

Quality Control of Pastry Products using the HACCP Method

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Abstract: HACCP is a procedure that companies have to apply in order to protect the quality of food products. The purpose of this paper is to describe the critical points in which hazard can come to light in the production process, the evaluation and the measures applied to prevent and control these critical points. This method is applied to all the technological processes in order to obtain the pastry products without yeasts.

Keywords: pastry products, hazard analysis, critical control points.

1. Introduction

HACCP is an acronym for "Hazard Analysis and Critical Control Points". It is a preventive method used for increasing the safety of food, cosmetics and drugs. The method appeared in 1971 in the U.S.A.

The European Community has promoted since 1983 introduction of HACCP principles in its legislation. In the EU Council Directives on food hygiene HACCP is a concept as well as a method of operation, applied to all phases of food production. The purpose of these directives is to encourage food manufacturers and retailers in the application of HACCP in their own companies. In the UK, in September 1995 a mandatory application of HACCP has been instituted in all links of the food chain [1].

HACCP is a scientific system of self control of the manufacturing process, which has been extensively used in food production to prevent problems that may occur, using the critical control points (CCP) in manufacturing process, where the risk can be controlled, reduced or eliminated. A company must have a real system to meet requirements and prevent spoilage of products. It is a system that controls the relevant hazards to food safety, through Critical Control Points (CCP). A CCP is defined as a point, step, or procedure in a food manufacturing process at which:

- control that is essential to prevent or eliminate a food safety hazard or reduce it to an acceptable level can be applied; and where,
- later processing steps won't correct these safety problems [2].

If one of the parameters of the CCP are out of control it is possible to reach the compromise of food safety. Unlike Critical Control Point, Control Point (CP) is any step in the process at which biological, chemical, or physical risks or hazards can be controlled, and usually is related to quality or production issues and not to product safety, unless the control point supports a CCP.

The hazard is any physical, chemical, biological agent or body, which, if present in the food in the moment of

consumption, has the capacity to affect the innocuity or the hygienic quality of the product.

A critical limit is defined as a maximum and/or minimum value to which a biological, chemical, or physical parameter must be controlled at a CCP to prevent, eliminate, or reduce to an acceptable level, the occurrence of a food safety hazard. A critical limit is used to distinguish between safe and unsafe operating condition at a CCP.

By monitoring CCP, the elimination of the risk is ensured or the risk is reduced by keeping it at levels below the critical limit. The monitoring of CCP means observation and planned measurement of risk from that critical control point. It is achieved through: inspection, sensory assessment, physical records, chemical analysis and microbiological analysis. Following an international statistics, it appeared that the ratio of chemical and biological hazards is 1/100 000. The laws of our country require that mandatory implementation of HACCP system, not its certification.

Some benefits of implementation or certification of the system are:

- A quality system that ensures food safety meaning that the food will not affect consumers if food is prepared or consumed as indicated;
- Is the guarantee for the production and trade of safe food, being transparent, both for official inspection, and consumers;
- Is a quality system "urged" by retailers (who are first in contact with customers and stakeholders to market safe products);
- Is a system that minimizes risk over the technological process [3].

HACCP implementation is related to determining in advance the rules of good practice on the following: construction, machines location, technological process, personnel, cleaning and disinfection, pest control, raw and auxiliary materials used, including water, product traceability, transport.

HACCP team should be multidisciplinary and include a motivated member of the executive management who is

able to provide necessary financing and general motivation of the company to ensure successful implementation of HACCP. HACCP team will also need a well educated person who will lead the implementation of HACCP.

The team should include multidisciplinary specialists: who understand biological, chemical and physical hazards associated with a particular group of products, who are responsible or involved in production / manufacturing of products, who have experience and practical knowledge of hygiene, and working process and function of the equipment operating within the organization, as well as other specialists with appropriate knowledge in microbiology, hygiene and food processing technology [5].

Optimally, a multidisciplinary team will be built within the organization. But which lacks the necessary experience, the team should be assisted by qualified specialists/ experts to help them resolve difficulties, including risk analysis, control and determination of the critical control points. Experts can be from the commercial and industrial associations, independent experts and regulatory authorities.

HACCP plans are developed by the HACCP team and approved by the General Manager of the Company. Distribution of documents is based on the distribution list, so that at any moment the workplace where they were broadcast is known.

Along with the distribution of documents available, obsolete documents are promptly removed from all points of distribution, by the concern of the elaboration unit. After withdrawal invalid documents are destroyed or identified by writing "invalid". Change documents may be determined by revising the organization and functioning of society, reference documents (regulations, rules, laws, etc.) and applications employees / customers / suppliers / external organizations.

Because the information contained in the records must be complete and easy accessible, forms are used. That forms offer directions regarding the data that has to be recorded.

By their format they provide indications of data to be recorded. Encoding of the forms is made by Quality Officer in accordance with regulations: "The development and codification of procedures, work instructions and HACCP plans". The preservation of the documents is for a specified period of time.

Verification of the HACCP plan will be made quarterly. Tests and other evaluation methods will be applied in order to determine if the system is effective [6].

Tests will be applied on:

The production process

- Analysis of process deviations that occur
- Analysis of corrective measures taken

2. Conditions of production

- hygiene plan testing
- maintenance plan testing
- testing the method of recording and handling complaints from customers
- Testing the training method

3. Final products - a quality control of the product is made by sampling the final product.

Plan review will be made annually or if changes occur in conditions or methods of operation:

- Changing raw materials, ingredients or primary packaging
- Acquiring new equipment or other changes in processing conditions
- Changes in the technological flow
- Changes in legislation
- Changing equipment

The present paper aims at identifying and monitoring potential risks in the process of cheese pastry, and implementation of corrective actions in order to restore critical control points within acceptable limits.

2. Experimental

The product considered in this paper is a pastry product made from dough without yeast, with a homogeneous cheese-based filling. The product is distributed frozen, roasting and selling being achieved at the point of working partners [5]. Raw materials and materials used in the manufacturing process are presented in table 1.

TABLE 1. Raw materials and materials used in the manufacturing process

Name of raw materials	Quantity %
Meal	32.23
Water	27.84
Margarine for puffs	25
Cottage	15
Sour	3
Thickener	2.33
Milk replacer powder	1.15
Salt	0.87
Acidifying	0.58
Sugar	0.29
Dyes	1.36

In table 2 (Physicochemical characteristics) and 3 (Microbiological characteristics) are showed the physicochemical and microbiological characteristics of the studied frozen product [5].

TABLE 2. Physicochemical characteristics

Features	Conditions of eligibility	Verification methods
Content filler%	25-30	STAS 91/83
Fat content,%	30-35	STAS 91/83
Total salt,%	1-3	STAS 91/83
Humidity,%	40-45	STAS 91/83

TABLE 3. Microbiological characteristics

Features	Verification methods	Limits
Escherichia coli	ISO 16649-2/2002	Absent
Salmonella	SR EN ISO 6579/03	Absent
Stafilococcus coagulazopositiv	SR EN ISO 6888-1/2002	Absent

Packaging of the finished product is in printed polyethylene bags and PVC boxes and the closure of the bags is made by thermal closure. The storage is made by freezing at least $-18 \pm 3^{\circ}\text{C}$, protected from external effects. The transport is made with special vehicles so that the cold chain is respected, and that no changes will occur [5].

3. Results and Discussion

Potential risks were identified in the process of cheese puff pastry. Then the risks have been evaluated using the criteria resulted from the severity and frequency of risk occurrence.

Gravity is the consequences suffered by a consumer from exposure to a contaminant and is divided as follows:

- High (3 points) - fatal consequences, serious illness, incurable damage that occurs either immediately or after a longer period
- Media (2 points) - substantial damage and / or illnesses
- Small (1 point) and minor injuries or illness, minor effects or no effects at all.

Frequency is the probability to have a contaminant in the final product upon consumption. Probability is determined by measurements or observations during certain specific situations arising during the manufacturing process.

They are classified as:

- Small (1 point) - virtually impossible to produce or improbable
- Media (2 points) - can occur, they happen to occur
- High (3 points) – it occurs systematically.

Stability risk class was made taking into account the four possible levels: level one - no measure of control ($f \times g = 1$), level 2 - without control measures, but in risk analysis you take into account this risk ($f \times g = 2; 3$), level 3 - general control measures for possible control points ($f \times g = 4$), level 4 - specific control measures to eliminate or reduce risk to acceptable levels ($f \times g = 6;9$). Control measures were established for each risk.

HACCP team has determined the critical control points through the "Decision tree method", analyzing risks of 2,3,4 degree [7].

Figure 1 "A decision tree" is presented to identify critical control points.

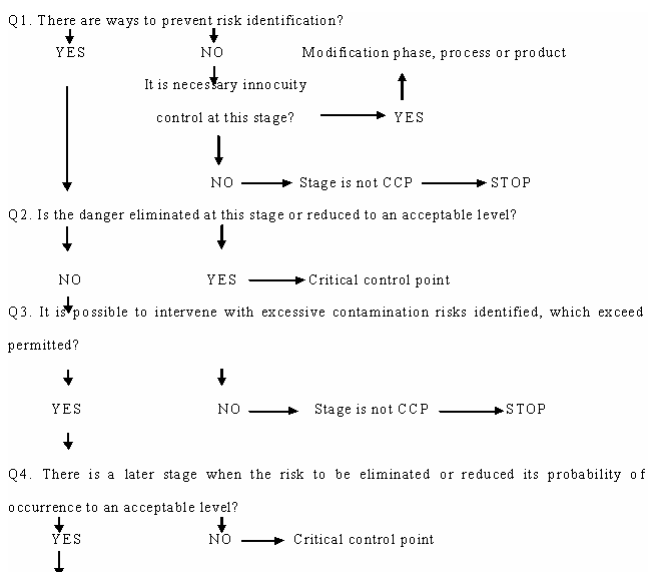


Figure 1. Decisional tree

The critical control points for pastry without yeast have been determined at all stages of the technological flow (figure 2).

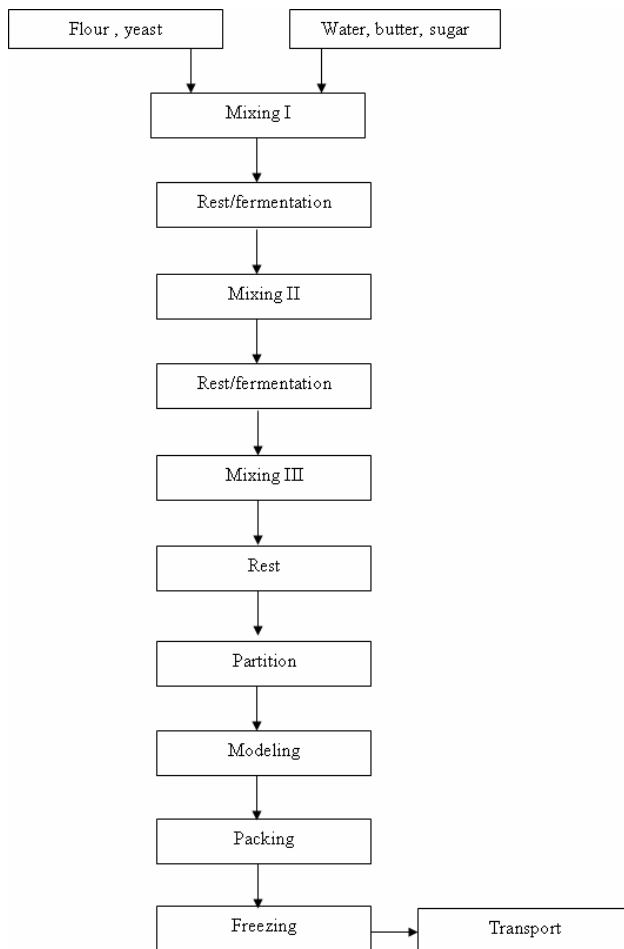


Figure 2. Technological flow chart

Table 4 presents only those stages of the production process, which will be monitored to eliminate non-compliance. For each critical control point acceptable limits were set, taking into account the existing regulatory requirements and manufacturing technology. When critical limits of critical control points have been reached or are about to be reached, the product is identified and isolated and will be treated as non-compliant product.

To restore the process within the default parameters of the manufacturing technology and in order to restore the critical control point within the allowed limits, corrective actions are established following the steps:

1. Analysis of identified problems is made in order to determine their causes, for taking correct decisions for corrective actions. The analysis of deficiencies occurred is made by the HACCP team. In its analysis, the main problem is breakdown in partial problems and a hierarchy of importance is established. Once the individual influences of each second problem on the main problem is established, the causes of the second problem are identified.

2. The establishment of the causes of the existing problems is made after the analysis performed by the HACCP team.

Possible causes of identified or potential problems are:

- Inadequate or nonexistent procedures and instructions
- Failure of procedures or instructions
- Lack of control of the processes
- Lack of appropriate training
- Improper working environment
- Financial and human resources inadequate or insufficient.

3. The establishment and the implementation of corrective actions is made in order to remove causes of the existing non-compliances.

HACCP team established methods for monitoring critical control points (CCP) and the correct actions

required to be applied when exceeding the critical limits established.

In Table 5 methods are presented through which are made: monitoring, frequency and corrections to be applied to eliminate risk.

In order to restore critical control points within the allowed limits, responsible have been designated for monitoring the steps taken into discussion and other responsible which will deal with the implementation of corrective actions. Recordings will be made according to a pre-verification program.

In Table 6 appointed responsible are presented, and also the records that have to be made regarding the applicability of corrective actions.

TABLE 4. Critical control points

No.	Stage of technological process	Risk	Risk class	"Decision tree" questions				CCP
				Q1	Q2	Q3	Q4	
1.	Screening / dosing flour	F-foreign body	4	YES	YES	-	-	YES
2.	Freezer	M-microbiological development	3	YES	NO	YES	NO	YES
3.	Packaging / weighing / metal detection	F-foreign body	4	YES	YES	-	-	YES
4.	Cold storage	M- microbiological development	3	YES	NO	YES	NO	YES
5.	Unloading cars at the premises and the partners	M-microbiological development	3	YES	NO	YES	NO	YES

TABLE 5. Monitoring, frequency and corrections

Stage of technological process	Risk	Critical value		Monitoring		Corrective actions
		Parameter	Allowable limit	Method	Frequent	
Screening / dosing flour	F	foreign body	Absent	Cleaning and checking sites	Weekly	Replacement sites
Freezer	M	Core temperature of frozen product	Maximum - 13°C	Thermometer measurement kernel	-freezer shock: each trolley; -tunnel freezer: each kneading	-Declaring non-compliant product - Prohibition of leaving the cold store frozen products 72 hours min
Packaging / weighing / metal detection	F	Metal objects	Feros Ø2,0 mm Neferos Ø2,0 mm steel Ø3,0 mm	Metal detection, verification standards	Each package of frozen, from 3 to 3:00 hour random download	Declaring non-compliant product
Cold storage at headquarters and in the premises of	M	Storage temperature	+ 18±3°C	Monitoring parameters storage	Standing on the viewing display, scoring 6 times per day	-Technical department store closing -Announcement, application services provider of cold air service, - Declaring non-compliant product
Unloading cars at the premises and the partners	M	Core temperature of frozen product	Maximum - 13°C	Thermometer measurement kernel	Every download	-Declaring non-compliant product; -Prohibition of leaving the cold store frozen products 72 hours min

TABLE 6. Responsible for implementing corrective actions and for monitoring

Stage of technological process	Responsible monitoring	Responsible for implementing corrective actions	Recordings
Screening / dosing flour	Appointed Technical Department	Head of technical department	"Weekly checks Schedule"
Freezer	Packer	-Department quality-control product -Commission analysis of non-compliance	"Application of shock freezing" "Application of freezing tunnel" "Report of noncompliance"
Packaging / weighing / metal detection	- Metal-detector - Chief packing, respectively -Department quality-control product	-Department quality-control product	"Application of product verification parameters" "Report of non-compliance items"
Cold storage at headquarters and in the premises of	Chiefs and heads of exchange deposits	-Chief Deposit - Technical Department - Department-product quality-control	"Track temperatures in frozen food store" - headquarters "Table for the notation temperatures" work-points
Unloading cars at the premises and the partners	Store bosses at the premises	- Commission of Analysis of non-compliance - Heads of deposits	Receiving frozen-Register -Report of noncompliance
	Drive-in partners	Transport logistics department Transport bosses	"Centralized route" "Report of non-compliance items"

4. Conclusions

HACCP examines the way of the development of food production, the distribution, the evaluation of the risk points, physically, chemically and microbiologically and elaborates the ways to prevent hazards and the ways to reduce risks.

Food Safety System - HACCP works by rules of good hygiene and manufacturing practices, procedures and instructions, appropriate training, discipline and conscientious, good communication, accurate and complete registration system and monitoring the CCP[4].

System efficiency can be proven by a safe finished product on which microbiological and physicochemical analysis do not indicate dangerous contaminants outside the established maximum limits, no complaints, no major deviations in the CCP, increased product market request and little corrective action.

Maintaining the system of frozen food safety operational, is assured by providing a plan of main actions of the scheme. The main actions related to maintaining the HACCP system are presented in table no 7.

Communication is an important factor in the smooth implementation and operation of the HACCP system, as this ensures a continuous link between all departments involved in the action and also a good connection between the departments and the HACCP team.

HACCP programs are necessary as long as there are new requirements for producers from the food industry around the world. Thus, for operators of food producers to be certified as ISO, an HACCP a plan must be drawn. The implementation of an HACCP system is a laborious work specific to each company.

TABLE 7. The main actions related to maintaining the HACCP system

Nr. crt.	Action	Term
1	Internal Audit	Quarterly
2	HACCP plan reassessment	Annual
3	HACCP plan review	If the changes
4	Analysis of deviations from critical limits at the PCC	Quarterly
5	Case review of complaint trends	Monthly
6	Simulation procedure recall	Annual
7	Technical News	As appropriate
8	Analysis of training and retraining for operating requirements	Quarterly

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