








# Application of Hygiene and Sanitation in The Hairtail Fish Freezing Industry

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**Abstract.** Food hygiene is carried out by controlling location, equipment, personnel, and food products factors that can cause health problems. One of the foodstuffs that quickly deteriorate so that it requires strict hygiene control is Hairtail fish. The "X" fish processing industry performs freezing to prevent spoilage of Hairtail fish caught by fishermen around the industry. Hairtail fish is easy to decompose because of its high water and protein content, and the impact of natural circumstances. Frozen Hairtail fish is used to meet export demand so hygiene and sanitation in the processing are needed to prevent fish poisoning. The purpose of the study was to obtain an overview of the hygiene and sanitation application to deliver suggestions for efforts to improve hygiene and sanitation in the industry. The descriptive research method was carried out through surveys, interviews, and observations. The results showed that several variables did not meet the principles of hygiene and sanitation, especially for facilities. Employees do not have good knowledge and have not optimally applied the principles of hygiene and sanitation. As a recommendation, efforts are needed to complete the infrastructure and increase employee understanding, which will improve the quality of frozen Hairtail fish.

**Keywords:** Hygiene and Sanitation, Hairtail Fish, Freezing Industry.

## 1 Introduction

Indonesia is an archipelagic country that has a lot of marine natural resources, one of its fishery products is Hairtail fish (*Trichiurus savala*). Hairtail fish was previously a less desirable commodity because the composition of fish meat was less than the bones. The COVID-19 pandemic has forced people to eat foods that can boost their immune systems [1]. The high content of omega in the fish meat can increase endurance, this causes an increase in demand for fish exports. Hairtail fish are exported to several countries in Asia, including Korea, Taiwan, China, and Singapore where exports to these countries are not disrupted despite the implementation of regional quarantine [2].

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Q. D. Utama et al. (eds.), *Proceedings of the 7th International Conference on Food, Agriculture, and Natural Resources (IC-FANRES 2022)*, Advances in Biological Sciences Research 35,  
[https://doi.org/10.2991/978-94-6463-274-3\\_21](https://doi.org/10.2991/978-94-6463-274-3_21)

Hairtail fish is a commodity that quickly deteriorates due to its high water and protein content, which is around 77% [3] and 17.43% [4], respectively. The decline in fish quality is caused by microbial activity, sunlight, and poor handling of workers [5]. These biological and chemical aspects can cause food contamination hazards. One way to maintain quality and prevent contamination of fish is by low-temperature preservation or freezing. Food preservation through the freezing process can be achieved by a combination of two factors, namely the temperature and water activity, where these factors can reduce the rate of chemical reactions, biochemistry, and microbiological activity. The freezing process is carried out by exposing food products at very low temperatures, lowering the product temperature until it reaches its freezing point, then freezing (turning water into ice), and finally lowering the product temperature to the desired freezing temperature. The freezing process aims to reduce the growth of bacteria and the rate of the enzyme reaction by changing the water in the fish's body into ice grains at a temperature of  $-10^{\circ}\text{C}$  or lower [6].

Physical, chemical, and biological contamination can threaten food safety or cause harm to food consumed by consumers. Food safety hazards need to be controlled throughout the food chain. One way that can guarantee food safety is a food safety system to control the production process and is based on the precautionary principle, namely HACCP (Hazard Analysis and Critical Control Point). The application of HACCP should begin with the application of hygiene and sanitation procedures to prevent contamination due to food production or handling operation [7].

Community economic productivity through industrial downstream needs to be done to improve the community's economy and product added value. The presence of the "X" fish processing industry with the main focus on the process of freezing fish has become a driving force for the community's economy with the assistance of the provincial government of the Special Region of Yogyakarta. This industry already has Good Manufacturing Practices (GMP) documents, implemented Sanitation Standard Operating Procedures (SSOP), and obtained Processing Feasibility Certification. This industry has also obtained HACCP category C certification. The increasing demand and expansion of export share to Europe require this industry to increase the HACCP category to B or even A. Based on this, it is necessary to identify problems in the application of hygiene and sanitation to support system improvement in food safety. This study aims to determine the application of hygiene and sanitation in the hairtail fish industry and provide recommendations for improving the application of hygiene and sanitation in the industry.

## 2 Materials and Methods

This research was conducted in one of the fish processing industries in Yogyakarta, Indonesia in May 2021. The tools used for this research were questionnaires, stationery, and cameras for activities documentation. The data required is data on the activity and process of handling fish in the "X" fish processing industry. The data collection method was carried out through a survey method, by following the activities and flow of the Hairtail fish handling processing from the initial stage of receiving raw materi-

als to the final product. In addition, data was collected through observation and interviews. Interviews were conducted with the person in charge of HACCP. The data collection method is descriptive including primary data and secondary data. Primary data includes an overview of the company, facilities and infrastructure, raw materials, production process flow, temperature and time used in processing and storage, as well as label and packaging information. Secondary data is information about employees who become respondents.

### **3 Results and Discussions**

The "X" fish processing industry was established in 2018 and operated in 2019. This industry is managed by an integrated fisheries cooperative engaged in human resource training activities in marine and fisheries, offshore fishing, processing, and marketing of fishery products. The strategic location makes it easy for this industry to get raw materials and distribute processed products. The location selection is supported by fishing grounds and also easy road access. A strategic location can minimize production costs, especially distribution and raw materials [8]. The main activity of the "X" fish processing industry is freezing fish with commodities such as Hairtail fish, tuna, skipjack, and common dolphinfish. The resulting product is frozen whole round (whole fish, without scales, without removing the stomach).

#### **3.1 The Hairtail Fish Processing**

The Hairtail fish processing process begins with the raw materials received. Incoming raw materials come from fishermen or suppliers at fish auction places around the factory. The Hairtail fish were brought using a pickup truck with a Styrofoam box that has been given ice. Temperature checking is done using a thermometer where incoming raw materials can be accepted when the temperature is  $\leq 4$  °C. The next process is sorting to separate fish by type, quality, and size. Quality checking is based on organoleptic properties, namely the smell of fresh fish (free from spoilage) and appearance (bright eyes). After that, the weighing process is carried out and separated based on the weight of the fish. Then the fish are washed using clean water and arranged in a long pan covered with plastic. Fish are arranged without weeding (removal of scales and entrails). After that, the freezing process is carried out using an Air Blast Freezer (ABF) which uses freon as a cooling material [9]. Then the glazing process is carried out to prevent dehydration of the product by spraying water on the fish after the ABF process [10]. In the next process, the fish are wrapped one by one with polyethylene plastic so that they do not stick to one another, then labeling is carried out, and packaged using cardboard. The last stage is stored in cold storage at -25°C. Product delivery is carried out by container truck with a temperature of -20°C which aims to maintain product temperature.

### 3.2 The Characteristics of Industry

The number of employees is 15 workers and divided into three workers handling the sorting process, two workers doing the weighing process, and ten workers in charge of the arrangement process. Most of the employees are residents who live near the industry and have a low level of education. The person in charge of HACCP is an agricultural graduate and has good knowledge of hygiene and sanitation, but not other employees.

### 3.3 The Hygiene and Sanitation

The results of observations on the application of hygiene and sanitation are as follows

**Water Safety.** Water is used in the washing process, cleaning production sites, and equipment. The water used comes from well water with a depth of 60 meters which has been tested beforehand and meets the requirements of clean water quality. The water is not chlorinated and some of the water is also used to produce ice. Ice is a very important requirement in maintaining the quality of fishery products [11]. The ice used in the production process is in the form of flake ice which is produced by the company through an ice machine with a capacity of 2.5 tons/day (1 minute/kg). If the production of flake ice is insufficient, the company buys ice blocks from suppliers with a capacity of about 8-11 tons. The quality of the water for ice blocks obtained from this supplier is unknown.

**Machines and Equipment.** Machines and equipment used in the production process are manual, semi-automatic, and automatic. Manual equipment includes production tables, thermometers, long pans, shelves, baskets, cutting boards, scissors, knives, hand pallets, pallets, and basins. Semi-automatic production equipment including digital scales. Automatic equipment used includes temperature gauges, and Air Blast Freezing (ABF). Equipment maintenance is carried out once a year with oil changes, besides that, cold storage Freon is filled if needed. The electricity used is 6600 VA (cost 7-12 million/month) and is equipped with a generator (only for cold storage).

Monitoring of equipment hygiene is carried out regularly. Equipment control is carried out on a weighing device which is calibrated once per year by the Legal Metrology Standardization Center, Ministry of Trade of the Republic of Indonesia. Washing equipment using water with a chlorine content of 0.5 ppm. Chlorine is used as a disinfectant that can kill microbes [12]. Equipment management does not run optimally, for example after washing, equipment, and containers are dried outside the factory, this can lead to contamination by pests and insects. In addition, the weighing tool is covered in plastic wrap which makes the tool difficult to clean. Sanitation program for the area around the industry is not carried out.

**Cross-Contamination Prevention.** All employees wear boots but do not use special clothes (apron), hair covers, and gloves. Clothing used for the production process is also used outside the process room. There are no locker and changing rooms facilities for employees. Dry warehouse for storing packaging and labels, separate from frozen warehouse for storing final products. Frozen warehouses use storage areas such as plastic pallets and cabinet shelves to prevent contamination.

**Hand Washing Facility, Sanitation, and Toilet.** The company has implemented supervision in sanitation, by providing hand and foot washing facilities before entering the processing room. However, the foot sink is not filled with sufficient water, so it does not meet the requirements for the wet process. The implementation of health protocols to prevent Covid-19 is carried out by wearing masks, providing hand sanitizer, and taking temperature measurements. Handwashing facilities are equipped with soap. The number of toilets is sufficient according to the requirements, namely as many as 4 units. The toilet is equipped with a sink and soap but the conditions are inadequate, where one of the toilets is directly connected to the household kitchen. The construction of this toilet is not feasible because the walls and ceiling use wood material.

**Ingredient-Contaminant Protection.** The factory design is good, according to the process flow, but the factory area is narrow and does not follow the production capacity, causing the production flow is not optimal. The raw materials receiving area is not equipped with a canopy. The canopy is used to avoid sun exposure to raw materials because UV rays can accelerate oxidation which causes rancidity [13]. Light-colored floors and walls are made of materials that are easy to repair and clean. The floor cleanliness is good, flat, and there are no puddles. The wall design has gaps, between the floor and the wall, and the walls and walls do not form a curved angle so it's difficult to clean. There is a door that opens inward, which can lead to the entry of dust and dirt from the outside. Production sites use sliding doors, where the door rails can become a place for dirt and dust to accumulate. The processing area is not ventilated. Ventilation should be designed so that air does not flow from the contaminated area to the clean area [14]. The lamps used are uncovered and there are no procedures for handling fragile materials to prevent product contamination.

The processing flow applies the First In First Out (FIFO) system, which means that the first raw materials received will also be handled first [15]. The washing process is less than optimal due to the condition of the fish arranged in the basket with low water discharge. Drain baskets containing washed fish are placed near the watery floor and there are fish body parts that are in contact with the floor. This should be avoided to prevent cross-contamination. The process of freezing fish is carried out in the ABF room, the size of the room is quite large and the machine starts to operate when the ABF room is full of fish. After the ABF process, the product is removed and put back into the previous process room, for the glazing process. This can pose a cross-contamination hazard.

**Proper Labeling, Storage, and Toxic Substance Utilization.** The packaging used is primary and secondary packaging, respectively plastic and cardboard. The label is placed on the packaging, where the label is an information medium that contains information about the product and is a communication channel for producers to consumers [16]. The label is placed in the primary packaging, containing information on the production code, production date, size, and brand (on request, with or without a brand). The label on the secondary packaging contains grade information based on weight, namely the WPPP grade category is divided into 1-2 ounces; 2-3 ounces; and 3-4 ounces, and the WAAA grade category is divided into 5-7 ounces; 8-9 ounces; and >10 ounces.

The final product of frozen hairtail fish has been packaged in cardboards and then stored in cold storage at -25 °C equipped with a temperature control device. The arrangement of cardboards in cold storage is carried out regularly according to the production code with the FIFO system. Product distribution is carried out after the order quota from consumers is fulfilled. The transport vehicle (container truck) used to transport the product is equipped with a cooler at a temperature of -20 °C to maintain the temperature of the product during shipping [17].

**Administering The Health Condition of Personnel Which Can Lead to Contamination.** The company has a restroom but it does not meet the health requirements. Employees infected with diseases such as influenza, cough, and typhoid are not allowed to come to work. The company does not provide clinic and doctor facilities.

**Pest Extermination in The Processing Unit.** Pest control is done by installing mouse traps, insect control is done by installing plastic curtains and UV lights. The plastic curtains function to prevent insects from entering the processing room [18]. The UV lamp function to trap insect such as flies, mosquitoes, etc. [19, 20], but the UV lamp used in the processing room is not optimal for trapping flies. The UV lamp at the entrance is not working.

### 3.4 Recommendations

Based on the research results, some recommendations that are useful for improving the application of hygiene and sanitation in the "X" fish processing industry are as follows. Washing facilities need to add hot water facilities to dissolve residual fat and support equipment disinfection. It is necessary to employ a maintenance manager to carry out the process of monitoring and evaluating the performance of production equipment and machines used during the production process. Employees must wear hats or head coverings, gloves, and aprons. Toilet facilities must be improved by building separate from the household kitchen. Employee hygiene facilities need to be equipped with hand dryers, changing rooms, and a place for rinsing footwear. Health check facilities and regular health checks for employees need to be established. The door should use a door that is opened by being pushed from the inside to remove air from the inside. Process flows need to be reorganized to prevent cross-contamination.

The process room needs to be provided with Air Conditioner (AC) to control air circulation and the cleanliness of the room air needs to be monitored. Lighting facilities or lamps need to be covered, replacing damaged UV light bulbs.

## 4 Conclusion

The application of hygiene and sanitation in the "X" fish processing industry is quite good but not optimal because there are still activities that have the potential to cause contamination. Implementing improvements need to be made based on recommendations. Improvement requires comprehensive and integrated collaboration to address a wide range of issues including infrastructure, employee behavior change, costs, and management. Improving the application of hygiene and sanitation is an effort to prevent food safety hazards and also has an impact on improving product quality. Future research is to evaluate the application of HACCP in the "X" fish processing industry.

**Acknowledgments.** This study was supported by DIPA APBN (budget) for 2021 of Balai Besar Standardisasi dan Pelayanan Jasa Industri Hasil Perkebunan, Mineral Logam, dan Maritim, Ministry of Industry of Republic of Indonesia.

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