

Food Safety System Design Using Hazard Analysis Critical Control Point (HACCP) on Beverage Product X at a Milk Tea Producer

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Abstract. Food safety is a primary concern in food industry. Hazard Analysis Critical Control Point (HACCP) is a systematic preventive approach that aims to ensure food safety in a comprehensive manner, starting from raw material retrieval from supplier, production phase, up to the distribution to end consumers. Furthermore, the approach is capable of reducing risks associated with food hazard to their acceptable level. Our research took place in a company that produces a wide array of milk tea with a variety of flavours, i.e. product X. Recent increase in overall demand and competitors in Indonesian milk tea market subsequently forces the company to pay more attention to the quality of their product X. Thus, the company aspires to certify its food safety system and management. This research proposes a design and implementation plan of HACCP for quality assurance and food safety of product X. The main outcomes of this research are the HACCP plan for raw material, packaging material, and production process. Further potential improvements are suggested with regard to production process, production equipment, production layout, human resource, sanitation, and documentation system. The HACCP plan consists of ten Critical Control Points (CCPs), a series of documentation forms, and additional documents specifically attributed to support the implementation phase of HACCP plan.

Keywords: food safety, quality management, HACCP, hazard analysis

1 Introduction

Standards are conceptually introduced as an enforcement tool for quality in different majors in higher level of education [1]. Furthermore, sustainability and environment have been key aspects in recent development of engineering and design [2-3]. This research aims to complement student's conceptual understanding by providing a case study of the implementation of standards in food industry that is profoundly concerned with sustainability and environmental issues.

Food safety management system has been proven to result in higher customer's satisfaction, better food safety, and increased perceived quality in company's branding [4].

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One implementation of standards in food safety management is HACCP. Theoretically, HACCP is a part of ISO22000, and most companies are advised to acquire a HACCP certification first-hand prior applying for ISO22000 [5].

This research takes place in a certain milk tea producer, the producer of Beverage Product X that is based in Bandung. Due to the perishable nature of its products, the company aims to standardize its food safety by acquiring ISO22000 certification, starting from the HACCP requirements.

2 ISO14001 Environmental Management System

HACCP is a preventive system that identifies, measures, and controls the hazard level in a food system, with an objective of satisfying food safety requirements in a company. In practice, HACCP complements the implementation of ISO9000, quality management system, and even serves as the basis of ISO22000, food safety management certification [6]. There are 4 key steps of preparing and applying HACCP in a company [7]:

1. Planning, which includes a gap analysis
2. Doing, in which the company applies the 12 implementation phases of HACCP
3. Checking, or HACCP plan verification prior full implementation
4. Acting, when HACCP plan, prerequisite program, and other food safety management programs have been implemented and monitored

There are 12 steps of HACCP application according to SNI 01-4852-1998. Out of those steps, five are of preparation phase and the remaining seven are general hygiene principles. The 12 steps of HACCP as [8] is listed in Table 1.

Table 1. Twelve Steps of HACCP (Thaheer, 2005)

HACCP Preparation		HACCP Principle	
Step	Program	Step	Program
1	Assemble the HACCP Team	6	Conduct a Hazard Analysis
2	Describe the Product	7	Determine Critical Control Points
3	Identify the Intended Usage	8	Establish Critical Limits for Each CCP
4	Construct Flow Diagram	9	Establish Monitoring System for CCP
5	On-Site Confirmation of the Flow Diagram	10	Establish Corrective Actions
		11	Establish Verification Procedures
		12	Establish Documentation and Record Keeping Procedures

3 Methodology

The methodology of this research is in accordance with HACCP principles adopted from Codex Alimentarius Commission – WHO, which consists of 7 general hygiene principles, Codex practical principles, and other relevant food safety regulations. First, preliminary study is conducted on both theoretical methods and practical implementation of the case. Furthermore, the five steps of HACCP preparation are executed, which end with a confirmed flow diagram. The methodology proceeds with the application of HACCP principles, starting from hazard analysis until the design of record-keeping procedures. Lastly, recommendations from gap analysis and a detailed implementation plan are proposed.

4 Analysis

Prior analysis, required data is gathered based on the twelve HACCP steps. The gathered data consists of consumer identification data and production flow diagram of the products. Further, the flow diagram is validated directly with on-site observation on production floor. An example of confirmed production flow diagram for mixing sub-process is presented on Fig. 1.

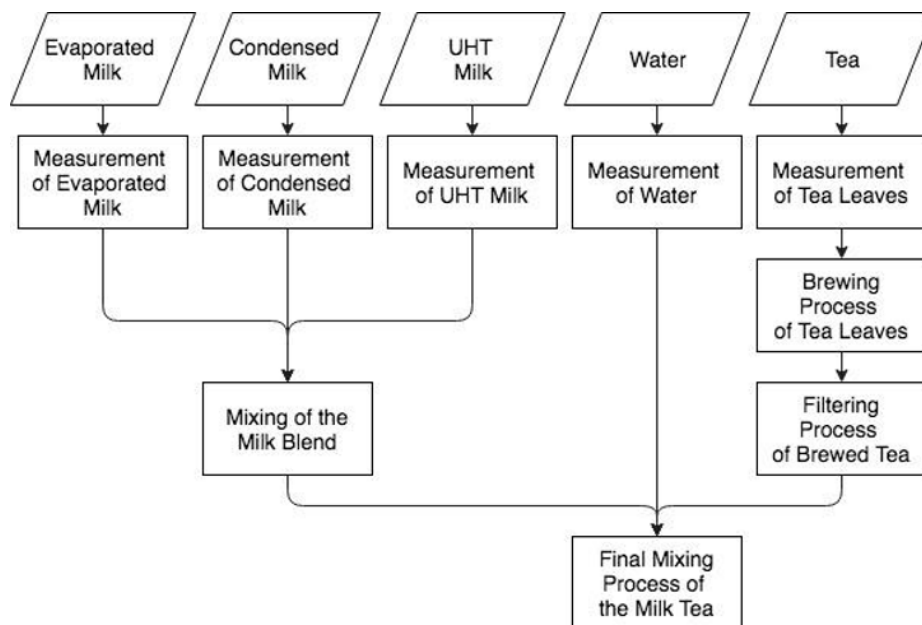


Fig. 1. Process Flow Diagram for the Mixing Sub-process of Product X

After the data is gathered, gap analysis is conducted. In this event, the company’s current business model is compared to the referred standards, i.e. ISO 22000, and thus the gap between the two conditions is analyzed. This information is crucial for the following stages, which are HACCP plan design and the fulfillment analysis.

4.1 HACCP Safety Management System Design

The design of food safety management system begins by implementing the HACCP principles, or the sixth HACCP step. After the entire process flow diagram is verified on-site, this research proceeds to hazard analysis and identification. The hazard identification refers to several standards and food regulations, three of which are KBPOM No.

HK.00.06.1.52.4011, SNI 7387:2009, and SNI 3141.1:2011. Further, the significance of each potential hazard is calculated based on its likelihood and severity, in accordance with ZNS standard of ISO 31000:2009.

The critical control points (CCP) are determined based on the process flow diagram and hazard analysis. In this research, 4 CCPs are identified in raw material handling and 6 CCPs are identified within the production process. Moreover, critical limit and monitoring system are designed for each CCP, accordingly. To minimize potential hazards, the monitoring system defines three specific components for each point: procedure, frequency, and person in charge. Afterwards, the entire plan is verified using sampling, audits, and document verification.

Lastly, documents and record-keeping procedure is defined properly. Appropriate documentation benefits the company when it requires a data-driven root cause analysis, CCP monitoring, or performance appraisal for certification.

4.2 Fulfilment Analysis of Prerequisite Programs

The purpose of prerequisite programs is to guarantee the continuity of the production process and wellness of the environment during the implementation of HACCP. This research analysed the fulfilment of two prerequisite programs: Good Manufacturing Practices (GMP) Analysis and Sanitation Standard Operation Procedures (SSOP).

The GMP is a system that ensure each product to be produced and controlled according to its required standards. The GMP analysis is based on 75/M-IND/PER/7/2010 food processing regulation of Indonesian Ministry of Industry [9]. Based on such standard, there are six aspects that are currently unfulfilled: construction, laboratory, product labelling, sanitation and maintenance, documentation, and human resource training.

Furthermore, the analysis on SSOP is conducted to control, monitor, and improve the sanitation aspect of the factory and its surrounding environments. The SSOP analysis is based on 715/MENKES/SK/V/2003 food hygiene and sanitation regulation of Indonesian Ministry of Health [10]. This research also considers regulations released by U.S. Food and Drug Administration (FDA) to complement the SSOP analysis. Our analysis indicates that two aspects are dissatisfying: water safety and pest control.

4.3 Managerial Implications

Based on the analysis on HACCP implementation, prerequisite programs fulfillment, and the existing condition of the company, this research recommends potential improvements on different aspects of the company. The recommendations are made on the following aspects: production procedure, layout, human resource, sanitation, and record-keeping system, as displayed on Table 2. Additionally, implication analysis is conducted on both managerial and business aspects of the plan.

Table 2. Proposed Improvements on Four Aspects

Aspects	Recommendations
Production Procedure	Raw material quality checklist, minimum distance of cooling storages, additional warning sign on product label, and assignment of food safety supervisor
Layout and Construction	Eliminating dead corner to reduce bacterial growth

Aspects	Recommendations
Human Resource	HACCP implementation training and HACCP-specific internal audit
Sanitation	Instalment of anti-siphon valves and procurement of pest control equipment

5 Conclusion

In this research, a HACCP-based safety management system is designed in a milk tea producer. Further, there are three key outcomes that this research concludes: the HACCP plan as the main outcome of this research, a newly-designed documentation system to reinforce implementation, and recommendation points to ensure effective implementation of HACCP.

First, the output of the HACCP-based safety management system is a HACCP plan. The objective of the plan is to maintain the quality and food safety of product X. The plan consists of ten critical control points, each with its own critical limit, monitoring requirements, corrective actions, verification, and record-keeping procedures.

Secondly, this research also proposes a documentation system that aims to control the effectiveness of HACCP implementation. Further, it also enables user to track food hazards and to keep the implementation records in general. The newly-designed documentation system consists of 30 documents, which includes 1 quality manual, 13 procedures, 9 work instructions, and 7 forms.

Lastly, based on the current situation of the company, several improvements are recommended to ensure an effective implementation of HACCP. Thus, this research provides a set of specific recommendations for CV Bumi Lestari, which aims to improve its production procedures, production equipment, production layout, human resource, sanitation, and documentation system.

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