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FOOD SAFETY AND HACCP SYSTEM IN THE *PHYSALIS* CONFITURE PRODUCTION

Abstract. The identification of hazards and the principles of the food safety management system are considered. Within the processing of the fruit and berry raws, the jam and confiture production technologies could assume Critical Control Points that will influence the final product safety. In the productionof *Physalis* confiture with a lemon, a sugar and apple pectin,by taking into account the principles of the HACCP system,the technological processes are analyzed. *Physalis* as a natural antioxidant has a high nutritional value and useful features in medicine. In this regard it is important to keep all *Physalis* benefits in the confiture production. Each technological process step by step analyzed, andprerequisites of the Critical Control Points were determined. The most important production stages are: reception and sorting, cleaning and sterilization. For the avoiding of the negative factors,monitoring system, control and corrective actions on the base of the HACCP / MS ISO 22000:2018 Food safety management systems standard are offered.

Key-words: food safety, HACCP, confiture, *Physalis*, hazards, risks, prerequisite.

Introduction

Safety of food products is the concept according to which the food products will not cause any harm to the consumer if they are prepared and/or eaten according to the appropriate application. In this regard, for the supporting of the specified concept and regulations of the harmless productions, a safety management system of food is important. Investments into safety management systems of food are key prerequisite of reliable and stable supply of safe food products and growth of international trade [2].

HACCP (Hazard Analysis and Critical Control Points) systemis a simple and logical control system based on the concept of preventing problems by identifying hazards, establishing critical control points and developing measures for monitoring, preventing and correcting them. It should be developed taking into account seven basic principles [4]:

1. Conduction of possible hazardsanalysis;
2. Identification of Critical Control Points (CCP).
3. Determination of Critical Limits for CCP.
4. Establishment of a monitoring system for control on CCP.
5. Setting of corrective actions.
6. Fixingof verification procedures.
7. Establishment of principles for maintaining records and documentation.

Within the processing of raw fruits and berry, the jam and confiture production technologies Critical Control Points that will influence the final product safety can be established.

To obtain confiture based on*Physalis*, following products areused: *Physalis* fruits, lemon, sugar and apple pectin.

The technological process of production of the confiture consists of:reception and sorting of initial products, cleaning, washing, grinding and mixing, filling, packing, sterilization, storage. There is a potential risk of hazard detection in each stage of the production of confiture.

The HACCP system should take into account all categories of potential risk: biological, chemical and physical hazards [8].

Biological risks include risks resulting from the action of living organisms including yeast (osmophilic yeast), microorganisms (pathogens), protozoa, parasites, etc., their toxins and waste products [3,5].

Chemical risks can be divided depending on the source of origin into three following groups:

1. Inadvertently ingested chemicals;

a) Agricultural chemicals: pesticides, herbicides, plant growth regulators, etc.

b) Chemicals used in enterprises: cleaning, washing and disinfecting agents, lubricating oils, etc.

c) Infections from the external environment: lead, arsenic, cadmium, mercury, etc.

2. Naturally occurring risk factors of products plant, animal or microbial metabolism, such as aflatoxins.

3. Chemicals intentionally added to food, such as preservatives, acids, food additives, substances that facilitate processing, etc.

Physical risks are associated with the presence of any physical material that is not present in the natural product or the food product, and which can cause disease or harm to the person who consumed the food product (glass, metal, plastic, etc.) [6].

MATERIALS AND METHODS

For the preparation of the confiture following ingredients were used:*Physalis*, sugar, lemon and apple pectin.Organoleptic and physicochemical properties were analyzed in accordance with the GOST (State standard) 34447-2018 “Confiture” [9,10].

Physalis is a member of the Solanaceae family that owns a large number of edible plants: potatoes, tomatoes, eggplants and others. In recent years, *Physalis* has begun to firmly conquer the world markets due to its high nutritional value and the promise of its application in medicine in the treatment of malaria, hepatitis, rheumatism, arthritis, dermatitis, asthma, cardiovascular and oncological diseases, Alzheimer's disease, dementia and anti-fatigue. *Physalis* fruits contain all the essential and non-essential amino acids, in the largest number of essential L-*valine* and L-*isoleucine*, and of the interchangeable amino acids L-*tyrosine*. The phytoncide content makes the *Physalis* fruits as good physiological an antiseptic, they also contain polyphenols, ascorbic acid (vitamin C), carotenes (vitamin A), thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), calcium, ferrum, phosphorus and other organic acids, macro- and microelements, tannins. The content of solids is in the range from 6% to 10%. *Physalis* fruits are used in the treatment of diseases of the gastrointestinal tract, chronic cholecystitis, in hypertension, as a multivitamin, and extracts of the *Physalis* have anti-inflammatory, hemostatic and analgesic effects. Due to the presence of water-soluble pectin and gelling properties, *Physalis* has been used in the cooking, in the preparation of jelly, marmalade, confiture, jam, yoghurt and soft drinks [1,7,11].

Results and discussion

In the presented work, an analysis of the likely hazardous factors in the production of *Physalis* confiture is carried out. All stages of production were analyzed as sources of hazards: reception and sorting of initial products, cleaning, washing, grinding and mixing, filling, packing, sterilization, storage. The summarized results are presented in table 1.

Table 1- Hazard Analysis in the production of *Physalis* confiture

Name ofoperation	Process parameters	Consideredfactors	Controlledhazards	Preventive action	Responsible person
1. Reception and sorting of *Physalis*, sugar and lemon	*Physalis* berries must be fresh or frozen, quite ripe, clean, without foreign smell, without peduncles, heterogeneous in size and color, without any damage and disease. Lemon fruits are fresh, clean, not ugly, without mechanical damage, without damage by pests and diseases, with a pedunlet exactly cut at the base of the fruit	Microbiological	a) bacteria of the group of *Escherichia coli* (BGEC), b) pathogenic microorganisms	Control at the reception	Head of Laboratory
		Chemical	a) pesticides b) herbicides c) plant growth regulators	Input control	Head of Laboratory
		Physical	a) glass b) metal c) plastic	Control at the reception	Head of Laboratory
	Presence of microorganisms in sugar	Microbiological	Pathogens	Control at the reception	Head of Laboratory
		Chemical	a) mercury b) arsenic c) copper	Input control	Head of Laboratory
		Physical	a) glass b) metal c) plastic	Input control	Head of Laboratory
2. Cleaning	The remains of unsuitable parts of raw materials	microbiological	Bacteria, viruses, yeasts, moulds and viruses	Cleaningprocessc ontrol	Foreman
3. Washing	Detergent residues	Physical	At non-observance of the washing process, the berries which are not completely cleared from strangers can remain	Control of washing process	Foreman
4. Grinding and mixing	Metal fragments, personal belongings of staff	Physical	If the grinding and mixing processes are disregards, foreign objects or particles can input into the finished product	Control grinding and mixing processes	Foreman
5. Filling	Contaminated packaging	Microbiological	Sterilizing	Control of the filling process into the packaging, the creation of aseptic conditions	Foreman
6. Packing	Presence of foreign objects	Physical	If the packing process is disregard, foreign objects or particles can input into the finished product (rubber from the cover, glass, plastic).	Control of the packing process	Foreman
7.Sterilization	Incorrect compliance of the sterilization process	Microbiological Physical	*Escherichiacoli* bacteria Impurities Metal parts of equipment	Creating aseptic conditions Use of metal detector	Foreman
8. Storage	Package integrity	Microbiological	Temperature,°C Duration, h	Control of temperature-time variation	Foreman

The technological scheme for the obtaining of *Physalis* confiture with the identification of possible CCP (Critical Control Points) is presented in Figure 1.

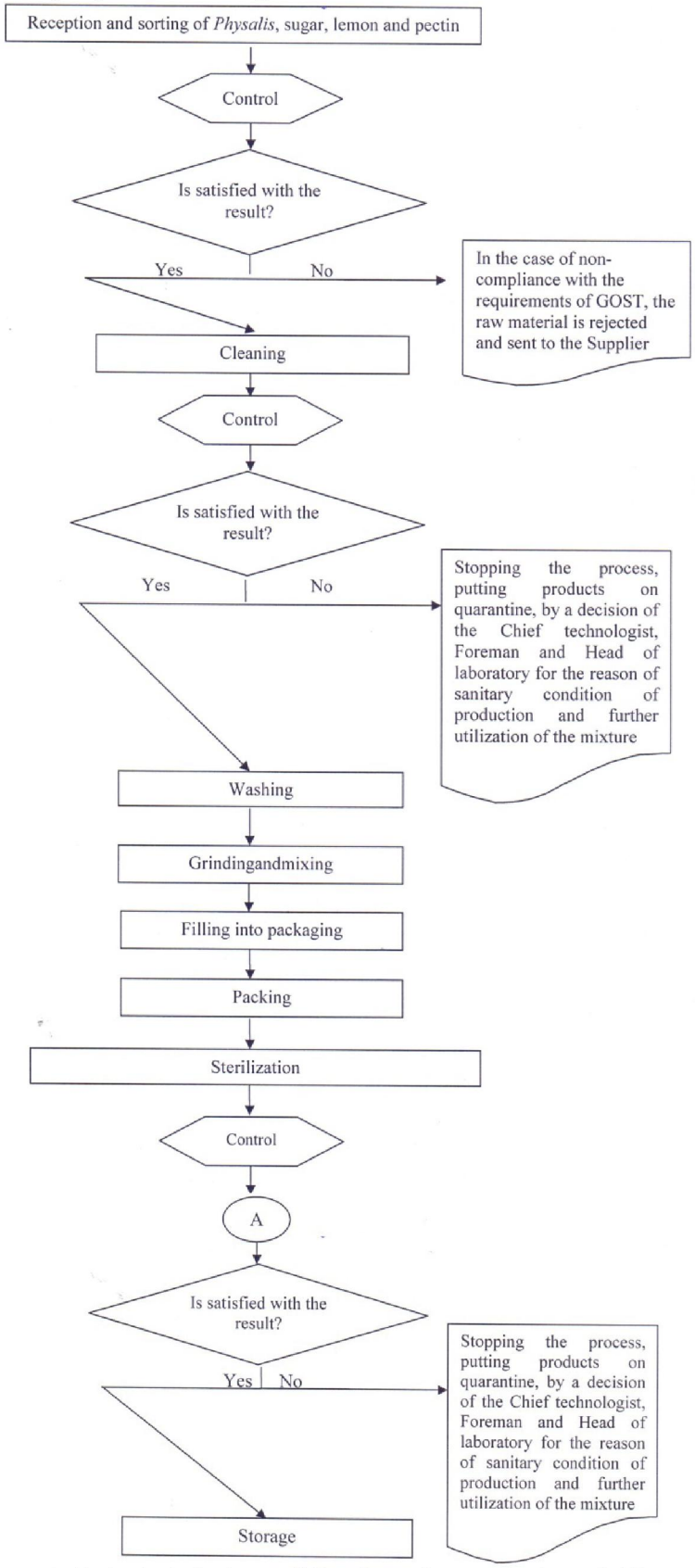

Figure 1 - Technological scheme of *Physalis* confiture production and CCPs

By analyzing of the Figure 1, three CCPs with high risks are identified: reception and sorting, cleaning and sterilization. These production stages and offered control actions are presented in the Table 2.

Table2 - Prerequisites of the CCPs risk assessment and control actions in the production of *Physalis* confiture

Prerequisite	Risk	Control actions	Degree of risk
CCP 1	Reception and sorting of Physalis, lemon, sugar and apple pectin	Physalis berries must be fresh or frozen, quite ripe, clean, without foreign smell, without peduncles, heterogeneous in size and color, without any damage and disease. The fruits of the lemon are fresh, clean, not deformed, without mechanical damage, without damage by pests and diseases, with a stems evenly cut off at the base of the fruit. More thorough visual inspection and laboratory analysis of berries and fruits.	High
CCP 2	Cleaning	Compliance strictly with the parameters of cleaning, identifying rotten, mismatching berries, cleaning of foreign objects	High
CCP 3	Sterilization	Control of sterilization parameters	High

CONCLUSION

Thus, the analysis of the most possible dangers in the production of confiture from *Physalis* carried out, with potential prerequisites of the CCPs (Critical Control Points) istaken into account: biological, chemical, and physical risks. The dangerous factors and critical control points are determined.The most important production stages are: reception and sorting, cleaning and sterilization. As the checking operations are necessary visual inspection and laboratory analysis of berries and fruits. A monitoring system for the control of CCPs and corrective actions are also required. For the avoiding of the negative factors,monitoring system, control and corrective actions on the base of the HACCP / MS ISO 22000:2018 Food safety management systems standard are offered.

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PHYSALIS КОНФИТЮРІ ӨНДІРІСІНДЕГІ ТАМАҚ ҚАУІПСІЗДІГІ ЖӘНЕ НАССР ЖҮЙЕСІ

Аннотация. Тамақ өнімдерінің қауіпсіздігін басқару жүйесінің қауіптілігі мен принциптері қарастырылады. Жеміс-жидек шикізатын өңдеу кезінде джем мен конфитюрді өндіру технологияларының соңғы өнімнің сапасына әсер ететін сыни бақылау нүктелері болуы мүмкін. Лимон, қант және алма пектині бар *Physalis*конфитюрасын өндіру кезінде ХАССП жүйесінің принциптерін есепке ала отырып, технологиялық үдерістер талданады. *Physalis*табиғи антиоксидант ретінде медицинада жоғары тағамдық құндылыққажәне пайдалы қасиеттерге ие. Осыған байланысты конфитюралар өндірісіндегі *Physalis*-тің барлық артықшылықтарын сақтау маңызды. Әрбір технологиялық процесс кезең-кезеңімен талданады және сыни бақылау нүктелері анықталады. Өндірістің ең маңызды кезеңдері: қабылдау және сұрыптау, тазалау және зарарсыздандыру. Жағымсыз факторларды болдырмау үшін HACCP / ISO 22000: 2018 стандарты негізінде мониторинг, бақылау және түзету әрекеттері ұсынылады.

Түйін сөздер: тағам қауіпсіздігі, ХАССП, конфитюр, физалис, қауіптер, тәуекелдер, алғышарты.

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ПИЩЕВАЯ БЕЗОПАСНОСТЬ И СИСТЕМА НАССР В ПРОИЗВОДСТВЕ КОНФИТЮРА *PHYSALIS*

Аннотация. Опасности и принципы системы управления безопасностью пищевых продуктов рассматриваются. Технологии производства джема и конфитюра при переработке плодово-ягодного сырья могут иметь критические контрольные точки, которые будут влиять на качество конечного продукта. При производстве конфитюра *Physalis*с лимоном, сахаром и яблочным пектином, с учетом принципов системы ХАССП анализируются технологические процессы. *Physalis*как природный антиоксидант обладает высокой пищевой ценностью и полезными свойствами в медицине. В связи с этим важно сохранить все преимущества *Physalis* в производстве конфитюров. Каждый технологический процесс поэтапно анализируется, и определяются критические контрольные точки. Наиболее важными этапами производства являются: прием и сортировка, очистка

и стерилизация. Во избежание негативных факторов предлагаются системы мониторинга, контроля и корректирующие действия на основе стандарта HACCP / ISO 22000: 2018 системы управления безопасностью пищевых продуктов.

Ключевые слова: пищевая безопасность, ХАССП, конфитюр, физалис, опасности, риски, пререквизит.

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