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REVIEW ARTICLE: The Use Of Glass Bottle Packaging (*Jar*) In Maintaining The Quality And Quality Of Fishery Processed

Thallita Nasywa Faddilah[1], Junianto[2]

Department of Fisheries, Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia
[1] *Student, Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia.* E-mail : *thallita19001@mail.unpad.ac.id*
[2] *Lecture, Faculty of Fisheries and Marine Science, Padjadjaran University, Indonesia.*

ABSTRACT

Processed products, especially processed fisheries, are in demand among the community today. But there are constraints from the decline in the quality of fishery processed products caused by improper packaging. In the review of this article, I will discuss about glass bottles in maintaining the quality and quality of fishery processed such as fish sambal, fish abon, and fish oil. The use of glass bottle packaging is also not without cause, because glass bottles have nonpermeable properties that are considered to prevent a decrease in quality in fishery processed products. In the first study, smokedstingrays used glass jar packaging with variations in dry cooking methods with the addition of cooking oil cauldron-bag aroma is best (the aroma is close to fresh sambal) and has the longest shelf life of 197.96 hours or equivalent to 8 days. In the second study, the results offish stored in plastic bottles were damaged on the twentieth day with a peroxide content of 36.69meq / kg which with the same amount of peroxide content in the glass bottle on the thirtyth day. The third study, namely abon fish packed glass bottles produce the longest shelf life of 194 days in a temperature of 30^{o} C. And the last study is Shidal, the product remains acceptable for up to 90 days of storage with an overall acceptability score of >3.0. Shidal after 90 days of Storage.

KeyWords
Glass bottle, quality, packaging, processed fisheries, food safety

INTRODUCTION

Packaging is a container that serves to protect a product from any damage. Today, the use of packaging is not only protecting goods, but packaging is also needed as acommunication between prospective consumers and manufacturers, So that in the design of the packaging there are information that must be known by prospective consumers. The goal is for prospective consumers to know what products to eat or use. According to the Directorate General of Processing and Marketing of Agricultural Products of the Ministry of Agriculture of the Republic of Indonesia (2012) informs in general the function of packaging is to protect and preserve products, as aproduct identity, and increaseefficiency, such as facilitating the process of calculating shipments and storage of products.

On packaging also requires proper packaging techniques and selection and requires consideration. The main purpose of packaging itself is that the packaging should provide optimal protective properties to protect the product from external causes of damage such as light, oxygen, moisture, microbes or insects and also maintain quality and nutritional value and extend shelf life, especially in processed fisheries. Examples of packaging that is often used is bottle packaging, both plastic and glass bottles are often used in processed fisheries such as Fish Oil, Sambal Ikan, Abon Ikan and many more. In addition, the purpose of the following review is to see how much influence bottles (*jar*) have in maintaining quality and quality quality on fishery products.

DISCUSSION

Food safety becomes something important in the provision of food for the community. Food safety becomes the main requirement for food to be consumed so that individuals are not exposed to *foodborne disease* or food poisoning caused by food contaminated by bacteria, parasites, viruses, or toxins. Packaging is also an important factor in protecting food safety. This time the packaging that will be discussed is bottle packaging (*jar*). Examples of processed that generally use bottles (*jar*) are sambal. In the processing of sambal according to Koswara (2009), the packing material that is often used is a glass jar. The use of glass jars is not without cause, according to Shin and Seike (2014) Glass jars have several advantages that are inert, resistant to pressure and nonpermeable.

One type of sambal that is favored in Indonesia is fish sambal. In one of the studies Wahyuningsih et al (2012), the process of making sambal petis using tuna. While in one of the research penelitian Dian Affandi et al (2020) the manufacture of sambal added smoked stingrays to produce a distinctive taste and aroma. During the storage stage, sambal products coupled with fish are more susceptible to microbiological decline in quality by characterizing the growth of microbes in the form of bacteria. Organoleptic damage that occurs is a change in aroma or smell, while chemically is the onset of acid in sambal. What needs to be considered in addition to paying attention to the packaging is the way it is cooked. The method conducted in this study is byan testing of total titrationed acid (TAT); *Total plate count* (TPC) testing and sensory testing. Different from this sambal processing, smoked stingrays are steamed to reduce the effects of microbial cross-contamination due to smoke fish storage conditions during distribution and sale. After that the smoked stingray is reduced in size using *chopper* to become a suwir smoked stingray. According to Fellows and Axtell (2002), sterilization of glass *jar* is also necessary by placing a glass *jar* on a pot of warm water and boiling it until the water boils for 10 minutes. After sterilization, the glass *jar* is left to dry before being used to pack the sambal. Then sambal smoked stingrays are put into the jar with the *hot filling* method by leaving a *headspace* (thedistance between the product and the packaging cover then after being tightly closed). Glass *jar* are sealed using plastic seals.

Total titrationed acid (TAT) according to Sukandar et al (2014) is the percentage of acid present in the material and determined titration by standard base. According to Wulandari (2001) Totalmacid titration in food is formed due to the formation of organic acids by the activity of microorganisms in the breakdown of carbohydrates,proteins, and organic substances. The acid content in smoked stingray sambal can affect the taste and aroma of sambal. The results obtained are in the following table

Table 1. Total Acid Tited Sambal Stingray Smoked Glass *Jar* Packaging with Variations of Cooking Methods

Cooking Variations	Time (hours)	Total Origins (%)		
		35 (°C)	45 (°C)	55 (°C)
Dry	0	0,47	0,47	0,47
	12	0,48	0,51	0,56
	24	0,59	0,61	0,63
	36	0,61	0,63	0,67
	48	0,71	0,75	0,78
Half Dry	0	0,49	0,49	0,49
	12	0,51	0,53	0,56
	24	0,61	0,64	0,65
	36	0,63	0,66	0,68
	48	0,76	0,78	0,80
Dry	0	0,49	0,49	0,49
	12	0,51	0,52	0,52
	24	0,59	0,61	0,63
	36	0,60	0,62	0,66
	48	0,70	0,72	0,74

From **Table 1.** , the total value of the acid titrated during storage continues to grow. The increase in total acid is in line with the increasing number of existing microbes. During storage,the total acid formed in smoked fish jar packaging has not exceeded the standard limit of 0.5% to 2% (National Standardization Agency, 2009).

Subsequent testing used the Total *Plate Count* (TPC) which is a parameter used to calculate the number of microbes that grew during storage in the study. According to Fardiaz (1993) the number of colonies that grow is the total number of microbes contained in foodstuffs such as bacteria, squash and yeast. The quality of food will be low if the TPC value is high, because it can be harmful if consumed, related to the safety of food products.

Table 2. *Total Plate Count* Sambal Stingray Smoked Glass *Jar* Packaging with Variations of Cooking Methods

Cooking Variations	Time (hours)	Total Mikroba (CFU/gram)		
		35 (°C)	45 (°C)	55 (°C)
Dry	0	$7{,}70 \times 10^2$	$7{,}70x10^2$	$1{,}85x10^5$
	12	$6{,}90 \times 10^3$	$8{,}25x10^3$	$1{,}85x10^5$
	24	$1{,}84x10^4$	$2{,}39x10^4$	$1{,}85x10^5$
	36	$1{,}27x10^5$	$1{,}85x10^5$	$2{,}08x10^5$
	48	$1{,}47x10^5$	$1{,}85x10^5$	$2{,}16x10^5$
Half Dry	0	$8{,}48x10^2$	$8{,}48x10^2$	$8{,}48x10^2$
	12	$8{,}75x10^3$	$9{,}25x10^3$	$1{,}01x10^4$
	24	$2{,}02x10^4$	$2{,}21x10^4$	$2{,}27x10^4$
	36	$2{,}06x10^5$	$2{,}27x10^5$	$2{,}51x10^5$
	48	$2{,}30x10^5$	$2{,}40x10^5$	$2{,}58x10^5$
Dry + Oil	0	$7{,}68x10^2$	$7{,}68x10^2$	$7{,}68x10^2$
	12	$7{,}53x10^3$	$8{,}70x10^3$	$9{,}10x10^3$
	24	$1{,}76x10^4$	$2{,}48x10^4$	$2{,}55x10^4$
	36	$1{,}00x10^5$	$1{,}53x10^5$	$2{,}07x10^5$
	48	$1{,}35x10^5$	$1{,}87x10^5$	$2{,}68x10^5$

From the results in **Table 2.** , Total Plate Count (TPC) Sambal stingray smoked glass jar packaging continues to increase at each storage temperature at all variations of cooking methods during storage. It is thought to be caused by bacteria that grow (recover) during storage, supported by optimal temperature for their growth during storage. During storage the number of microbes exceeds the maximum limit according to SNI 01-4865.1-1998 which is 10^4 CFU / gram (National Standardization Agency, 1998). At storage temperatures of 35 (^{O}C) and 45 (^{O}C), the TPC value of sambal on all cooking variations exceeds the SNI limit at the 24th hour of pumping. After the storage temperature of 55 (^{O}C), the value of TPC sambal cooked dry and dry plus oil exceeds the SNI limit at the 24 hour, while the half-dried sambal does not meet the SNI at the 12th hour.

Table 3. Restoration of Shelf Life of Sambal Stingrays Smoked Glass *Jar* Packaging with Variations of Cooking at Room Temperature (30 ^{O}C)

Cooking Variations	k	Shelf Life (hours)
Dry	0,00878	165,95
Half Dry	0,00898	155,04
Dry + Oil	0,00711	197,96

Known from **Table . 3** The longest shelf life of the overall variation in cooking methods is the variation of dry cooking with the addition of cooking oil. According to Pasaribu (2004) the added oils are palm oil containing oleic fatty acids (30-40%), miristat acid (1.1-2.5%), palmitic acid (40-46%), stearate acid (3.6-4.7%) and acid linoleate (7-11%).

From the research of Dian Affandi et al (2020) the restoration of shelf life of smoked stingray sambal is determined based on the parameters of total titrationed acid (TAT), because it has the lowest Ea and slope values and R^2 values at most. high. So the quality of smoked stingray sambal using glass jar packaging with variations in dry cooking methods with the addition of cooking oil is the best sambal whose aroma quality is best (the aroma is closest to fresh sambal) and has the longest shelf life of 197.96 hours or equivalent to 8 days.

In addition to sambal, there are also other processed products that are packaged using bottles, namely fish oil. Fish oil used in the L.Resti et al study (2016) used siamese jambal fish. So far the waste of the stomach contents of siamese jambal fish, especially belly fat, has not been utilized optimally. Waste contents of jambal fish can be used as added value in the field of fisheries can also overcome the problem of environmental pollution due to the waste produced more and more because the demand for jambal fish is increasing. According to Hwang et al (2006), the stomach contents of siamese jambal including the digestive tract, liver, bile and stashed fat (abdominal fat) are potential sources of fat with a high omega 3 content. In addition, according to Kaban et al (2005) in the stomach contents of fish and heads there is quite a lot of oil content. In a study conducted by Lia et al (2016), the method carried out is an experimental method that is the storage of fish oil in plastic bottles and glass bottles. The main ingredient used in this study is the belly fat of siamese jambal fish obtained from pekanbaru market as much as 3 kg. Peroxide analysis materials used are acetic acid, chloroform, saturatedKI, a akuades, starch 1%, and sodium thiosulfate 0.01N. The free fatty acid analysis materials used are 95% ethanol, indicator pp and KOH 0.1N. Further analysis of the number of free fatty acids and peroxide numbers is carried out at intervals of 0, 10, 20, 30, and 40 days. The main parameters studied in this study were peroxide number analysis, acid analysis and free fats. The supporting parameter is temperature. Peroxide numbers are used because they are the most important values for determining the degree of damage to the oil produced, the peroxide value is used as a measure of the extent of the reaction. The tranquility has happened.

Table 4. Content (%) of siamese jambal fish oil-free fatty acids in plastic bottles and glass bottles during storage

Observation (Day)	Free fatty acid content (%)	
	Plastic bottles	Glass bottle
0	0,22	0,11
10	0,44	0,17
20	0,90	0,28
30	2,70	1,93
40	3,50	2,79

In this study there was also a difference in the stability of siamese jambal fish oil in plastic and glass bottles during storage, where the fish oil decreased in quality along with the length of storage. The decrease in quality occurs due to the longer the storage time. The results obtained also fish oil stored in glass bottles are better quality compared to fish oil in bottles plastik.

Table 5. Contents of materials (meq/kg) peroxide number of siamese jambal fish oil in plastic bottles and glass bottles during storagen

Observation (Day)	Peroxide (meq/kg)	
	Plastic Bottle	Glass Bottle
0	4,25	1,4
10	23,88	5,23
20	36,69	11,37
30	46,73	36,09
40	60,34	49,68

Fish oil stored in plastic bottles was damaged on the 20 day with a peroxide content of 36.69meq / kg which with the same amount of peroxide content in the glass bottle on the 30 day. According to Budijanto et al (2001), peroxide numbers can affect the shelf life of a product, where the peroxide number is high then the product is not durable to store long and vice versa if Low peroxide numbers then the shelf life will be longer. This is in accordance with the opinion of Panagan et al (2011), that the smaller the peroxide number means the better the quality of the oil, and the less hydrolysis process occurs.

Another type of processed fishery that generally uses bottles is abon fish. Abon fish is a type of processed fish that is processed by boiling and frying and then seasoned. While according to Karyono and Wachid (1982) abon fish is a processed product of fishery made from fish meat and through the process of grinding, frying, drying by frying, as well as the addition of auxiliary ingredients and fish meat flavoring ingredients. According to research by Wahyuningsih et al (2018) which uses cobs *(Euthynnus affinis)*as its main raw material. The study compared the effect of aluminum foil packaging with glass bottles on the shelf life of fish abon. The method is the ASLT (accelerated*shelf-life testing)*Arrhenius method.

The restoration of shelf life is determined through changes in the quality of fish abon based on two factors. Factor I is a type of packaging consisting of 2 levels, namely: K1 = aluminum foil and K2 = glass bottle. Factor II is that the storage temperature consists of 3 levels, namely: S1 = 30^{0}C, S2 = 40^{0}C andS3 = 50^{0}C. Analysis is carried out during storage (days) consisting of 5 levels, namely: P0 = 0 days, P1 = 7 days, P2 = 14 days, P3 = 21 days and P4 = 28 days. Each combination of packaging type and storage temperature is done with 2 repeats. Thus there are 30 combinations of treatments then obtained 60 units of experiments. The analysis included water content, total microbes and TBA's efficacy tests. Do not forget also the descriptive organoleptic test that includes color,aroma, and texture on fish abon. And the restoration of the shelf life of fish abon using the Arrhenius method.

Table 6. Calculation of shelf life of abon based on TBA analysis

Packaging	Temperature (1/T)	Equation	Value y	K	ln (Ao) - (At)	Shelf Life (day)
Aluminium Foil	0.0033	y = 0.0146x +1.1291	4.4720	0.0114	1.3302	116.4300
	0.0032		4.1554	0.0157		84.8397
	0.0031		3.8585	0.0211		63.0443
Glass Bottle	0.0033	y= 0.0211x+ 1.1564	4.8238	0.0080	1.5576	193.8257
	0.0032		4.3682	0.0127		122.8918
	0.0031		3.9416	0.0194		80.2215

The results obtained from the analysis of the embassy of TBA *(thiobarbituric acid)*abon fish using aluminum foil packaging produce a maximum shelf life of only 116 days ina temperature of 30° C. While in abon packed glass bottles produce the longest shelf life of 194 days in a temperature of 30^o C. According to Herawati (2008), efforts to extend the shelf life of products can be done by paying attention to the stages of the production process.

The next product is a very popular product from India. This product is also popular in Bangladesh known as *chepa shutki* (Nayeem et al., 2010). Shidal is a salt-free, semi-fermented fish product. Shidal is a half-dried and almost anaerobically fermented fish in a clay pot called mutka. The fermentation process takes about four to six months in anaerobic conditions until the product acquires characteristics of smell, texture and appearance. Neither food additives/preservatives nor starter cultures were added during the processing steps (Muzaddadi and Basu, 2003b). Shidal has a very short shelf life after being removed from the mutka. Therefore, mutka is used as the main packaging and transportation ship. Since glass is an inert material that has the highest impermeability to volatile gases and substances, glass bottles can act as an effective packing material that is expected to retain the volatile flour component of shidal.

In this study shidal used four species namely *Puntius (P. chola, P. sarana, P. sophore* and *P. ticto)* that had been sterile and collected in polyethylene bags as soon as the shidal was removed from the mutka. In this study using 2 kg of Shidal packaged using a glass bottle (*Jar*) with a capacity of 3 liters, height of 19.5 cm x 13.5 cm, the diameter of the outer mouth 10 cm and the thickness of 0.5 cm with stainless steel thread covered cork and plastic then stored at 4ºC (T) and also at separate environmental temperatures that serve as control (C). Sampling is done asepticly in a sterile petri dish, from each glass bottle for different microbiological, biochemical and sensory analysis. The container is immediately closed after sampling and sampling continues at intervals of 15 days to 120 days of storage. Samples were analyzed in three aspects for moisture, ash, pH and free fatty acids (Free Fatty Acids) following AOAC (2000), lipid content with soxlet method (AOAC, 2000), non-protein protein and nitrogen (NPN) with Kjeldahl method (AOAC, 2000); total volatile nitrogen base content (TVB-N) according to Conway micro diffusion method (Conway, 1947); tiobarbiturat acid value (TBA) following Tar-ladgis et al. (1960); peroxide (PV) number according to Jacob (1958); and amino nitrogen (AAN) is free by the Method of Pope et al. (1939).

Organoleptic appearance is judged based on the color, aroma, and texture of the processed. The proximal composition clearly indicates that shidal is a very nutritious food. pH indicates a significant difference ($p<0.05$) over the storage period. The initial decrease in pH indicates process fermentation and the formation of organic acids. The decrease in pH may also be due to the high buffer capacity of fish meat (Dakwa et al., 2005) FFA showed less value in sample cooling indicating that low temperature storage may reduce lipid hydrolysis. These findings agree with the findings of Srikar et al. (1993) which reported lower PV and lower FFA content in salted mackerel and pink mackerel when stored at 2.5 ^{o}C after 35 days of storage. TBA values represent the level of edging in the product and values above 3-4 indicate a decrease in quality (Karacam and Boran, 1996). It was observed that in this study, values were within an acceptable range.

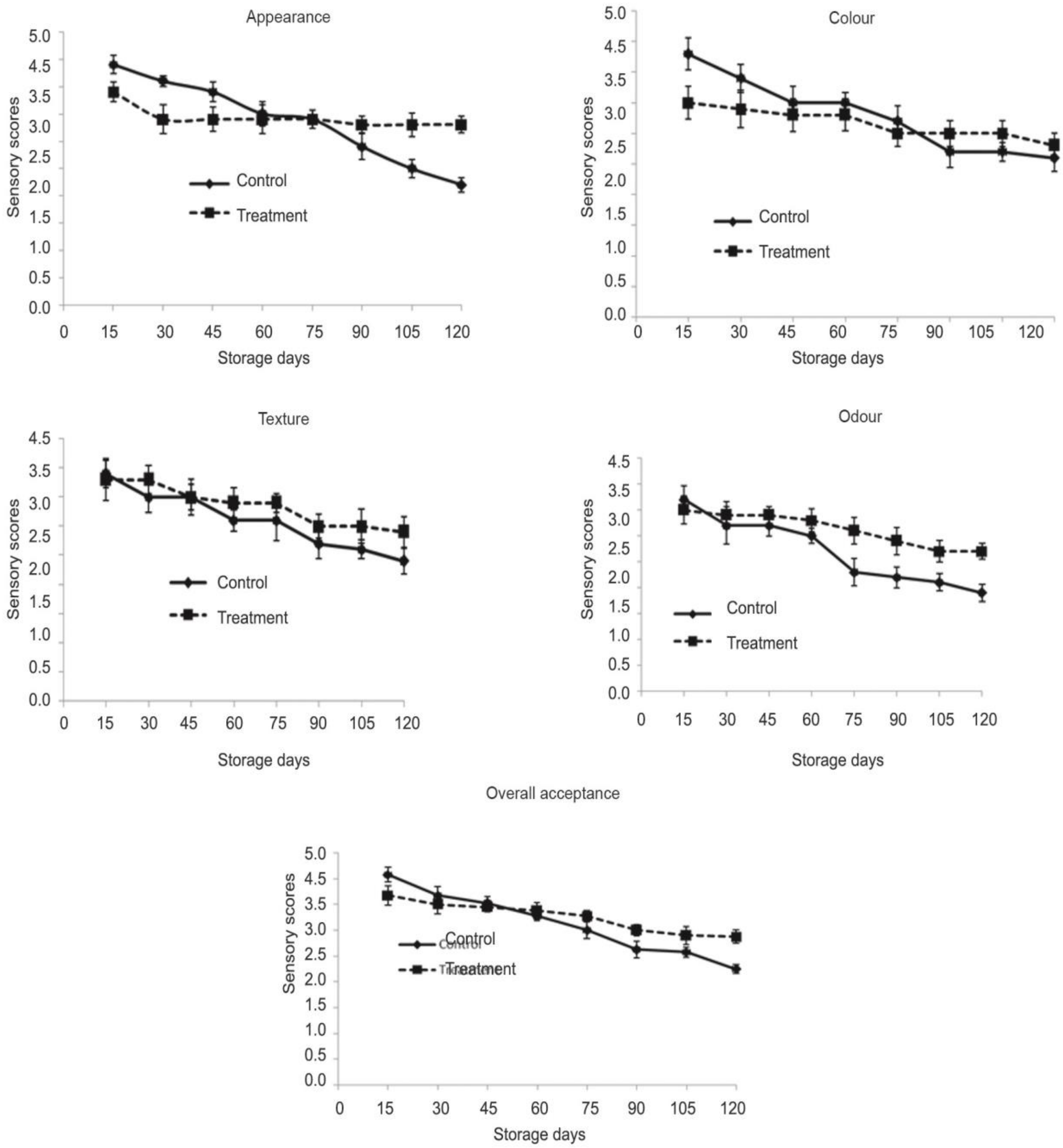

Fig. 1 Calculation of shelf life of abon based on TBA analysis

Fig. 2 Good Quality Shidal after 90 days of storage under refrigerated condition.

Fig. 3 Shidal after 12 days in storage

It was observed that low temperature storage of shidal had a positive effect in extending shidal shelf life. Shidal stored at low temperatures shows fewer fluctuations in the scores of all sensory parameters indicating stable shidal quality during storage**.** The product remains acceptable for up to 90 days of storage with an overall acceptability score of >3.0. Shidal after 90 days of Storage in refrigerated condition is shown in **Fig.2** These products are available in the northeastern part of India, indeed do not have proper packaging and preservation methods and lose their distinctive flavor in a short time after being consumed out of mutka.

Conclusion

In the first processed perikanan is in the research sambal stingray smoke using glass jar packaging has a long shelf life. Dengan variations of dry cooking methods with the addition of cooking oil the quality of the aroma is best (the aroma is close to fresh sambal) and has the longest shelf life of 197.96 hours or equivalent to 8 days. Then in the second process is to compare fish oil stored in glass bottles and plastic bottles. The number of peroxides is high so the product is not durable to store long. And the result of the number of peroxides obtained is fish oil stored in plastic bottles damaged on the twentieth day with a peroxide content of 36.69meq / kg which with the same amount of peroxide content in the glass bottle on the thirtyth day. Thus, fish oil stored in glass bottles is betterquality. And the next fishery process is abon of smoked stingrays by comparing using aluminum foil packaging with glass bottles. Using TBA's military analysis, fish abon using glass bottle packaging produces the longest shelf life of 194 days in a temperature of 30^o C. And in the last process that is shidal with storage in the Low temperatures have a longer shelf life. Shidals stored at low temperatures are more stable during the storage period. The product remains acceptable for up to 90 days of storage with an overall acceptability score of >3.0.

Of the four fishery processed that use a variety of packaging such as plastic bottle packaging, aluminum foil, and glass bottles, the use of glass bottle packaging is considered better to maintain quality and avoid decreasing the quality of fishery processed products. Glass bottle packaging has nonpermeable properties that do not allow any liquid or gas to enter through it which can cause contaminated food.

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