

A Model HACCP Plan for Fish Seasoning Powder Production

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Abstract Many kinds of seasoning powder available in market contain high amount of monosodium glutamate (MSG) in Myanmar. So, natural seasoning powder without MSG from fish and vegetables seasoning powder was considered for safe and healthy product as substitute of MSG. The main aim of this research is to design Hazard Analysis and Critical Control Point (HACCP) plan for fish based seasoning powder production. Local indigenous raw materials such as Ngar-Gyin (Mrigal fish), cabbage, carrot, cauliflower, chinese cabbage, garlic and ginger were used in the formulation of fish based seasoning powder. The prerequisite programs (PRPs), operational prerequisite programs (OPRPs), hazards, critical control point, preventive measure, critical limits, monitoring procedure and corrective actions have been designed in this HACCP plan. A sample generic HACCP plan was recommended. Three Critical Control Points (CCPs) in the processing; cold storage of raw fish; pressure cooking and packaging were identified. A HACCP plan was completed with prerequisite programs dealing with the identified hazards.

Keywords: *Mrigal fish, indigenous raw materials, HACCP, critical control points*

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1. Introduction

Convenience foods, such as Ready to Cook (RTC) and Ready to Eat (RTE) food can be consumed immediately after thermal treatment. Therefore, customers only need minimal preparation of the food [1].

Both synthetic and natural flavor as food additive are needed to enhance sensory characteristics. Food additive which can add, enhance and establish taste and flavor is called flavor enhancer. To establish the sensory attributes particularly the taste and flavor of the dishes, that dishes need flavor enhancer. Flavor enhancer in form of seasoning powder is commonly made from meat or poultry, seldom found from fish [2]. Conventional production of plant-based condiments and seasonings implicate losses of volatile compounds as well as hygienic and quality problems, which may bring relevant safety risks for the population [3,4].

Seasoning powder product contained enough amounts of I, Fe and cobalamin. It indicated that this product was potential to be developed due to nutrition compound that was contributed positive effect on human health. Although seasoning powder was applied only in few amounts the health benefit was important to be considered. Seasoning powder produced had low water

content and it might show the stability of product during storage [5].

Food safety is of increasing importance in the food industry. The main reason is the susceptibility of the products to microbiological, physical and chemical hazards. Hazard analysis critical control point (HACCP) is a systematic approach, the aim of which is to determine the hazards related to food, to identify critical control points (CCP), and to put them under control. For the food industry, the HACCP program is currently recognized as the best approach to control food safety.

Now with the introduction of food quality and safety systems HACCP has become synonymous with food safety [6,7]. Hazard analysis and critical control point (HACCP) is a preventive method that is used to control food processing procedures by identifying the hazards of food production and furthermore, to ensure food safety by controlling the hazards and reducing the risks. The CCPs in the process are monitored continuously to prevent a possible major hazard in advance. Codex Alimentarius Commission describes CCPs as control stages to prevent, reduce or eliminate hazards. The aim of this study is to prepare fish seasoning powder from locally available Ngar-Gyin, Mrigal fish (*Cirrhinus mrigala*) and vegetables, and to study potential hazards for safe production of fish seasoning powder through the development of effective food safety management system.

2. Materials and Methods

2.1. Raw Materials

The fresh Ngar-Gyin, Mrigal fish (*Cirrhinus mrigala*) was purchased from Hlaing market, Hlaing Township, Yangon Region. Carrot, white radish, chayote, cabbage, chinese cabbage, cauliflower, garlic, ginger, sugar and salt were purchased from local market. Lactose (Commercial Grade) was purchased from Super Shell Chemical Shop, 27th street, Pabedan Township, Yangon Region.

2.2. Method of Preparation

Firstly, the raw fish was prepared by dressing (scaling, gutting, removal of gills, removal of slimes, removal of head and tail) and then washed with potable water. Carrot, white radish, chayote, cabbage, chinese cabbage and cauliflower were peeled, chopped and washed with potable water.

The prepared raw fish, vegetables and other ingredients such as salt, lactose, sugar, garlic, fresh ginger juice were added to the pressure cooker with 2 L of water. These raw materials were cooked in the pressure cooker at 121°C, 15psi for two and half hours.

After pressure cooking, the resultant fish and vegetables paste was blended by using a domestic blender. The blended paste was spread on the tray and dried by hot air oven at drying temperature (70°C). At the end of drying, the dried products were scrapped and cooled at room temperature for 10 min.

After drying, the dried product was ground using a domestic blender. Finally, the fish seasoning powder was obtained, weighed and stored in an air tight container.

2.3. Methodology

This study did not use quantitative research. The main aim of this study was to design a HACCP model not to implement it in the actual situation. Therefore, there is no statistical data. This study matched a qualitative approach. It gives the intricate details of phenomena that are difficult to convey with quantitative methods. Qualitative research is exploratory and open-minded which is applicable to this study [8].

2.3.1. Hazard Analysis and Critical Control Point (HACCP) Principles and Procedures

The concept of HACCP was consisting of seven principles as follows:

Principle (1): List all potential hazards associated with each step, conduct a hazard analysis, and consider any measures to control identified hazards.

Hazards are nature that their elimination or reduction to acceptable levels is essential to the production of a safe food so the HACCP team could next carry on a hazard analysis to identify HACCP plan (Pierson and Corlett, 1992).

Principle (2) : Determine Critical Control Points

When more than one CCP is obtained, control is used to address the same hazard. In the HACCP system, the determination of a CCP can be facilitated by using a

decision tree, which indicates a logic reasoning approach. It should be used for guidance when determining CCPs (Pierson and Corlett, 1992).

Principle (3): Establish Critical Limits for each CCP

For each critical control point, critical limits must be specified and validated. In some cases more than one critical limit will be elaborated at a particular step [9].

Principle (4): Establish a Monitoring System for each CCP

One of the scheduled measurement or observation of a CCP relative to its critical limits is Monitoring. To detect loss of control at the CCP, the monitoring procedures must be done [10].

Principle (5): Establish Corrective Actions

For each CCP in the HACCP system in order to deal with deviations when they occur, specific corrective actions must be carried out. These actions must to make sure that the CCP has been brought under control [11].

Principle (6): Establish Verification Procedures

To determine the HACCP system is working correctly that verification and auditing methods, procedures and tests, including random sampling and analysis can be applied. To confirm the HACCP system is working effectively that the frequency of verification should be sufficient [12].

Principle (7): Establish Documentation and Record Keeping

Efficient and accurate record keeping is essential to the application of a HACCP procedures should be documented. Documentation and record keeping should be appropriate to the nature and size of the operation [13].

3. Results and Discussion

The purpose of the implementation of food safety management system is to be safe for consumption and commercial production of prepared fish seasoning powder. The implementation of food safety management system is generally considered to be the process such as product description, the description of process flow diagram, hazards in process and CCP decision matrix chart analysis, HACCP control chart and labeling.

Table 1 shows the product description of fish seasoning powder, it can observe that there is a full description of the product including kind of food, ingredients, composition, packaging, method of storage, storage conditions, distribution method, shelf life, customer requirements and intended use. According to this table, consumers easily and clearly know about the product.

Figure 1 shows that process flow diagram of fish seasoning powder and it needed to be check for accuracy. It was visualized the flow of the production process and made the process transparent. Any potential hazards were analyzed and taken into account hazards that could affect the safety and quality of the food and determination of the CCPs. There are three CCPs: (1) raw fish cold storage, (2) pressure cooking and (3) packaging.

A hazard is defined as any biological (B), physical (P) or chemical (C) property that could cause a product to be unsafe for consumption [14]. Hazards in process and critical control point (CCP) decision matrix chart analysis are tabulated in Table 2. According to the table, among these process steps, there are two critical control points

(CCPs), pressure cooking step and packaging step. For pressure cooking step, it has biological hazard and physical hazard. The changing of temperature and pressure caused microbial growth. For packaging step, it has biological hazard, chemical hazard and physical hazard. The leakage and moisture absorption from surrounding caused microbial growth. Storage and distribution condition are critical to comply with consumer acceptability and shelf-life.

Table 3 shows that the HACCP control chart of the fish seasoning powder and it needed to be controlled the potential hazards. From this table, it was contained all potential critical hazards, critical control point, critical limits, responsible person, frequency, record, corrective action and verification. Three CCPs – (1) raw fish cold storage step, (2) pressure cooking step and (3) packaging step were found in the processing of fish seasoning powder.

Table 1. Product Description of Fish Seasoning Powder

Item	Product Description
Product Description	Fish Seasoning Powder Contents Mrigal fish, carrot, white radish, chayote, cabbage, chinese cabbage, cauliflower, ginger, garlic, water, sugar, lactose, and salt
Product Specification	Composition Moisture 7.1% Protein 41.3% Fibre 1.4% Fat 18.2% a_w 0.35 pH 5.6
Packaging (Primary & Secondary)	Fish seasoning powders are packed in food graded laminated bags. The quantity of fish seasoning powder will vary from 15g/ 30g small packs to 75g/ 80g family packs.
Method of storage	Carton box are put on the wooden rack accordingly step wise.
Storage Conditions	Cartons are stored at normal room/ ambient temperature.
Distribution Method	Covered van, Pick-up
Shelf Life	6 months
Customer Requirements	Direct consumption
Intended Use	Ready to use

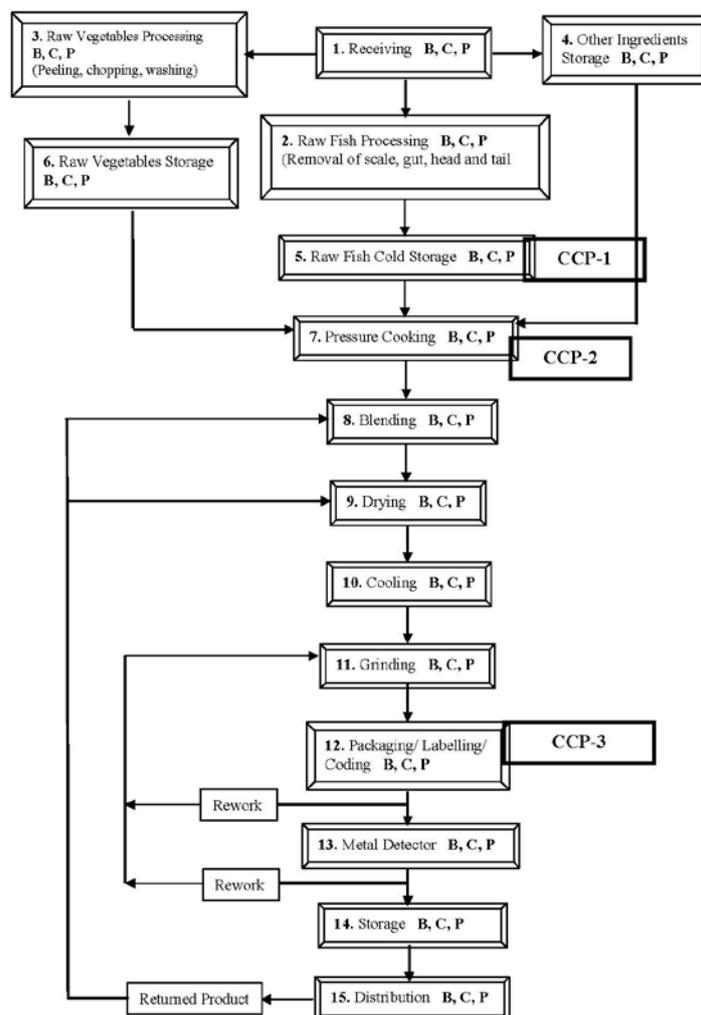


Figure 1. Description of Process Flow Diagram

Table 2. Hazards in Process and CCP Decision Matrix Chart Analysis

Step No.	Process Step	Hazard	Control Measures (SOP's or work instructions)	Q-1: Do control preventive measure(s) exist?	Q-2: Is the step specifically designed to eliminate or reduce the likely occurrence of a hazard to an acceptable level?	Q-3: Could contamination with identified hazard(s) occur in excess of acceptable level(s) or could these increase to unacceptable levels?	Q-4: Will a Subsequent step eliminate identified hazard(s) or reduce likely occurrence and acceptable level?	CCP
1.	Receiving raw fish, vegetables and other ingredients	B	Biological hazard content in fish and Other raw materials.	Yes	No	No	-	Not a CCP
		C	Additive and heavy metals. Residue of chemicals.					
		P	Foreign particle					
2.	Raw fish processing	B	No	No	-	-	-	Not a CCP
		C	Food allergen					
		P	Foreign particle					
3.	Raw vegetables processing	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
4.	Other ingredients storage	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
5.	Raw fish cold storage	B	Microbial growth due to storage temperature changes.	Yes	Yes	-	-	CCP
		C	No					
		P	No					
6.	Raw vegetables storage	B	Microbial growth due to storage temperature changes.	Yes	No	No	-	Not a CCP
		C	No					
		P	No					
7.	Pressure cooking	B	Microbial growth due to temperature and pressure changes.	Yes	Yes	-	-	CCP
		C	No					
		P	Foreign particle					
		C	No					
		P	No					
8.	Blending	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
9.	Drying	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
10.	Cooling	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
11.	Grinding	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
12.	Packaging	B	Microbial growth due to leakage and moisture absorption from surrounding	Yes	Yes	-	-	CCP
		C	Chemical hazard from foil pack					
		P	Foreign particle present during weighing and Forming					
13.	Metal Detector	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
14.	Storage	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					
15.	Distribution	B	No	-	-	-	-	Not a CCP
		C	No					
		P	No					

Table 3. HACCP Control Chart

Sr. No.	Process Step	Hazard	Control Measure	Critical Limit	How	Who	Frequency	Record	Corrective Action	Verification
1.	Raw fish cold storage	Biological hazard	Control temperature	Storage temperature range (- 18°C ± 2°C).	Fixed temperature	QC	Every batch by batch	Monitor and record the temperature hourly	Reserve another electric source if the current electric source is off	Review per batch, Auditing
2.	Pressure cooking	Biological hazard and physical hazard	Control temperature and pressure	Cooking temperature range (121±10°C). Cooking pressure range (15±5 psi)	Suitable temperature and pressure management	QC and production department	Every batch, Every 30 minutes	Monitor and record the temperature and pressure every 30 minutes	Reserve another electric source if the current electric source is off	Review per batch, Auditing
3.	Packaging	Biological hazard, chemical hazard and physical hazard	Control temperature and humidity. Leak test.	No leakage. Control temperature and humidity of packaging room (<30°C and <60%).	Auto packing and control of leakage under temperature controlled room.	Packing operator & QC department	Every 30 minutes (packet checks and temperature & humidity)	Leak test report	Reject the wrapper, finished pack and recheck whole batch	Auditing

4. Conclusion

The study was designed a HACCP plan model for a fish seasoning powder plant to develop the safety and quality of products. The model is built up step-by-step based on the seven principles and twelve procedures of HACCP system. The product description was used to help the consumer to the potential hazards in the final products. Then, the appearances of potential hazards were controlled with the prevention measures in the whole process. The critical control points were determined by using the questions in the decision trees. Finally, the HACCP control chart was built up to contain components of several HACCP principles which are control measure, critical limits, corrective action and verification. There are three CCPs such as raw fish cold storage, pressure cooking and packaging were found in the processing of seasoning powder. GMP at all steps of production must be strengthened, the effective control HACCP system of the products must be established and a more efficient correction of the processing steps are possible by the use of statistical process control to improvement of food safety and quality of prepared fish seasoning powder.

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