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Development of a HACCP plan on the technological flow of manufacturing biscuits with vegetable

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Abstract

The purpose of this paper was to identify the potential dangers that may appear at each stage of the technological process of obtaining appetizer biscuits with vegetables. This fact required the development of a HACCP plan through quality control implementation analyzes and the determination of critical control points (CCP) in the process of obtaining biscuits with vegetables.

The research was carried out covering the entire technological process from the reception of raw materials to the storage of the finished product.

Keywords: biscuits with vegetable, HACCP plan, critical control points, physical, chemical and biological hazards

1.Introduction

Food safety is an international challenge requiring close cooperation between countries in agreeing standards and systems. European consumers not only require much higher dietary quality and hygiene and health standards in the products they purchase but also look for certification and protected origin products (national or geographic) and processing methods. The hazard analysis and critical control points (HACCP) system is a science-based system created to identify specific hazards and actions to control them in order to ensure food safety and quality [1].

The food industry is responsible not only for producing safe foods, but also for demonstrating how food safety issues are designed and implemented. Developing a food safety management system contributes to this goal in an open and transparent manner [2].

HACCP is a systematic approach to identification, assessment and control of hazards during production, processing, manufacturing and preparation food. The goal of HACCP is to identify potential hazards and identify them as being of control critical control points (CCPs). By analysing and controlling documenting the process for potential emerging threats, the system develops principles that will lead to food safety guarantees. Employees are appointed within the organisation who are responsible for managing the HACCP plan [3].

Every HACCP system is capable of addressing and accommodating changes in technological advancement, advancement in equipment design, adjustments in processing procedures, and so on. Principles of the HACCP system have been adopted by the Codex Alimentarius Commission (CAC), and application guidelines are presented in an annex to the general principles of food hygiene [4, 5, 6].

HACCP implementation is based on seven principles that are used to identify and control hazards to an acceptable level [7, 8].

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Effective and efficient legally defined food control systems are essential to protect the health of consumers. Besides, they are essential to creating an environment in which countries can ensure the safety and quality of food products entering the international market and verify that imported food products meet national requirements. Undoubtedly, one of the motivations for the introduction of HACCP systems for food enterprises is to increase export potential. The European market is, for many reasons, extremely attractive for food producers from many countries of the world, and therefore knowledge of the EU food legislation is an important factor for them to successfully enter this market [9].

Hazard is a biological, chemical or physical agent in or condition of, food with the potential to cause an adverse health effect according to Codex Alimentarius. The adoption of a completely new system of managing food safety compared to HACCP led to the development of ISO 22000, which is the new international generic standard for food safety management systems (FSMS). It defines a set of general food safety requirements that apply to all organizations in the food chain. ISO 22000 controls food safety hazards through prerequisite programs (PRPs) and HACCP plans [10].

In light of HACCP system (Hazard Analysis and Critical Control Points), in food processing industry, the emergence of product defects is motivated by the presence of hazards which were not eliminated at a specific level of the technological process, or whose level was not reduced to an acceptable level, i.e. one safe for consumers' health. Three main categories of hazards can be enumerated in such a context:
(1) physical hazards
(2) chemical hazards
(3) biological [11].

2. Materials and method

Vegetable biscuits were designed in three variants, namely: with green onions, green garlic and green basil, with red peppers and dried tomatoes and with carrot.

The HACCP system includes effective methods of preventing possible hazards on the technological flow regarding food safety and food quality improvement. And the documentation and records made within the HACCP plan can easily lead to tracing the source of contamination, and reducing the consumption of human, material and financial resources.

3. Results and discussion

The results of the conducted study are summarized and presented in tables 1, 2, and 3.

Table 1. Development of the HACCP plan. Identification of critical control points

Technological operation	Risk type	CR	1. Are there at this stage preventive provisions for the identified risk?	2. Does this operation eliminate the risk or reduce the likelihood of recurrence to an acceptable level?	3. Could contamination with the identified risk exceed acceptable levels?	4. Could the risk be excluded or its likelihood be reduced in a subsequent operation?	NO. CCP
			If YES , go to the following questions	If NO, go to the next question	If NO - stop, this is not a CCP	If NO, this is a CCP	
			If NO, is control necessary in this operation for safety?	If YES, this is a CCP	If YES, go to the next question	If YES - stop, this is not a CCP	
			If YES change the step or process and go back to question 1		|		
			If NO, stop - this is a CCP Determine how and where this risk factor will be controlled				
Raw material reception	B	3	Yes	No	Yes	No	**CCP1**
	C	2	Yes	No	Yes	No	
	P	2	Yes	No	Yes	No	
Raw material preparation	B	2	Yes	No	Yes	Yes	**CP**
	C	1	Yes	No	Yes	Yes	
	P	1	Yes	No	Yes	Yes	
Dosing	B	1	Yes	No	Yes	Yes	**CP**
	C	2	Yes	No	Yes	Yes	
	P	2	Yes	No	Yes	Yes	

Table 1 *(continuation)*

Homogenisation	B	3	Yes	No	Yes	No	
	C	3	Yes	No	Yes	No	**CCP 2**
	P	2	Yes	No	Yes	No	
Dough kneading	B	2	Yes	No	Yes	Yes	**CP**
	P	1	Yes	No	Yes	Yes	
Modelling and stamping	B	1	Yes	No	No	Yes	**CP**
	C	1	Yes	No	No	Yes	
	P	1	Yes	No	No	Yes	
Baking	B	3	Yes	No	Yes	No	**CCP 3**
	C	2	Yes	No	Yes	No	
	P	3	Yes	No	Yes	No	
Cooling	B	3	Yes	No	Yes	No	**CCP 4**
	C	1	Yes	No	Yes	No	
	P	2	Yes	No	Yes	No	
Packaging	B	2	Yes	No	Yes	Yes	**CP**
	P	1	Yes	No	Yes	Yes	
Storage	B	2	Yes	No	Yes	Yes	**CP**
	C	1	Yes	No	Yes	Yes	
	P	1	Yes	No	Yes	Yes	

Table 2. HACCP plan on biscuit with vegetables the technological flow of manufacturing

Operation	**Risk**	**Monitoring procedure**					**Corrective action**	**Who answer**	**Notes**
		What	**Limits**	**How**	**When**	**Wo**			
Raw material reception CCP1	**Biological:** Moulds, Bacteria **Chemical:** Mycotoxins, Insecticides, Pesticides, Fertilizers **Physical**	Genus *Fusarium graminearum Aspergillus Bacilius mezentericus Zearalenone* Foreign bodies, impurities, sand, soil	Absence or exceeding of maximum limits allowed by official regulations for these substances	Physico-chemical determinations and microbiological	At all receipts of raw materials made	Production Engineer	The product is not received, Suppliers with problems are dropped from the list of selected suppliers	Procurement Officer, raw materials manager, quality engineer	Reception control sheet
Homogenisation CCP 2	**Biological:** Contamination with pathogenic bacteria **Chemical:** Traces of cleaning agents remaining after sanitization. **Physical:** Mineral and organic impurities	Hygiene status of homogenizing mixers and their proper rinsing The appearance of the dough mass	As per technical specifications Hygienized equipment after each flow	Sanitation monitoring sheets Visual check	Ongoing	Engineering Technologist	Withdrawal	Quality Engineer	Review Bulletins
Baking CCP 3	**Biological:** Incomplete inactivation of existing microflora due to failure to maintain thermal regime **Physical:** Contamination with impurities	Genus *Fusarium graminearum Aspergillus* and *Penicillium* Burnt debris	The temperature conforms to the standards	Monitoring and recording of thermal regime parameters	Monitoring and recording thermal regime parameters	Quality Engineer	Elimination of baked products found to have manufacturing irregularities. Identifying the causes. Furnace repair	Technologist engineer, machinery mechanical engineer	Baking temperature record sheet
Cooling CCP 4	**Biological:** Room pathogenic microorganisms **Physical:** Mineral impurities	*Listeria monocytogenes* Dust particles or smoke from furnaces	Absence of microbes and mineral impurities	Verification the sanitation of cooling installations	With every load	Engineering Technologist	Identification and isolation of non-conforming products Identifying the causes	Engineering technologist, refrigeration engineer	Cooling observation sheet

Table 3. Control procedures per operation of the technological flow manufacturing of biscuit with vegetables

Operation	Monitoring procedure				Corrective measures	Who is responsible	Records
	what	how	when	who			
Raw material reception	The state of hygiene and maintenance of the raw materials reception areas	Visual according to the system procedure	Before the stage of reception	Quality control inspector	Sanitation, repairs, personal improvement	Responsible activity of hygenisation	Evidence and preoperative control
	Provenance compliance with the technical specification and the quality certificate	Check at Reception	To each reception	Administrator	Excludere din lista furnizorilor acceptați	Manager supply-acquisitions	Document Inputs
Raw material preparation	Provenance compliance with the technical specification and the quality certificate	Check at Reception	To each reception	Administrator	Return to supplier, Removal from the list of supported providers	Manager supply-logistics	Records
Dosing	Sanitation and maintenance conditions of raw material preparation facilities	Visual	Daily	Quality inspector	Resanitization, repairs, personal retraining	Responsible sanitation	Evidence and control pre-operational
	Compliance with good hygiene and food safety practices	Visual	Permanent	Quality inspector, engineering technologist	Reinstruire, recalificare personal	Engineering technologist	Register for semi-finished samples
Homogenisation	Compliance with good hygiene and food safety practices	Observable	Daily	Quality inspector	Personal retraining	Responsible sanitation	Evidence and control pre-operational
	The state of hygiene and maintenance of the space intended for homogenization	Visual	Permanent	Quality inspector	Personal retraining resanitization, machine repairs	Quality engineer	Recording and control pre-operational
Dough kneading	Hygiene and maintenance of the areas intended for kneading the dough and forming the dough structure	Visual	Permanent	Production engineer	Personal retraining resanitization, machine repairs	Electrotechnical engineer	Recording and control
Modelling and stamping	The state of hygiene and maintenance of the space intended for molding	Visual	Daily	Stream Engineer	Checking and repairing machines	Mechanical engineer	Registration, record keeping and verification
Baking	Compliance with good hygiene and food safety practices	Visual	24/24	Quality inspector, Engineering technologist	Personal professional development	Quality engineer	Record cookie baking samples
Cooling	Compliance with temperature and cooling time	Observable	Daily	Production engineer	Bug fixes, repairs on stream	Responsible for technological flow	Cooling temperature monitoring sheet
Packaging	Detector metale	Permanent	Daily	Engineering technologist	Confiscation of non-compliant product	Engineering technologist	Metal detector sheet
	Compliance with good hygiene and food safety practices	Visual	Daily	Automation supervisor, Quality engineer	Personal retraining, bug fixes	Supervisor Quality engineer	Register samples "biscuits with vegetable" type product
Storage	Hygiene and maintenance of storage space	Visual	Daily	Preoperational	Resanitization, repairs, personal retraining	Responsible sanitation	Control record
	Temperature and humidity in the warehouse	Twice/day	Permanent	Engineering technologist, automation supervisor	Bug fixes, program modification	Supervisor logistics	Observation sheet Storage temperature
	Compliance with good hygiene and food safety practices	Visual	24/24	Quality engineer	Personal training	Quality engineer	Register samples biscuits with vegetable

4.Conclusions

The importance of the HACCP plan is evident in monitoring food factories until a safe product is supplied to the consumer. This must be checked regularly by continuous monitoring of records and control documents. The results showed that there are critical control points in some processing steps and with theoretical and practical training these points were controlled.

Compliance with Ethic Requirements: Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exists) respect the specific regulation and standards.

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