A Review on Refrigeration System In The Transportation of Live Shrimp

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ABSTRACT

The production of aquaculture in Indonesia is currently dominated by shrimp, so that shrimp is used as a mainstay commodity in the fisheries sector which is generally exported in frozen and live forms. Transport of live shrimp is important because it can be developed in the industry to produce export commodities. To support these activities, it is important to develop a refrigeration system that is indispensable for the survival of shrimp during the transportation process. There are many techniques used for the transportation of aquatic products that have been developed to increase their usefulness in life and improve product quality. The design of a more suitable method for transporting live shrimp was evaluated based on the different methods in containers, aerators and pure carbon dioxide.

Keyword: - *Transportation system, Live shrimp, Container packaging, Aerators, Export commodities*

1. INTRODUCTION

Fish farming activities have developed rapidly in order to improve the food production system over the last few years, so that several fishery products have been widely known by the public. The production of aquaculture in Indonesia is currently dominated by shrimp, so that shrimp is used as a mainstay commodity in the fisheries sector which is generally exported in frozen and live forms. Shrimp is one of the special fishery products, has a specific aroma and has high nutritional value. In addition, shrimp meat contains many essential amino acids that are important for humans, such as lysine, histidine, arginine, tyrosine, tryptophan, and cysteine [1].

The potential for shrimp production in Indonesia from year to year continues to increase. So far, the potential for Indonesian shrimp has increased by 7.4 percent per year on average. Meanwhile, Indonesia is one of the largest shrimp exporting countries in the world with an export value of between 850 million and 1 billion US dollars per year [2].

The type of sea shrimp that is categorized as having important economic value of the many species found in Indonesian waters is tiger shrimp (*Penaeus monodon*). This is due to the delicious and savory taste of tiger prawns and its very high nutritional content. Tiger prawn meat contains high protein. According to [3], the protein in fresh shrimp meat is 85.81%. Shrimp also contains quite complete essential amino acids. Another advantage of tiger prawns is that they contain only a small amount of fat.

Consumer interest in tiger prawns is not limited to the delicious taste of the meat. Waste from the body parts of tiger prawns is also a special attraction. The head and shell (carapace) can provide significant added value. Shrimp shell waste can be used as raw material for various industries, such as the pharmaceutical, cosmetic, food and textile industries. One of the contents of shrimp shells that can be used as industrial raw materials is chitin and chitosan (compounds derived from chitin). Shrimp shell contains 10-60% chitin, of its dry weight. The main markets for chitin in the world are Japan, the United States, the United Kingdom, and Germany.

Based on some of the advantages possessed by the tiger prawns, it is necessary to equalize the distribution of shrimp, namely by carrying out transportation activities. Transport of live shrimp is important because it can be developed in the industry to produce export commodities. To support these activities, it is important to develop a refrigeration system that is indispensable for the survival of shrimp during the transportation process.

2. TRANSPORTATION OF LIVE SHRIMP

2.1 Transportation System

Transport of live shrimp is an act of moving live shrimp from one place to another in which measures are given to maintain a high degree of survival of fish to the destination. Based on this statement, the transportation of live shrimp is basically forced to place the shrimp in an environment different from their original environment accompanied by sudden changes in environmental characteristics. Live shrimp to be transported are required to be in good health and not disabled to reduce the chance of dying during stunning and transportation.

According to [4], most of the aquatic species are transported for local and international market needs every day. Transportation to the market can occur starting from a short distance of 1 hour or as long as 30 hours from the cultivation site. Transport of live shrimp under these conditions can cause stress, which often results in high mortality rates or very weak fish.

Transportation is divided into two ways, namely the wet system and dry system. The wet transportation system demands the same medium as the previous fish habitat, namely water and sufficient oxygen [5]. Wet system transportation can be done in a closed or open way. In a closed way, the fish are transported in a closed container with all the necessities of life for the fish in the transport package. The container used can be a plastic bag or other tightly closed packaging. In the open way, fish are transported in open containers and a continuous supply of oxygen is provided throughout the journey [6]. The dry system is the transportation of live fish using non-water media [7]. In this system, fish are conditioned in conditions of low metabolism, respiration and activity [5]. Based on this, it is necessary to stun the fish so that their metabolic rate is at a basal level.

2.2 Shrimp Fainting Technology [8]

Shrimp fainting is carried out in several stages. Shrimp to be fainted were accommodated in a conditioning bath for 12 hours without being fed. Shrimp are fasted for half a day to regulate their metabolic processes. The water in the conditioning bath is adjusted to the acidity, salt content, normal temperature of the water where the shrimp live.

The fish are transferred to the fainting tub, the number of fish in the fainting tub is adjusted to its capacity. To maintain the dissolved oxygen content in the water, an aerator is installed in the fainting tub. The fainting body is connected to the fainting machine. The fainting machine uses an electrically regulated water chiller.

Furthermore, the temperature and time are gradually lowered for one to two hours, until the fish or shrimp pass out. When unconscious, the position of the fish or shrimp is tilted. The fainting temperature starts at room temperature until it reaches a critical temperature for shrimp or fish. This critical temperature ranges from 5 to 15.5^{o}C. Automatic temperature and time control using a micro controller that is applied to the Water Chiller water pump or compressor in the fainting machine. After fainting, the fish or shrimp are left at a predetermined temperature for 10 until 20 minutes. This treatment is to get a perfect state of fainting. Prawns are then removed and put in packing box. Shrimp are laid in a row on a stabilizing medium. Fisheries entrepreneurs can choose a stabilizing medium such as fish wet saws or unconscious shrimp. Fish or shrimp unconscious in containers can be brought to their destination using land,

sea or air transportation. One day later the fish can be revived. The trick is simple, just put the fainted fish or shrimp in the water.

3. REFRIGERATOR SYSTEM FOR LIVE SHRIMP TRANSPORTATION [9]

There are many techniques used for the transportation of aquatic products that have been developed to increase their usefulness in life and improve product quality. Although not much research has concentrated on the transportation of life without the use of water. Many studies aim to examine good packaging, oxygen levels, and carbon dioxide consumption. Based on European Patents, a live fish transport system was developed using moisture permeable packaging that produces oxygen and uses pure carbon dioxide.

Many companies design more suitable methods for the transportation of live fish and evaluate the different methods in containers, aerators and pure carbon dioxide. All of them managed to improve the quality of the product. Silkstream designs systems for the transportation of live fish, which are now widely used worldwide. The system takes place during fish transportation, regulates coils and continuous movement, so that fish do not come into contact with rough surfaces, this can reduce stress. Although this system is submerged in water for fish transportation, the information can be used as a comparison parameter for research on live shrimp transportation.

3.1 Containers Foam

The systemchosen is a container designed for storage and transportation of live lobsters. Designed by Rose Seafood Industries, Inc. and has been redesigned several times to improve its comfort (Figure 1). The container is adjusted to the body shape of the animal to be transported.

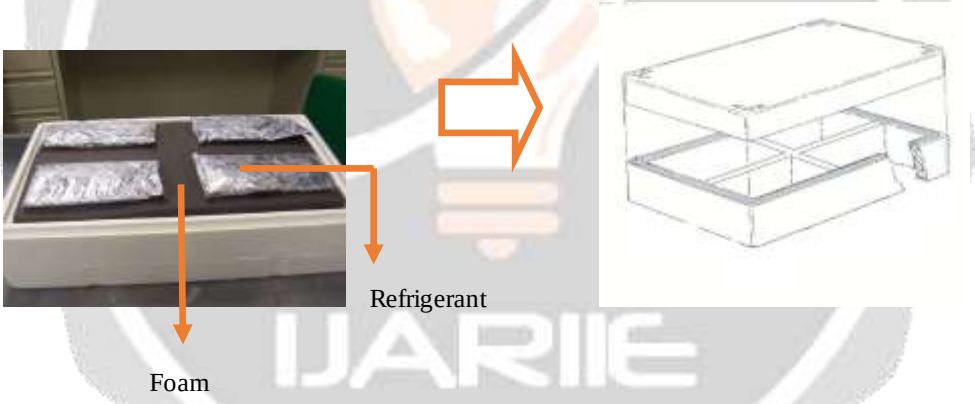

Fig -1: Location of Foam Layers and Refrigeration Equipment [9]

3.2 The Measurement of Total Thermal Load

The total thermal loading on the system indicates that the temperature in the system can be adjusted to the desired range. The temperature in the system obtained the optimum level for shrimp resistance is 15^{o}C. This refrigeration technique can be used in aircraft cargo depending on pre-cooling conditions, handling, and the shortest time to adjust to the conditions.

Shrimp is transported alive, so it has a time limit in tolerable conditions. The respiration process of shrimp during preparation uses energy and produces carbon dioxide. These changes will affect the survival of the shrimp and cannot be stopped, but can be slowed down during transportation. A critical condition during the isolation and design of refrigeration systems for loading containers is the time the container is exposed to sunlight, while waiting to be transported.

4. DETECTION OF POTENTIAL HAZARDS IN LIVE SHRIMP WITH HACCP SYSTEM

The HACCP (Hazard Analysis Critical Control Points) system is needed to guarantee the shrimp to be exported. These critical points are identified from cultivation to processing sites. The tipping point at the cultivation level is likely to come from contamination of the culture water and the environment in which it lives. Care must be taken at each phase of raw material processing [10].

Shrimp that will be transported from the farm to the delivery place, is packed well in the loading box. Some places of delivery do not pay attention to hygienic conditions, so that it becomes a critical point in fish transportation.

Critical points that can cause harm to shrimp, can occur from the place of cultivation to the end of the transportation process. However, each process shows a different risk of contamination. Water quality, harvesting methods and transportation are the main areas for contamination.

According to [11], the standard practice of the shrimp industry must be in accordance with HACCP to ensure product safety and quality. In relation to the interests of food safety, the government and processor exporters have to share perceptions in order to improve product quality, control system for quality standardization, buyer requirements, constant supervision, improve government laboratories and conduct various trainings for workers in the shrimp industry. Testing and monitoring are carried out on all stages of production, quality control, sanitation and hygiene standards adjusted to the food safety provisions of the importing country.

5. CONCLUSIONS

Shrimp is a commodity that has good prospects for development. Based on some of the advantages possessed by shrimp, it is necessary to do an even distribution of shrimp, namely by carrying out transportation activities. Transport of live shrimp is important because it can be developed in the industry to produce export commodities. To support these activities, it is important to develop a refrigeration system that is indispensable for the survival of shrimp during the transportation process.

There are many techniques used for the transportation of aquatic products that have been developed to increase their usefulness in life and improve product quality. The design of a more suitable method for transporting live shrimp was evaluated based on the different methods in containers, aerators and pure carbon dioxide. The system takes place during fish transportation, regulates coils and continuous movement, so that fish do not come into contact with rough surfaces, this can reduce stress. The total thermal loading on the system indicates that the temperature in the system can be adjusted to the desired range.

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