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## **HACCP SECURITY SYSTEM AT CONFECTIONERY PRODUCTION ENTERPRISES**

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The Hazard Analysis and Critical Control Points (HACCP) safety system is a food safety management system that is used worldwide to prevent risks associated with food products. It is mandatory for all enterprises producing food products, including confectionery. In this article, we will look at what the HACCP security system is, how it works at confectionery production enterprises and why it is important for ensuring food safety.

HACCP at a confectionery enterprise implies a food safety management system (FSMS), which builds the work of the enterprise within the framework of international standards, but HACCP is not comprehensive, does not take into account a large number of biological, chemical, physical threats in the production of confectionery products, unlike FSMS based on ISO 22000:2018, FSSC 22000 standards, BRC or IFS [1]

Such a quality management model is used at all stages of confectionery production, starting from the receipt of raw materials and ending with the packaging of finished products. At the same time, critical control points are determined at each stage of production, where it is necessary to control and manage risks. [2]

As for the production of confectionery products, due to the fact that the process takes place at a high temperature, the sterilization of products is carried out very efficiently, as a result of which the possibility of the development of harmful microorganisms in them is minimized. Therefore, we can say that in most cases, in the production of confectionery products, the sources of potential danger are foreign elements, as well as contamination with foreign chemicals.

For example, all raw materials used for the production of chocolate pastes must have hygiene certificates, certificates of conformity and quality certificates, comply with the requirements of regulatory documentation, sanitary norms and rules [3].

For the production of chocolate pastes, a list of potentially dangerous factors has been compiled: physical, microbiological and chemical, which is given in Tables 1-5, based on all available information, including NTD.

Table 1. List of physical hazards

№ п/п	Name of the danger	Short description
1	Building materials of workshops	Plaster, paint, pieces of wood
2	Birds, rodents, insects and their waste products	This group is characterized by the fact that the places of their localization and their excrement are difficult to access
3	Personal items	Buttons, earrings, jewelry, combs, small personal items
4	Personnel waste	Hair, nails
5	Elements of technological equipment	Small pieces of equipment (nuts, screws, bolts, screws, pieces of electrical wiring, pieces of conveyor belt)
6	Wear products of machinery and equipment	Fragments of parts undergoing sharpening, knives, blades
7	Metal mixtures	Sawdust of metal origin, pieces of electrical wire
8	Glass fragments	Glass thermometers, electric light bulbs
9	Water	Smell, taste, color, turbidity
10	Contamination with lubricants	With abundant lubrication of the rollers, contamination of the products is possible

Table 2. List of microbiological hazards

№ п/п	Name of the danger	Brief description
1	QMAFAnM - Quantity of Mesophilic Aerobic and Facultative Anaerobic Microorganisms	Sanitary-indicative m/o. They are taken into account when assessing the condition of containers, equipment, hands, san. clothes and shoes. When assessing the sanitary well-being of water, raw materials, auxiliary materials, finished products.
2	Bacteria of the E. coli group	Determines the degree of contamination of equipment, tools, raw materials, finished products, water, hands, clothes.
3	S. aureus	It is taken into account when assessing the sanitary and hygienic state of production, the quality of disinfection, the sanitary well-being of water, raw materials, and finished products.
4		They cause damage to raw materials, auxiliary materials, and finished products.
5	Salmonella	They are included in the group of pathogenic m/O. The incidence of salmonellosis continues to be high in all countries of the world. The source of salmonella infection for humans are animals and birds.
6	Mycotoxins (Aflatoxins)	Toxins released by mold fungi. Acute and slow-flowing carcinogenic processes can cause.

Table 3. List of chemical hazards

Name of the danger	Short description
Elements of detergents	Niko, Rapin-B - burns, soda ash, bleach solution, ferry
Pesticides	Hexachlorocyclohexane, DDT and its derivatives are normalized
Radionuclides	The content is normalized: cesium – 137, strontium - 90
Toxic elements	Lead, arsenic, cadmium, mercury
Food additives flavorings	Flavorings, dyes, baking powder

Table 4. Selection of considered hazards for products produced by the chocolate production shop

№ п/п	Name of the factor	Probability of implementation	Severity of consequences	The need for accounting
1	Building materials	3	2	+
2	Birds, rodents, insects and their waste products	3	2	+
3	Personal items	2	1	-
4	Personnel waste	2	1	-
5	Elements of technological equipment	2	2	-
6	Wear products of machinery and equipment	2	2	-
7	Metal mixtures	3	3	+
8	Glass fragments	3	3	+
9	Water	2	2	-
10	Contamination with lubricants	3	2	+
11	Elements of detergents	3	2	+
12	Pesticides	2	3	+
13	Pesticides	2	4	+
14	Radionuclides	2	4	+
15	Toxic elements	2	4	+
16	Food additives flavorings	2	2	+
17	QMAFAnM - Quantity of Mesophilic Aerobic and Facultative Anaerobic Microorganisms	2	3	+
18	Bacteria of the E. coli group	2	3	+
19	S. aureus	2	3	+
20	Yeasts	2	3	+
21	Pathogenic, including salmonella	2	3	+
22	Mold	2	3	+

Table 5. Determination of CCP in the technological process of production of chocolate pastes.

№ Operation	Dangerous factor	A1	A2	A3	A4	CCP
<b>Metal mixtures</b>						
1	Dosing and mixing of components	+	-	-	-	
2	Grinding of the prescription mixture	+	-	-	-	
3	Homogenization	+	-	-	-	
4	Laying out chocolate pastes	+	-	-	-	
5	Packaging of chocolate pastes	+	-	-	-	
6	Acceptance quality control	+	-	-	-	
7	Transportation to the warehouse	+	-	-	-	
8	Keeping	+	-	-	-	
9	Periodic tests	+	-	-	-	
10	Realization	+	-	-	-	
<b>Glass fragments</b>						
1	Dosing and mixing of components	+	-	-	-	
2	Grinding of the prescription mixture	+	-	-	-	
3	Homogenization	+	-	-	-	
4	Laying out chocolate pastes	+	-	-	-	
5	Packaging of chocolate pastes	+	-	-	-	
6	Acceptance quality control	+	-	-	-	
7	Transportation to the warehouse	+	-	-	-	
8	Keeping	+	-	-	-	
9	Periodic tests	+	-	-	-	
10	Realization	+	-	-	-	
<b>Elements of detergents</b>						
1	Dosing and mixing of components	+	+			CCP
2	Grinding of the prescription mixture	+	+			CCP
3	Homogenization	+	+			CCP
4	Laying out chocolate pastes	+	-	-	-	
5	Packaging of chocolate pastes	+	+			CCP
6	Acceptance quality control	+	-	-	-	
7	Transportation to the warehouse	+	-	-	-	
8	Keeping	+	-	-	-	
9	Periodic tests	+	-	-	-	
10	Realization	+	-	-	-	

HACCP Working Group, based on the list of CCP for input control of the main and auxiliary raw materials and for each operation of the production process, develops "HACCP Worksheets", which provide for control objects, monitoring, corrective and preventive actions.

In this case, the HACCP worksheets are designed for processes:

- dosing and mixing of components;
- periodic tests;
- for homogenization and acceptance quality control;
- laying chocolate pastes.

Internal inspections of HACCP are carried out immediately after the introduction of the HACCP system and then with established frequency at least once a year or on an unscheduled basis when new unaccounted hazards and risks are identified [4].

Table 6. List of CCP in the technological process of chocolate paste production

№	Name of the operation	Name of the CCP	The considered dangerous factor
1	Dosing and mixing of components	Control of the presence of detergent elements; Control of the presence of contamination with lubricants; Control of the availability of paper and packaging materials; Control of the availability of building materials, birds, rodents, insects and their waste products	The factor of the presence of detergent elements; The factor of the presence of contamination with lubricants; The factor of the availability of paper and packaging materials; The factor of the availability of building materials, birds, rodents, insects and their waste
2	Grinding of the prescription mixture	Control of the presence of detergent elements Control of the presence of contamination with lubricants	The factor of the presence of detergent elements The factor of the presence of contamination with lubricants
3	Homogenization	Control of the presence of detergent elements; Control of the presence of contamination with lubricants; Control of dosages of food additives	The factor of the presence of detergent elements; The factor of the presence of contamination with lubricants; Factor of introduction of food additives
4	Laying out chocolate pastes	Availability control QMAFAnM, Bacteria of the E. coli group, yeast, pathogenic, including salmonella	The factor of the presence of QMAFAnM, Bacteria of the E. coli group, yeast, pathogenic, including salmonella
5	Packaging of chocolate pastes	Control of the presence of detergent elements	The factor of the presence of detergent elements
6	Acceptance quality control	Control of dosages of food additives	The factor of the presence of food additives
7	Periodic tests	Control of the presence of radionuclides, pesticides, toxic elements, mycotoxins; Control of the presence of QMAFAnM, Bacteria of the E. coli group, yeast, pathogenic, including salmonella, molds.	The factor of the presence of radionuclides, pesticides, toxic elements, mycotoxins; The factor of the presence of QMAFAnM, Bacteria of the E. coli group, yeast, pathogenic, including salmonella, molds.

Preventive actions have been developed to control dangerous factors. Preventive actions are also taken in cases that are not critical control, but constant monitoring of which is necessary, since with insufficient control they can lead to a failure of the technological process.

The preventive actions include:

- control of the parameters of the technological process of production;
- heat treatment;
- the use of natural preservatives;
- use of a metal detector;
- periodic monitoring of the concentration of harmful substances;
- washing and disinfection of equipment, inventory, hands, shoes, etc.

Based on the analysis, which is based on a list of potentially dangerous factors in the production of chocolate pastes: physical microbiological and chemical, it is worth noting that the HACCP safety system at confectionery production enterprises provides:

1. Hazard identification: Identification of possible hazards associated with each step of confectionery production, from the purchase of raw materials to the packaging of finished products. This may include bacteria, viruses, chemical pollutants, etc.

2. Identification of Critical Control Points (CCPs): Identification of points in the production process where hazards may occur that can be controlled or prevented. These points should be strictly controlled and monitored.

3. Establishment of control criteria: Definition of criteria that will be used to assess the safety of the product at each step of production.

4. Development of a monitoring plan: Definition of monitoring methods for each RCMP, including frequency, methods and reporting.

5. Development of management procedures: Definition of management procedures in case of detection of hazards or violations at any stage of production.

6. Personnel training: Training of personnel in food safety methods and management procedures, as well as their role in the HACCP safety system.

7. System verification: Conducting audits and regular inspections to ensure that the HACCP security system meets the requirements and its effectiveness.

When developing and implementing the HACCP safety system, it is necessary to take into account the specifics of confectionery production, such as the use of various ingredients, equipment features and storage conditions. In addition, all local and international regulatory requirements for food safety should be observed.

As part of the development of such concepts as "safety" and "quality" on the market, we can confidently say that HACCP will gain popularity and be implemented all over the world. In the short term, HACCP will increasingly be adopted by food industry enterprises and government agencies.

To include food safety in the overall strategy of the company, it is necessary to formalize the implementation process. The organization should plan the safety of manufactured products as carefully as the output and costs. Food safety should be an integral part of the overall strategic plan and contain clearly formulated goals for each level of employees. This makes it possible to raise the importance of the HACCP system and make this system one of the tools for assessing the success of the company [5].

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