-vacuum packaging was higher than in vacuum packaging with the highest total bacteria, namely log 7.32 CFU/g at the 3rd week of storage.

Table 2. Water Content of Processed Carp (*C. Carpio*) during Room Temperature Storage.

Storage Time (Week)	Water Content (%)	
	Non-Vacuum	Vacuum
0	32,75 ± 1,2^{d}	33,01 ± 0,84^{d}
1	43,04 ±1,15^{bc}	40,50 ± 1,06^{c}
2	44,97 ±0,69^{b}	43,32 ± 0,89^{bc}
3	50,86 ±1,55^{a}	43,68 ± 0,34^{b}

The table above shows that processed fish with vacuum packaging has less water content than processed fish with non-vacuum packaging. This is caused by the internal activity of the processed product. Processed products with non-vacuum packaging undergo the breakdown of compound content in the product by microorganisms and oxygen.

Table 3. Protein Content of Processed Carp (*C. Carpio*) during Storage at Room Temperature.

Storage Time (Week)	Kadar protein (%)	
	Non-Vacuum	Vacuum
0	48,22 ± 0,74[a]	48,16 ± 0,88[a]
1	41,70 ± 0,53[b]	46,75 ± 1,12[a]
2	40,91 ± 1,27[b]	45,35 ± 1,67[a]
3	33,13 ± 2,14[c]	42,50 ± 0,77[c]

Protein content at week-0 of storage was 48%, but decreased during storage to 33% at week 3. The decrease in protein content occurred in processed fish, both by vacuum packaging and non-vacuum packaging. The decrease in protein content in non-vacuum packaging was faster than in vacuum packaging. The process of decreasing protein content was caused by the decomposition of organic compounds by the bacteria present in it.

Tabel 4. The degree of acidity of processed carp (*C. carpio*) during storage at room temperature.

Storage Time (Week)	pH	
	Non-Vacuum	Vacuum
0	5,07 ± 0,06[d]	5,11 ± 0,02[cd]
1	5,25 ± 0,05[bc]	5,17 ±0,06[cd]
2	5,32 ± 0,02[ab]	5,23 ± 0,05[bc]
3	5,40± 0,05[a]	5,25 ± 0,05[abc]

The increase in pH value was caused by the formation of base during storage. The degree of acidity or pH becomes more alkaline because a number of spoilage bacteria found in meat are able to carry out the fermentation process and produce ammonia.

Conclusion

- Microbial growth in vacuum packaged processed carp frozen food < Microbial growth in non-vacuum packaged processed carp frozen food.
- Moisture level in vacuum packaged processed carp frozen food < water content level in non-vacuum packaged processed carp frozen food.
- Protein content of fish with vacuum packaging > protein content of fish with non-vacuum packaging. However, the value of the protein content of both is equally decreased because the decomposition of organic compounds by the bacteria present in it.
- pH level in vacuum packaged processed carp frozen food < pH level in non-vacuum packaged processed carp frozen food.
- The appearance of processed carp frozen food in vacuum packaging is much fresher than in non-vacuum packaging.

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