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RESEARCH ARTICLE

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Implementation of Good Manufacturing Practices (GMP) in the processing of dried anchovy (*Stolephorus* spp.) at PT Insan Citraprima Sejahtera, Tuban, East Java

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Abstract

The drying process for anchovy is a preservation method aimed at minimizing spoilage risks in this highly perishable food product by reducing its water content. To ensure safety and quality, Good Manufacturing Practices (GMP) is implemented in dried anchovy processing to prevent or mitigate contamination risks. This study evaluates the implementation of GMP in the processing of dried anchovies (*Stolephorus* spp.) at PT Insan Citraprima Sejahtera, located in Tuban, East Java. A descriptive research approach was utilized, with data collected through observations and interviews. The findings demonstrate that PT Insan Citraprima Sejahtera effectively applies GMP at all stages of dried anchovy processing, as evidenced by well-defined procedural standards, adequate facilities and infrastructure, and rigorous quality control supervision. The resulting dried anchovy products meet the quality standards stipulated in SNI-3461:2019.

Keywords: Good Manufacturing Practice; fish processing; dried anchovy

Introduction

As a maritime nation, Indonesia possesses abundant fishery resources from both capture and aquaculture industries. Among these, anchovy (*Stolephorus* spp.) is a highly valued commodity with significant economic potential and established export markets, including Singapore and Japan. Due to its perishable nature, anchovy is commonly processed by drying, which reduces moisture content and extends shelf life. To ensure food safety, guidelines such as GMP are crucial. GMP serves as a management concept encompassing product manufacturing procedures and operational methods, aiming to minimize contamination risks and guarantee product safety and quality.

GMP is a management concept that encompasses product manufacturing procedures and operational methods. All products produced under GMP must meet established standards with minimal

deviation. It serves as a guideline that can be applied to anchovy processing, as its core principle is to minimize or eliminate contamination risks to ensure food products are safe and suitable for consumption[1]. GMP is a fundamental requirement for all aspects of production, storage, and distribution of commercial food products. It is essential for ensuring consistency, compliance with food safety standards, quality assurance, and alignment with consumer expectations. Industries that implement GMP produce safer and higher-quality products, reduce customer complaints, and maintain cleaner, safer, and more efficient working environments[2].

PT Insan Citraprima Sejahtera, a national private company located in Tuban, East Java, specializes in processing fishery products, including dried anchovies that have successfully entered global markets such as Singapore and Japan. GMP implementation ensures that all products manufactured by the company meet stringent food safety standards. This study aimed to assess the application of GMP in the processing of dried anchovy (*Stolephorus* spp.) at PT Insan Citraprima Sejahtera, Tuban, East Java.

Material and methods

Study area

This study was conducted at PT Insan Citraprima Sejahtera, located at Jalan Merak Urak No. 148 C, Sekardadi Village, Jenu Sub-district, Tuban Regency, East Java, Indonesia.

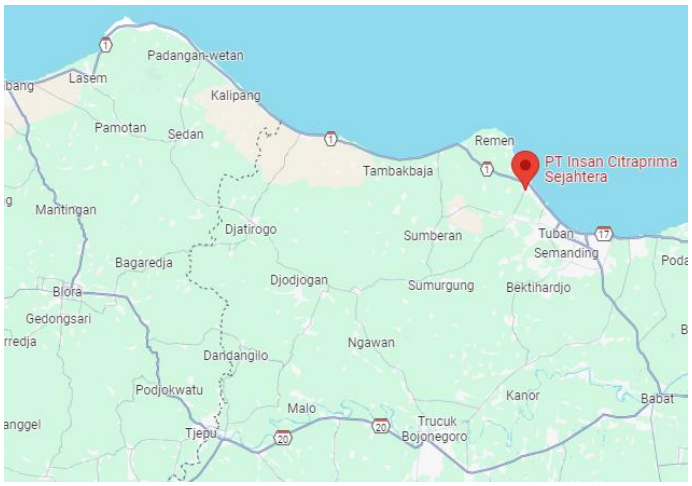

Figure 1. The research location at PT Insan Citraprima Sejahtera, Tuban, East Java, Indonesia.

Procedure

This study employed a descriptive method, with data collected through observations and interviews.

Research

Raw material reception

The raw material reception is the initial procedure in the production of dried anchovy (*Stolephorus* spp.) at PT Insan Citraprima Sejahtera. The raw materials, consisting of fresh and dried anchovies, are supplied from various regions. Upon arrival at the reception area, raw materials are handled by designated reception staff and inspected by the Quality Control (QC) team. PT Insan

Citraprima Sejahtera receives two types of raw materials: fresh anchovies (wet raw materials) and dried anchovies (dry raw materials). The fresh anchovies are sourced from fishermen in the Tuban region, spanning from Ngaglik Sub-district to Bulu Sub-district. During the peak anchovy fishing season, the factory can receive up to 4 tons of fresh anchovies daily. The dried anchovies are procured from northern coastal regions, ranging from Pasuruan to Banten. At the peak of the fishing season, dried anchovy deliveries to the factory can reach up to 6 tons daily, with shipments from Banten alone amounting to 8 tons.

GMP at the fresh raw material reception stage includes organoleptic and temperature inspections conducted by the QC team upon arrival. Organoleptic assessment evaluates the freshness of the anchovies using sensory analysis, while the maximum temperature standard for fresh materials is set at 3°C. To maintain this temperature during transportation, fresh anchovies are stored in containers filled with a 1:1 ratio of ice and water. For dried raw materials, GMP implementation involves organoleptic evaluations, as well as assessments of moisture and salt content. Organoleptic inspection provides indications of quality degradation or damage. The standards set by PT Insan Citraprima Sejahtera for dried raw materials include a moisture content of 38–40% and a salt content of 6–7%.

Washing

The washing process for fresh raw materials is conducted in the boiling room. Washing is performed by designated staff under the supervision of the QC team. Fresh anchovies are washed using running water to remove dirt and reduce contamination levels. The process involves two rinsing steps to eliminate any remaining dirt or debris that may have adhered to the fish during transportation. GMP implementation at this stage includes cleanliness checks of the washed fish and temperature monitoring to ensure the anchovies is free from dirt and foreign objects.

Boiling

The boiling process for fresh anchovies is carried out in the boiling room by the assigned staff. This stage aims to eliminate pathogenic microbes and remove any residual dirt from the fish. GMP implementation at this stage involves hourly temperature checks conducted by the QC team during the boiling process. The fish are boiled in high-temperature water ranging from 80–95°C. The primary objective of GMP application at this stage is to eradicate pathogenic bacteria, ensuring that the product meets the buyer's specifications.

Drying

The drying process at PT Insan Citraprima Sejahtera utilizes direct sunlight, a traditional sun-drying method. GMP is implemented during this stage by monitoring the fish's moisture content, conducted by the QC team. The goal of GMP application in the drying process is to extend the product's shelf life by ensuring the moisture content meets the company standard of 38–40%, thus aligning with the buyer's specifications. Additionally, the drying process aims to enhance product durability by achieving the appropriate moisture levels.

Sorting I

GMP implementation during the first sorting stage is conducted through a cleanliness inspection of the sorted products by the QC team, using visual observation to ensure high-quality and safe-to-consumer products. The first sorting process for dried anchovies at PT Insan Citraprima Sejahtera is performed using a sorting machine. The dried anchovies, after being checked by QC, are placed into the

sorting machine, which is equipped with a metal magnet. The machine separates the anchovies from dust, shells (shrimp skin), fish fragments, and local fish.

The sorting machine is equipped with a cylindrical metal catcher sensor designed to attract metal fragments present in the anchovies, which adhere to the magnetic field. Local fish fall into the first container, shrimp skin into the second container, while the anchovies are conveyed to the next stage, which is colour separation. The body colour of the anchovies is categorized into two types: yellow and white. The sorting machine is also equipped with a colour sensor to detect the colour of the anchovy bodies. White anchovies fall into the first container, while yellow anchovies fall into the second container.

Weighing and packaging I

GMP implementation during the weighing and packaging stage I involves checking the weight of the fish on each MC and calibrating the scales every two hours. The fish are weighed until they reach a total weight of 6 kg using a digital scale. The scales' accuracy is checked every two hours by calibrating them. Each MC is labelled with the production date, size, raw material origin, and traceability information.

Sorting II

GMP implementation during the second sorting stage is carried out by inspecting the cleanliness of the sorted products after each sorting process by the QC team through visual observation to eliminate any foreign objects missed during the first sorting stage. Sorting II is conducted manually in the sorting room using human hands. The dried anchovies are separated from local debris, including shrimp skin, fish fragments, shell fragments, *blirik*, *japoh*, squid, and clumps of anchovies. The second sorting stage aims to reduce the presence of local contaminants to 3% cleanliness in each MC. The goal of this stage is to obtain high-quality products that are safe for consumption.

Finishing and metal detection

The finishing and metal detection process takes place in the sorting room and is conducted by the finishing staff under QC supervision. This final stage ensures the product meets the desired quality by checking the cleanliness and quality of each MC of anchovies and preventing metal fragments from remaining in the final product. If the metal catcher fails to detect metal fragments, calibration is performed to adjust the sensitivity of the magnetic field, ensuring metal fragments are detected. GMP application in the finishing and metal detection stages involves checking the sensitivity of the metal catcher every two hours using a gaussmeter.

The metal fragments are detected by placing the anchovies on a table hole equipped with a metal catcher at the end of the finishing table. The metal catcher, with a thickness of 3 cm, is used to attract metal fragments from the product. The metal catcher is considered functional if the sensitivity check shows ≥ 10,000 Gauss. According to Muhtarom and Effendi (2020), food contaminated with metal fragments can cause health issues in humans[3].

Precooling

This stage involves reducing the temperature of the anchovies. The purpose of precooling is to maintain high product quality and freshness by placing the anchovies in cold storage for 24 hours. This stage is performed before storage. During precooling, the MC is placed on racks inside the cold storage room. GMP is applied during the precooling stage by inspecting the cold storage temperature every

hour by the QC team. The cold storage temperature must be maintained between -5°C and -15°C to preserve product quality.

Weighing and packaging II

Weighing is carried out using a digital scale to ensure the total weight meets the product specifications. The MC packaging is labelled with the supplier's logo, fish grade, and other relevant information. During this stage, the odour and moisture content of the dried anchovies are also checked before they are moved to storage. GMP is applied by monitoring the weight of the fish in each MC and calibrating the scales every two hours.

Storage

GMP implementation during storage is ensured by checking the cold storage temperature every hour by the QC team. The cold storage temperature should range between -5°C and -15°C, and the anchovies are stored at this temperature. Storing in cold storage helps extend the anchovies' shelf life by maintaining low temperatures. The product is organized using the first-in, first-out (FIFO) system, ensuring that products with earlier production dates are used first. Newer products, with a longer shelf life, are placed at the back, while products with shorter shelf lives are positioned at the front for easier retrieval.

Distribution

The distribution process involves transferring the products from the cold storage to containers using a hand pallet. Before the products are loaded into containers, they are inspected by the QC team for moisture content, odour, grade, and colour. Anchovies that pass the inspection are stamped by QC. Each container holds 1,450 MC of dried anchovies ready for export. The containers used are 20-foot refrigerated containers, set at -18°C, and are white in colour. GMP is applied in the distribution stage by monitoring product dates, recorded by QC for traceability of each MC.

Discussion

The use of ice can rapidly cool fish, offering ease of application, cost-effectiveness, and minimal alteration to the fish itself. According to Nusaibah et al. (2020), low-temperature conditions inhibit the growth of spoilage bacteria and slow down biochemical processes in fish, thereby delaying spoilage[4]. The organoleptic characteristics of freshly arrived dried anchovies must meet the parameters specified in SNI 3461:2019, including intact bodies, white colour, fresh, specific aroma, and firm texture. The quality standard for dried anchovies, as set by SNI 3461:2019, stipulates a maximum moisture content of 45% and a maximum salt content of 10%[5].

The washing process aims to cleanse the fish of dirt and slime from its surface, which can inhibit microbial growth. The water temperature used during this stage ranges from 20-26°C. High-temperature cooking can kill heat-sensitive pathogenic bacteria, such as *Escherichia coli*, which can be eradicated by heating to temperatures of 70°C or higher[6]. Boiling is performed using water mixed with a 6–7% or 0.6–0.7 ppt salt solution. The salt concentration affects the moisture content of the fish by drawing water out of the fish body, which then moves into the surrounding network, reducing the fish's water content[7].

High moisture content in food can support microbial growth and reproduction. Therefore, reducing moisture content inhibits microbial growth and development[8]. The sorting machine separates dried anchovies from dust, shrimp skin, fish fragments, and local fish. The machine is also equipped

with a cylindrical metal catcher sensor designed to attract metal fragments from the anchovies. This aligns with the provisions of PERMEN KP No. 17/2019, which mandates that processed fish products must be free from physical contaminants, such as metals, shells, and other foreign objects that could pose a hazard to consumers[9].

Calibration is carried out during the weighing and packaging stage I to identify scale discrepancies and calibration factors[10]. The dried anchovies are weighed and then packaged in PE plastic as the primary packaging material and MC as the secondary packaging. PE plastic is advantageous as a primary packaging material due to its strong flexibility and recyclability, while MC packaging helps prevent damage to the primary packaging during production and distribution. Traceability ensures the provision of information that aids in optimizing production efficiency, enhancing product quality control, and providing consumers with information about the origin and status of the product.

The second sorting stage aims to reduce the presence of local contaminants in the dried anchovies to 3% cleanliness per MC. As specified in PERMEN KP No. 17/2019, processed fish products must be free from physical contaminants that could harm consumers9. The finishing and metal detection stages are designed to ensure that no metal fragments remain in the final product. A metal catcher is a device used to attract contaminants such as metal fragments from food products[11]. The sensitivity of the metal catcher is checked using a gaussmeter, a tool used to measure the magnetic field strength induced by the device[12].

The precooling process aims to absorb field heat before the product is distributed or stored. For dried anchovies, precooling is achieved using air cooling in cold storage. During the weighing and packaging stage II, calibration of the scale is crucial to determine the extent of any discrepancies between the actual and displayed values[13]. After weighing, the MC packaging is sealed with transparent tape before entering the storage stage in cold storage.

In the storage stage, the cold storage temperature is monitored. The temperature must be maintained between -5°C and -15°C. Low temperatures inhibit the growth of spoilage bacteria and biochemical processes that could lead to the deterioration of food quality[14]. Storing dried anchovies at temperatures between -5°C and -15°C complies with PERMEN KP No. 17/2019, which specifies that fish products should be stored at appropriate temperatures to extend shelf life[9].

Product date inspection helps facilitate inventory tracking, grouping products based on their location, and streamlining the unloading process in the destination country. By checking product dates, errors in distribution can be minimized, ensuring that issues such as consumer dissatisfaction and product damage or errors during shipment are reduced[15–20].

Conclusions

In conclusion, PT. Insan Citraprima Sejahtera has successfully implemented GMP throughout the processing of dried anchovies, ensuring clear procedural requirements, supporting infrastructure, and quality control. The dried anchovies produced meet the quality standards set by SNI-3461:2019.

Acknowledgments

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Conflicts of Interest

The authors declare no conflict of interest

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