Packaging of Fresh Non-Fish Biological Resources: Crustacean, Molluscs and Seaweed (a Review)

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ABSTRACT

One of the efforts to maintain food security is the use of packaging. Food packaging is very important with the aim of maintaining its shelf life and maintaining its quality. Non-fish biological sources are all types of organisms other than fish which all or part of their lives are in the waters, including crustaceans, molluscs and seaweed. The existence of a container or wrapper can help prevent or reduce damage, protect the product in it, protect against the dangers of pollution and physical disturbances (friction, impact, vibration). Non-fresh fish packaging must have a principle that can maintain its quality well into the hands of consumers. The most important properties of the packaging include gas and water vapor permeability and the surface area of the packaging. Packages with good gas resistance and smaller surface area lead to a longer shelf life of the product.

Keyword: - *Packaging, Crustacea, Mollusc, Seaweed*

1. INTRODUCTION

Packaging is a process of wrapping, housing or packing a product using certain materials so that the product in it can be accommodated and protected. While product packaging is the wrapping part of a product that is in it. This packaging is one way to preserve or extend the shelf life or age of the food products or food contained therein.

Packaging is a container or media used to wrap and protect products from insects such as ants, physical contact and contamination with hazardous or toxic materials. Product packaging aims to protect the product from the effects of oxidation and prevent contamination with outside air.

One of the efforts to maintain food security is the use of packaging. Food packaging is very important with the aim of maintaining the shelf life and maintaining quality, so that food resilience can be maintained as an effort to maintain food security. An example of a food that has a low shelf life and is good for packaging is fish. Fish is a food that is favored by the world community because of its nutritional content which is good for the body, especially protein content. However, due to the nature of fish meat which has a high water content, around 70-80% of the body weight of the fish, it makes fish susceptible to being invaded by microbes that can make fish meat quickly decay. Thus the fish should be packaged properly.

1. FRESH NON-FISH BIOLOGICAL RESOURCES PACKAGING

2.1 Definition of Non-Fish Biological Resources Packaging

Packaging is the activity of designing and manufacturing a container or wrapper as a product [1]. Non-fish biological sources are all types of organisms other than fish which all or part of their lives are in the waters such as crustaceans, mollusks and seaweed. According to [2] fresh fish is fish that has the same characteristics as live fish, in terms of appearance, smell, taste, and texture. So it can be concluded that non-fresh fish packaging is an activity to wrap non-fish fish products that have just died to protect the products inside.

The existence of a container or wrapper can help prevent or reduce damage, protect the product in it, protect against the dangers of pollution and physical disturbances (friction, impact, vibration). In addition, packaging serves to place something so that it has forms that make it easier for storage, transportation and distribution.

According to [3], in general, packaging has several functions, namely:
1. Accommodate the product.
2. Protect and preserve the product.
3. As product identity.
4. Protecting bad influences from outside.
5. Expanding the use and marketing of the product.
6. Increase the attractiveness of potential buyers.
7. Means of information and advertising.

Packaging also has certain requirements, including:
1. Must be able to protect the product
2. Must be able to protect against physical damage
3. Easy to open/close, easy to handle and easy to transport and distribute.
4. Can show the identity, information and appearance of the product clearly in order to accommodate the product, protect and preserve the product.

Packaging can be classified based on the structure of the packaging system, namely:
1. Primary packaging: packaging that directly accommodates food ingredients
2. Secondary packaging: packaging that serves to protect the primary packaging.
3. Tertiary packaging: packaging after primary and secondary packaging, which serves as a protection during transportation.

2.2 Packaging Principle of Fresh Non-Fish Biological Resources

Quality assurance is very important in every technological process. If these requirements are not met, as a result, everything that is done during processing such as packaging will be wasted, which can cause serious economic losses. Non-fresh fish packaging must have a principle that can maintain its quality well into the hands of consumers. The following are the principles of packaging for non-fresh non-fish biological sources:
1. Keep the product below 0^{o}C and above the freezing point
2. Reduce dehydration
3. Reduce fat oxidation
4. Reduces damage by microbes
5. Prevents permeation of odor-causing compounds
6. Provides standard mechanical strength to reduce handling damage

2. FUNCTION AND MECHANISM OF FRESH NON-FISH PACKAGING

3.1 Function of Fresh Non-Fish Packaging

The most basic function of packaging is to contain and protect product from damage, making it easier to store, transport and marketed [3]. In general, the function of packaging in food ingredients is:
1. Accommodate the product during distribution from producer to consumer, so that the product is not scattered, especially for liquids, pastes or granules

2. Protect and preserve products, such as protecting from ultraviolet rays, heat, humidity, oxygen, impact, contamination from dirt and microbes that can damage and degrade product quality.
3. As a product identity, in this case the packaging can be used as a means of communication and information to consumers through the labels on the packaging.
4. Improving efficiency, for example: facilitating counting (one package contains 10, 1 dozen, 1 gross and so on), facilitates shipping and storage. This is important in the world of commerce.
5. Protecting bad influences from outside, Protecting the bad effects of the products inside, for example if the packaged product is a product that has a strong smell, or dangerous products such as hard water, toxic gases and products that can transmit color, then by packaging this product you can protect other products in the vicinity.
6. Expanding the use and marketing of products, for example, sales of soy sauce and syrup have increased as a result of the use of plastic bottle packaging.
7. Increase the attractiveness of potential buyers
8. Information and advertising facilities
9. Provide comfort for the user.

The 6th, 7th and 8th functions are additional functions of packaging, but with increasing competition in the food industry, these additional functions are even more highlighted, so that the appearance of the packaging must be really attractive to potential buyers, by making:
1. Prints that are multi-colored and shiny, so attractive and luxurious impression
2. Can be impressive containing quality and expensive products
3. The technical design of the container makes it easy for users
4. The technical design of the container always follows the latest techniques so that the packaged products seem to follow the latest developments.

In addition to the above functions, packaging also has an important role in the food industry, namely:
1. Identification of identity / product identity.
2. Product decoration.
3. Monitor device.
4. Promotional media.
5. Extension media or instructions on how to use and benefit the products contained therein.
6. For the government, packaging can be used as an effort to protect consumers.
7. For consumers, packaging can be used as a source of information about the content/product, and this is needed in making a decision to buy the product or not.

3.2 Mechanism of Fresh Non-Fish Packaging

The following is an example of a packaging mechanism for non-fresh fish products, namely frozen shrimp packaging based on the National Standardization Agency (SNI 01-2705.3-2006):

1. Reception
a) Potential hazards: contamination of pathogenic bacteria, poor quality of raw materials.
b) Objective: to obtain raw materials that are free of pathogenic bacteria and meet quality requirements.
c) Instructions: raw materials received at the processing unit are tested organoleptic, to determine their quality.
The raw materials are then handled carefully, quickly, carefully and sanitary with a maximum product temperature of 5°C.

2. Washing 1
a) Potential hazards: contamination of pathogenic bacteria and deterioration of quality.
b) Purpose: remove the dirt attached to the shrimp.
c) Instructions: put the shrimp into the basket and then wash it with cold running water and do it quickly, carefully and in a sanitary manner to maintain a maximum product temperature of 5°C.

3. Cutting head or without cutting head
a) Potential hazards: contamination of pathogenic bacteria, poor quality of raw materials.
b) Objective: to obtain raw materials that are free of pathogenic bacteria and meet quality requirements.

c) Instructions: raw materials received at the processing unit in whole form shall be cut off the head. Cutting the head is done carefully, quickly, thoroughly and sanitary with a maximum product temperature of 5°C.

4. Washing 2
a) Potential hazards: contamination of pathogenic bacteria and deterioration of quality.
b) Purpose: remove the dirt attached to the shrimp.
c) Instructions: put the shrimp into the basket and then wash it with cold running water and do it quickly, carefully and in a sanitary manner to maintain a maximum product temperature of 5°C.

5. Sorting
a) Potential hazards: deterioration of quality, contamination of pathogenic bacteria.
b) Objective: to obtain the appropriate quality, type and size and free from contamination by pathogenic bacteria.
c) Instructions: Shrimp are separated based on quality and size. Sorting quality is done organoleptic. Sorting is carried out carefully, quickly, thoroughly and sanitary with a maximum product temperature of 5°C.
6. Weighing
a) Potential hazards: contamination of pathogenic bacteria and deterioration of quality and underweight.
b) Objective: to get the weight according to the expected size and free from pathogenic bacteria.
c) Instructions: put the shrimp into a plastic basket and then weighed according to the specified weight. Weighing is done quickly, carefully and sanitary with a maximum product temperature of 5°C.

7. Washing 3
a) Potential hazards: contamination of pathogenic bacteria and deterioration of quality.
b) Purpose: remove the dirt attached to the shrimp.
c) Instructions: put the shrimp into the basket and then wash it with cold running water and do it quickly, carefully and in a sanitary manner to maintain a maximum product temperature of 5°C.

8. Compilation
a) Potential hazards: contamination of pathogenic bacteria, deterioration of quality and untidy arrangement.
b) Objective: to get a neat arrangement of shrimp and free from pathogenic bacteria.
c) Hint: the prawns are arranged in the freezing pan one by one. The preparation process is carried out quickly, carefully and sanitary with a maximum product temperature of 5°C.

9. Freezing
a) Potential hazards: partial freezing and drip loss.
b) Purpose: to freeze the product to a central temperature of –18°C quickly and not result in drying of the product.
c) Instructions: Shrimp that have been arranged in a freezing pan, freeze in a freezer until the fish's center temperature reaches a maximum of –18°C within a maximum of 4 hours.

10. Welding
a) Potential hazards: contamination of pathogenic bacteria and deterioration of quality.
b) Purpose: to coat the shrimp with ice water to prevent drying during storage.
c) Instructions: frozen prawns are then sprayed with cold water. The welding process is carried out quickly, carefully and sanitary by maintaining a maximum shrimp center temperature of –18°C.

11. Packing
a) Potential hazards: contamination of pathogenic bacteria and mislabeling.
b) The purpose of protecting the product from contamination and damage during transportation and storage and according to the label.
c) Instructions: shrimp that have been released from the freezer pan, then put into plastic and labeled inner cartons. The packing process is carried out quickly, carefully and sanitary by maintaining a maximum center temperature of -18°C.

3. TYPES OF FRESH NON-FISH BIOLOGICAL RESOURCES COMMONLY PACKAGED

4.1 Crustaceans

Crustaceans are aquatic animals found in seawater and fresh water. Crustaceans have a hard shell (shell) due to the presence of calcium carbonate deposits in the cuticle. All or part of the body segment contains an appendix that is originally biramous. Breathe with gills or the entire body surface. Antenna glands (green glands) or maxillary glands are excretory organs. Some examples of crustaceans, sure are prawns, crabs, lobsters and the like.

One of the fishery products which is one of the largest crustacean species in Indonesia is shrimp. Shrimp is a food ingredient that has high value and is loved by many people, both at home and abroad. The assessment is based on the commercial value and nutritional value. Not a few requests for products in the form of fresh shrimp both in Indonesia and abroad, therefore the handling method must be considered so that the shrimp are not damaged or rotten when sent, therefore one of the handling methods is freezing.

The basic principle of freezing is a way of preserving food by freezing the material at the freezing point of the food. Along with the freezing of some of the water content of the material or with the formation of ice, the availability of water decreases, as a result the activities of enzymes and micro-organisms can be inhibited or stopped which in turn can maintain the quality of the food. Freezing can maintain the taste and nutritional value of foodstuffs better than other methods, because low temperature preservation, namely freezing can inhibit microbial activity, prevent chemical reactions and enzyme activity that can damage the nutritional content of foodstuffs.

The production process for handling frozen shrimp is good at a fish processing company, that is, what must be done is starting from receiving raw materials, sorting, soaking, weighing, washing, preparing, freezing, glazing, packaging and labeling, cold storage, export. Receipt of raw materials is the process of receiving raw materials from various regions or suppliers [4]. Here is the description.

1. The process of receiving raw materials (receiving). The process is the initial stage of all processes in processing, where the raw materials that have been received from suppliers, both cultured shrimp and other caught shrimp are directly brought to the company to be processed into products according to the buyer's request. Fresh prawns outside the factory are in fiberglass or plastic tubs that are given ice and then immediately unloaded in the reception room. The acceptance of these raw materials must be controlled by experts in their fields.
2. Sorting. Sorting is to group shrimp based on the size range needed or desired. Sorting is done by manpower which includes sorting quality, size and color.

3. Weighing. Weighing is a weighing carried out to determine the weight, size and number of shrimp in a container containing frozen shrimp products. The purpose of weighing is, to find out how many shrimp will be frozen shrimp products that are ready to be frozen, in this weighing process the cold chain is kept in mind at each weighing table coated with crushed ice so that the quality of the shrimp waiting to be weighed is maintained, the temperature used is 2º C.

4. Weighing. The weighing process is carried out by washing with water mixed with ice and chlorine 25-35 ppm. Washing is done by flushing once, after that the raw material is dipped in chlorine water with a capacity of 25-35 ppm and then the raw material is re-dipped into plain water, so that shrimp that contains a lot of chlorine can be washed, the standard washing water temperature is 0-3°C.

5. Preparation. Shrimp that have been weighed are then arranged in the preparation room, shrimp are arranged in the inner pan by employees in the preparation section, preparation is carried out based on the weighing results so that the size of the shrimp in one inner pan is uniform. The preparation is done carefully so that the texture of the shrimp is not damaged. The stage of preparing the shrimp in the pan must be in accordance with the rules. This rule depends on the size of the shrimp.

6. Shrimp that have been arranged into a pan are then given ice water at a temperature of <5°C until full, then covered with a pan cover covered with plastic block. The provision of ice water aims to prevent dehydration and discoloration of the shrimp, if the shrimp have been arranged on a plate then the CPF is tightly closed. Freezing time on CPF is 4 hours at -40°C.

7. Glazing. Shrimp that have been frozen for 4 hours and then in the next process, namely the glazing process, which is to prevent oxidation, dehydration and improve appearance because a uniform thin layer of ice is formed, Glazing

is done by dipping the block shrimp into a tub containing 1 cold water. Fruit and water spray from a paralon pipe that is given a hole.

8. Packaging and labeling. The next process after glazing is packaging and labeling before this product is put in cold storage. This method of packaging and labeling is by first putting the product into a clear plastic block and then checking the inner carton by looking at the expired code, data and size. This packaging aims to protect the product from the risk of damage to physical defects, facilitate product identification, facilitate distribution and also beautify the appearance of the product.

9. Cold storage. Packaging and labeling are completed and then the product is put into a cold storage which is the last storage of the product before being exported, where the product is stored by arranging according to its size, this is done so that when the goods are sent, the officer on duty will have no trouble finding the product in question. In addition, the method of preparation here must be considered because if the method of preparation is not according to standards, it will result in frozen products because they can damage the packaging and even the products inside are crushed by other products. The purpose of storing shrimp in cold storage is to maintain the condition of frozen shrimp so that while waiting for the marketing process they are fresh and still fresh.
10. Export. Export is an activity where products that have been processed and finished packing are then ready to be marketed or exported to destination countries. The temperature of the container that will carry the product must have a standard temperature of -18°C, because the product reaches the buyer's hands must be fresh according to the buyer's request standard.

According to the Indonesian National Standard (SNI), the packaging of vannamei shrimp is as follows.
1. Packaging
a) The plastic bag is filled with water as much as 1/4 (quarter) - 1/3 (third) of the volume of the bag.
b) Vannamei shrimp seeds with a certain density are put in a plastic bag and then oxygen is added.
c) Transport time, density, water temperature and the ratio of water to oxygen according to each number of shrimp.
d) The end of the plastic bag is tied with a rubber band.

2. Packing
a) The plastic bag containing the seeds is put into a styrofoam box that has been lined with a plastic bag on the inside.
b) Put 2 plastic bags of ice cubes - 3 plastic bags lined with paper that absorbs water and placed between plastic bags into a styrofoam box.
c) The styrofoam box is closed and glued with duct tape.
d) The Styrofoam box and its contents are weighed (calculated) between 17 kg - 19 kg.
e) The styrofoam box is wrapped in a large plastic bag and then glued using duct tape on both sides.
f) The closed box is labeled.

Shrimp freezing is one of the processing of fishery products that aims to preserve food based on the inhibition of the growth of microorganisms. Resist chemical reactions and enzyme activity. Freezing can be done by various methods, one of the methods used is the IQF (Individual Quick Freezing) method. The IQF method is the freezing of materials in a short time. The benefits of the IQF method are that it prevents bacterial damage, ensures fast handling, results in better appearance and optimum utilization of freezer space.

4.2 Molluscs

Mollusca comes from the Roman molis which means soft [5]. The phylum Mollusca includes snails, clams, squid, octopus and cuttlefish. The shape is bilaterally symmetrical, not segmented, some of them have a shell of lime and have ventral legs. One type of mollusk is squid. Squid (*Loligo* sp.) belongs to the class Cephalopoda [6].

Although it belongs to the phylum molluscs, squid is not like other types of mollusks. Squid, cuttlefish, and octopus do not have an outer shell. The squid has a thin and clear skeleton inside its body [7]. Squid packaging commonly used is vacuum packaging.

The packaging system with vacuum gas (pressure less than 1 atm) carried out by removing oxygen from the packaging [8], is known as vacuum packaging. Vacuum packaging is made by placing the product in plastic,

followed by pumping air out and then closing it and after that the plastic packaging is hot-glued [9]. The process of vacuuming in the packaging aims to reduce the air content in the package, including oxygen. Low oxygen content is proven to be able to inhibit microbial growth. According to [10] the low oxygen contained in the packaging resulted in the inhibition of the growth of microbes such as Pseudomonas, Moraxella, Acinetobacter, Flavobacterium and Cytophaga.

Plastic packaging is packaging that is flexible, transparent, food grade/nonfood grade, not easily broken, lightweight so it does not increase transportation costs, easy to handle, can be colored and shaped according to taste, resistant to corrosion, can be colored and shaped according to taste, not resistant heat, some can contaminate the product, non-biodegradable. Examples of squid crackers and squid rengginang.

According to [11], in general the plastic used for fresh vacuum packaging is polyvinyledene chloride (PVDC). This plastic has the characteristics of low oxygen permeability and is not easy to shrink. High barrier ability to oxygen such as PVDC is required for vacuum storage techniques. Other plastics that can be used are PVDC-cellophane, polyethylene, polypropylenes or polyester.

Polyethylene (PE) is a thin single layered plastic that is widely used in the flexible packaging industry. HDPE (High Density Polyethylene) packaging is one type of plastic that is popular among the public. This plastic is produced at low pressure and temperature (50 – 70°C), is resistant to temperatures of 120°C, is watertight and airtight [8]. According to [12], HDPE plastic is able to provide the best protection against water (moisture), fats and acids and bases.

Mollusca packaging in a retort pouch can withstand sterilization temperatures; have high shelf life; strong; not easily torn/punctured; easy closing technique; example: PP-Alufo-PET. Use of aluminum for food packaging. Examples of shredded squid and lorjuk clam shell chips.

Glass as a packaging material has advantages and disadvantages. The advantages of glass packaging include: Impervious to water, gases, odors and microorganisms; Inert and unable to react or migrate into foodstuffs; The filling speed is almost the same as in cans; Suitable for products subjected to hermertic heating and closing; can be closed again after opening. Weaknesses of glass packaging include: heavy so that transportation costs are expensive; resistance to shattering and low thermal shock; potential hazard, namely from broken glass. For example squid sauce and squid sauce.

4.3 Seaweed

Seaweed is a type of large algae (macroalgae) which belongs to lower plants and belongs to the thallophyta division. Seaweed has similar morphological properties, because seaweed does not show any difference between roots, stems and leaves even though they are actually different. These forms are actually just thallus. The shape of the 5 seaweed thallus varies, among others, round like a tube, flat, flat, and round like a bag and hair and so on [13].

Handling is a pre-harvest activity to get good quality raw materials according to standards. Therefore, to get maximum results, pre-harvest activities will be able to maximize the quality of seaweed both from the quality of raw materials and selling value.

1. Harvesting
Seaweed that is ready for harvest, which is cultivated using the FAD method (rope), is harvested by pulling the FAD to the beach. The seaweed is removed from the ties, the shoots are picked to be replanted, then tied again to FADs as new plants. The optimum harvest age is 40-45 days, this is highly recommended because at that age the carrageenan content is very optimum.

2. Washing and Soaking
Harvesting should be done from noon. The harvest is washed with sea water to remove adhering impurities such as mud, salt, etc., so that the seaweed becomes clean. Furthermore, the seaweed was immediately immersed in 0.1% KOH alkaline solution until submerged and left in contact with the alkali overnight. The purpose of soaking using an alkaline solution is to get the maximum carrageenan. The next step is in the morning the seaweed is removed and washed with fresh water until it is clean and neutral.

3. Drying and Sorting
Neutral seaweed is dried using a seaweed dryer machine or it can also be done by drying, it can be carried out around the beach until it reaches a certain dryness (optimum) usually 20-30%. A simple drying mat is made of plastic material, so that it dries quickly and is cleaner, it can also be used with diesel fuel combined with a stove and to maintain the quality of drying it must be dried on a parachute.

4. Packaging and Storage
After the seaweed is dry, it is packaged in net or plastic sacks. To be more efficient where dried seaweed can be pressed (printed) into solid boxes per Kg or 5 kg so that subsequent packaging becomes more efficient in wooden boxes and is maintained so that air circulation is good. This is because if the air circulation in the room and packaging is not good, there will be a fermentation process, the seaweed will become musty and mold/mushroom will arise. Which consequently will reduce the quality of seaweed.
Edible packaging is bio plastic from seaweed that can be eaten and decomposed in nature, unlike ordinary plastic which pollutes the environment, our products are very environmentally friendly because they are made from natural ingredients without containing harmful chemicals. The packaging of this seaweed can be made as edible or biodegradable packaging, in the form of sachets / sheets. After unused, this packaging can be thrown into the ground and become fertilizer for plants, and it is safe to throw it into waterways.

4. THE FACTORS AFFECTING FRESH NON-FISH PACKAGING

Packaging has a very big role to prevent and slow down the occurrence of enormous damage to food ingredients. The type of packaging used for packaging materials has a major influence on the length of storage of foodstuffs, to slow down the deterioration of the quality in the food. These factors, for example, are the state of nature (the nature of food), the mechanism of change (sensitivity to water and oxygen), and the possibility of chemical changes (internal and external). Other factors are the size of the packaging (volume), atmospheric conditions (especially temperature and humidity), and the durability of the packaging during transit and before use against the entry and exit of water, gas, and odors [14]. The most important properties of the packaging include gas and water vapor permeability and the surface area of the packaging. Packaging with good gas inhibition and smaller surface area causes the product to have a longer shelf life [12].

Factors that affect the shelf life of packaged foodstuffs are the natural state or nature of the food and the mechanism by which changes take place, for example sensitivity to water and oxygen and the possibility of internal and physical chemical changes, the size of the packaging in relation to volume, atmospheric conditions, especially temperature and the humidity at which the packaging can withstand during transit and prior to use, and the overall packaging against the entry and exit of water, gases, and odors including gluing, sealing, and folding of parts [15].

Factors that need to be considered in food packaging include the nature of the food, environmental conditions, and the type of packaging material used. According to [8], the factors that affect the deterioration of food materials in connection with the packaging used can be divided into two main groups, namely:

1. Damage is determined by the nature of the product so that it cannot be prevented by packaging alone (physical, biochemical and chemical and microbiological changes).

2. Environmentally dependent and almost entirely controllable damage by the packaging used (mechanical damage, changes in the moisture content of foodstuffs, absorption and interaction with oxygen, loss and unwanted taste gain).

5. CONCLUSION

Packaging is a process of wrapping, housing or packing a product using certain materials so that the product in it can be accommodated and protected. Product packaging aims to protect the product from the effects of oxidation and prevent contamination with outside air. Packaging of food is very important with the aim of maintaining its shelf life and maintaining its quality, so that food resilience can be maintained as an effort to maintain food security. Fish is a

food that is favored by the world community because of its nutritional content which is good for the body, especially protein content. So that good packaging is needed so that the quality of fish from producers to consumers is needed. This is a challenge for us to create packaging with better quality.

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