

<https://doi.org/10.31891/2219-9365-2024-77-16>

UDC 338.439:614.3

BAL-PRYLYPKO Larysa

National University of Life and Environmental Sciences of Ukraine

<https://orcid.org/0000-0002-9489-8610>

ANTONENKO Artem

National University of Life and Environmental Sciences of Ukraine

<https://orcid.org/0000-0001-9397-1209>

e-mail: artem.v.antonenko@gmail.com

TOLOK Galina

National University of Life and Environmental Sciences of Ukraine

<https://orcid.org/0000-0002-2971-1645>

BROVENKO Tetiana

National University of Life and Environmental Sciences of Ukraine

<https://orcid.org/0000-0003-1552-2103>

KRYVORUCHKO Myroslav

State University of Trade and Economics

<https://orcid.org/0000-0002-7378-1050>

GORKUN Artem

Kyiv University of Culture

<https://orcid.org/0009-0002-0370-4823>

ACCREDITATION AND PROSPECTS OF HACCP SYSTEM IMPLEMENTATION IN FOOD PRODUCTION

The need for accreditation, implementation of the system of analysis of hazardous factors and determination of critical control points (HACCP) at food industry enterprises as a quality management system based on environmental friendliness and product safety is well-founded. The main task in the development of the industry is to increase the competitiveness of products, to strengthen the innovative focus by implementing quality management systems that ensure the quality of products at all stages of its production (life) cycle and contribute to increasing the effectiveness of the work of enterprises [4]. Such a food safety management system, which has proven its effectiveness and is accepted at the international level, is the HACCP system. Guaranteeing food safety is the main goal of applying the HACCP concept to the production process. There are many factors that are not related to the production and processing of products, but have a negative impact on the safety of food products. One aspect of the spread and implementation of this product safety management system is that it is a kind of basis for forming the quality of organic products. When certifying organic products, the necessary prerequisites are documentation of all stages of production and the ability to trace the path "from the doe to the table". Accordingly, the lion's share of the documents that should be at the processing enterprises of organic agricultural products have already been developed, provided that the HACCP system is implemented, and the requirements for product safety are also met. The implementation of the HACCP system requires planning the control of all areas of the technological process, defining the limits of research, application and maintenance of this system. The HACCP plan is drawn up at the enterprise - a document that, in accordance with the principles, determines the procedures and sequence of actions to ensure the control of hazard factors. The HACCP plan covers all areas of product production, from raw material acquisition to product processing or packaging, as well as supply to retail.

Keywords: HACCP, accreditation, quality management system, food products, critical control points.

БАЛЬ-ПРИЛИПКО Лариса, АНТОНЕНКО Артем, ТОЛОК Галина, БРОВЕНКО Тетяна

Національний університет біоресурсів і природокористування України

КРИВОРУЧКО Мирослав

Державний торговельно-економічний університет

ГОРКУН Артем

Київський університет культури

АКРЕДИТАЦІЯ І ПЕРСПЕКТИВИ ВПРОВАДЖЕННЯ СИСТЕМИ НАССР У ВИРОБНИЦТВІ ХАРЧОВОЇ ПРОДУКЦІЇ

Обґрунтована необхідність проведення акредитації, впровадження системи аналізу небезпечних факторів та визначення критичних точок контролю (НАССР) на підприємствах харчової промисловості як системи управління якістю на основі екологічності та безпечності продукції. Основним завданням у розвитку промисловості є підвищення конкурентоспроможності продукції, посилення інноваційної спрямованості шляхом впровадження систем управління якістю, які забезпечують якість продукції на всіх етапах її виробничого (життєвого) циклу і сприяють підвищенню результативності роботи підприємств. Такою системою управління безпечністю харчових продуктів, яка довела свою ефективність та є прийнятною на міжнародному рівні, є система НАССР. Гарантування безпечності продуктів харчування є основною метою застосування концепції НАССР до процесу виробництва. Існує безліч чинників, які не пов'язані з виробництвом і переробкою продуктів, але справляють негативний вплив на безпечність продуктів харчування. Одним аспектом поширення і впровадження даної системи управління безпечністю продукції є те, що вона – своєрідний базис для формування якості

органічної продукції. При сертифікації органічної продукції необхідними передумовами є документування всіх етапів виробництва та можливість простежити шлях «від лану до столу». Відповідно лівова частка документів, які повинні бути на підприємствах-переробниках органічної сільськогосподарської продукції, вже є розроблені, за умови, якщо впроваджена система HACCP, а також виконуються вимоги щодо безпечності продуктів. Реалізація системи HACCP потребує планування контролю всіх ділянок технологічного процесу, визначення меж дослідження, застосування і підтримання цієї системи. На підприємстві складається план HACCP – документ, що відповідно до принципів визначає процедури та послідовність дій з метою забезпечення контролю факторів безпеки. План HACCP охоплює всі ділянки виробництва продукції, починаючи від отримання сировини до переробки або пакування продукції, а також постачання у роздрібну торгівлю.

Ключові слова: HACCP, акредитація, система управління якістю, харчова продукція, критичні точки контролю.

Statement of the problem in a general form and its connection with important scientific or practical tasks

The predominance of the fifth technological system and the transition to the sixth determined the unconditional priorities of state support - science and education; the predominance of the intellectual nature of work over the industrial; integrated technologies; high-value labor. In general, this balance is based on three components - people, the economy, and the environment. In this chain, the quality and safety of food products, both in packaging for the consumer and in the process of their manufacture, transportation and sale, becomes an important tool. This is especially acutely felt in conditions of growing competition and open international integration

Analysis of the latest research

Many foreign and domestic scientists and scientists were engaged in the study of the quality and safety of food products based on the implementation of quality management systems at enterprises. Among them, we can name such scientists as V. Andriyuk, Y. Zhalilo, Y. Zavadskyi, L. Yevchuk, D. Krysanov, P. Sabluk, O. Piddubny, M. Porter, B. Ryzberg, V. Stevenson, R. Fathudinov et al.

However, a number of problematic issues still do not have a final scientific solution. This primarily concerns the economic and organizational aspects of accreditation, development and implementation of the HACCP system in the production of food products.

Formulation of the goals of the article

The purpose of the work is the accreditation and development of methodological foundations for the implementation of the HACCP system as a quality management system, which ensures the increase in the competitiveness of the products of food industry enterprises.

Presenting main material

The insufficient level of providing the population with safe food products is a global problem. Moreover, this problem is growing faster and more globally over time. The number of hungry people in the world is increasing every year. According to the UN, the food crisis is already present in more than 40 countries. Thus, according to Faostat, each inhabitant of Bangladesh and Burundi consumes only 3 kg of meat per year, while the average consumption of meat in the world is 36.9 kg. On the other hand, due to the lack in some countries of the modern industry of processing, preparation, packaging and storage of food products, up to 50% of them spoil and become unfit for consumption. To this must be added significant risks for the population due to diseases from the consumption of low-quality and dangerous food products that cannot be saved even by the most modern packaging.

Every year, 2.0 to 2.2 million people die worldwide from diseases related to stomach disorders due to consumption of contaminated food or water. Up to 30% of the population of developed countries are exposed to foodborne diseases. Thus, according to Professor Chris Griffith, up to 47.8 million cases of food-borne diseases are recorded in the USA every year, due to which more than 3 thousand people die, and losses due to compensation to victims and bankruptcy of enterprises amount to more than 210 million dollars [2].

Such examples show that due to insufficient management of control over the quality and safety of food products in production and in the process of its sale, both the population (illness, death) and business (additional losses, fines, bankruptcy) suffer.

That is why the resolution of the 126th session of the executive committee of the World Health Organization (January 2010) not only determines that food safety remains an urgent problem in the field of public health, but also emphasizes the need to find global and effective solutions its improvement in all parts of the world. The main executors of measures for the implementation and operation of food safety management systems are business enterprises that operate in markets along the entire chain - from the cultivation and preparation of agricultural products to production and retail sale [3].

The main task in the development of the industry is to increase the competitiveness of products, to strengthen the innovative focus by implementing quality management systems that ensure the quality of products at all stages of its production (life) cycle and contribute to increasing the effectiveness of the work of enterprises [4]. Such a food safety management system, which has proven its effectiveness and is accepted at the international level, is the HACCP system.

HACCP - Hazard Analysis and Critical Control Points - is a Latin abbreviation that stands for "system of risk analysis and critical control points". It allows you to guarantee the production of safe products by identifying and controlling dangerous factors. It was developed by the company "Pillsbury" together with the laboratories of the US Armed Forces and the National Aeronautics and Space Administration of NASA during the work on the American Space Program. At that time, NASA was faced with the task of developing a system that completely eliminates the possibility of the formation of toxins in food products intended for use by the crew of a spacecraft during work in outer space. To solve this problem, in 1971, the Pillsbury company presented the concept of HACCP at the first American National Conference on Food Safety. Since this system proved to be effective, soon all canners and meat processors were required to implement it, and later this requirement began to apply to all food manufacturers without exception [2].

The advantages of the HACCP system are better use of resources and a quick response to deviations from the requirements of regulatory documents. Before the introduction of HACCP, tests of the final product were carried out to assess its safety, that is, to determine the product's compliance with quality and safety requirements, a certain percentage of samples were selected for testing. The number of samples to be tested to make sure that the final product meets the standard does not always guarantee that the test results apply to absolutely all product samples from the lot.

Indeed, if there is a violation and a product is produced below the established standard, it is impossible to determine the reason for this before the end of product testing. Many of the microbiological tests require a 3-5 day incubation period to obtain results to prevent risk. All this leads to financial losses if the product has to be withdrawn from production, or, in the worst case, the consumer is poisoned - as a result of using a low-quality product. A risk that causes a product to be unsafe to consume may be biological, chemical or physical in nature or related to the condition of the food product, including:

- 1) physical risks – dirt, insects, etc.;
- 2) chemical risks – salts of heavy metals, pesticides, etc.;
- 3) biological risks – microbiology, hormones, etc.

A critical control point (CCP) can be associated with a raw material or a stage of work in the production process where the presence of a risk is recognized and measures are required to eliminate, prevent or reduce it.

In order to determine the most appropriate means of monitoring CTC, a complete understanding of the technological process is required. Tests where results are obtained quickly have an advantage over traditional time-consuming microbiological analysis (for example, measuring pH instead of counting acid-producing bacteria). At the same time, other stages require visual or sensory tests, such as those that take into account the color and smell of fresh fish.

Guaranteeing food safety is the main goal of applying the HACCP concept to the production process. There are many factors that are not related to the production and processing of products, but have a negative impact on the safety of food products. For example, in the production of vegetables, production areas may have a different level of mechanization, which is associated with additional mechanical factors that lead to fruit damage. These and other factors should be considered when planning a system for managing the safety of food products and agricultural raw materials.

Another aspect of the spread and implementation of this product safety management system is that it is a kind of basis for the formation of the quality of organic products.

When certifying organic products, the necessary prerequisites are documentation of all stages of production and the ability to trace the path "from the doe to the table". Accordingly, the lion's share of the documents that should be at the processing enterprises of organic agricultural products have already been developed, provided that the HACCP system is implemented, and the requirements for product safety are also met.

The implementation of the HACCP system requires planning the control of all areas of the technological process, defining the limits of research, application and maintenance of this system. The HACCP plan is drawn up at the enterprise - a document that, in accordance with the principles, determines the procedures and sequence of actions to ensure the control of hazard factors. The HACCP plan covers all areas of product production, from raw material acquisition to product processing or packaging, as well as supply to retail.

In order to develop and implement a system of analysis of dangerous factors and critical control points at the enterprise, it is necessary to implement seven principles:

- principle No. 1 - analyze dangerous factors;
- principle No. 2 – to determine critical control points (CCP);
- principle No. 3 – set the critical limit(s);
- principle No. 4 – to establish a monitoring system of the CPC;
- principle No. 5 – to establish a corrective action that will be implemented when monitoring shows that a specific CPC is out of control;
- principle No. 6 – establish verification procedures to confirm that the HACCP system functions effectively);
- principle No. 7 – establish the procedure for documenting all procedures and keeping protocols.

The implementation of the HACCP system involves the implementation of twelve stages.

Stage 1. Creation of a system development and implementation group (HACCP team). In order to fully understand the process and be able to identify all possible risks and CTCs, it is important that the HACCP team consists of people from various specialties.

Stage 2. Product description. It is necessary to prepare a complete description of the product. The description must include safety information, such as the composition, physical and chemical structure of the raw material and the final product, the amount of acid and alkaloid in the product (pH): any treatment that destroys or reduces the level of microorganisms (such as heating, cooling, smoking etc.; requirements for packaging, storage and transportation). Let's consider the example of PJSC "Chernivetskyi Hlebokombinat".

Stage 3. Determination of the field of use of the product. How the product will be consumed is an important question, as it is necessary to know whether heat treatment is required before consumption. All possible cases of improper consumption or their consequences must be taken into account.

Stage 4. Schedule (diagram) of the sequence of the production process. The main function of the team is to make a detailed diagram of the sequence of production processes from the purchase of raw materials to the delivery of the product to the consumer. Expertise from a production specialist is very important at this stage. Processes have certain characteristics in various enterprises, and a precise sequence diagram establishes the specific details of a given process.

Step 5. Checking the correctness of the sequence diagram on site. After completing the organization of diagrams and schemes, team members must check the prepared information with actual production at the production sites.

Stage 6. Determination of risks and means of control. Effective risk identification and risk assessment is the key to successful HACCP work. All real risks that may be present in any of the ingredients and at any stage of production must be considered.

Stage 7. Determination of critical control points. All ingredients and each step of the process are taken in turn, and the probability of each identified risk is considered. The team must determine the possibility of risk growth at this stage, whether it can be reduced or eliminated. Assessment and expertise of the HACCP team are the main factors in establishing a critical control point. It is very important that critical control points are kept under control. When determining the degree of monitoring for a critical control point, the risk assessment should be made in such a way that the level of monitoring of it is described. It should be noted that critical management points for producers-processors of organic agricultural products are interesting for consideration.

Stage 8. Signal levels and tolerances for CPC. The team must define signal levels and tolerances for each CCP, as well as the means by which risks will be controlled for each critical control point. They can determine, for example: the level of chlorine in water for washing; temperature during storage; using documented procedures. Everything must be registered. Critical constraints and target cost estimates must be defined.

Stage 9. Procedures for monitoring under the CPC. Monitoring is a mechanism for confirming that the production process or product handling procedures are kept under control at all critical control points.

Stage 10. Corrective actions. If monitoring indicates that the parameters are not in compliance or the process is not in control, corrective action should be taken as soon as possible. Corrective actions should take into account the worst case scenario and be based on an assessment of damage, risk and degree of danger.

Stage 11. Inspection and examination procedures. After performing all actions and procedures, they must be reviewed before use and regularly checked from the moment of work. The means of confirming the operation of the system can be: selection of samples for analysis by a method different from monitoring procedures; personnel survey, in particular, those specialists responsible for monitoring the critical control point; observation of a critical control point; audit by an independent person.

Stage 12. Keeping documentation. Record keeping is the main part of HACCP. Records demonstrate the correctness of procedures from the very beginning to the end of the process, tracing the production path of the product. In the documents, it is necessary to register real data on the implementation of HACCP, for example, the identification of risks and the selection of critical limits, as well as data related to the monitoring of the critical control point and the corrective measures taken.

As for Ukraine and the Chernivtsi region in particular, the HACCP system is being implemented more and more actively. Thus, in the Chernivtsi region, three food industry enterprises have HACCP certificates - Oil and Fat Combine PJSC, which is part of the VIOIL industrial group, Gals 2000 LLC and Chernivetsk Bread Plant PJSC, which is a structural unit of the Hlibni holding company investments" [6].

The Ukrainian market has already accumulated some experience in this matter. Thus, since July 1, 2003, the national standard DSTU 4161-2003 "Food safety management systems. Requirements", and on August 1, 2007, the national standard DSTU ISO 22000:2007 (identical to the international standard ISO 22000:2005), which includes the principles of HACCP, entered into force. In addition, this issue is regulated by the Law of Ukraine "On the safety and quality of food products" in Article 20 "Obligations of manufacturers and sellers (suppliers)".

At the beginning of 2022, a survey was conducted among food industry enterprises, as a result of which it turned out that almost half of them (43%) want to implement the HACCP system. Another 80-90% of companies

have not only heard about it, but also have a fairly clear idea of its capabilities. In addition, 99% of Ukrainian enterprises that export to the European Union have the HACCP system implemented and operating. Ukrainians should also consume products from manufacturers whose control system meets global requirements. This will become possible after the adoption of a new edition of the Law of Ukraine "On the Safety and Quality of Food Products", the draft of which already exists [7].

It is planned that the HACCP system will be introduced everywhere after the entry into force of the Law. The law "On the safety and quality of food products" will allow the recall of finished products directly from store shelves. At the same time, the manufacturer may lose up to 40% of its customers, which may lead to bankruptcy. That is why manufacturers are most interested in maintaining the highest quality standards when manufacturing their products, and thanks to the modern, accurate equipment of the HACCP system, it is impossible to falsify data for their submission to regulatory bodies. And enterprises will be inspected not by control bodies, but by special specialists of the State Vetphytosluzhba, who will be trained by qualified specialists from the European Union and the USA, where the HACCP system is very widespread. However, it should be noted the negative consequences of the introduction of the HACCP system for the producers themselves. Domestic enterprises will bear a number of costs, which can be conventionally divided into three groups: from the implementation of prerequisite programs; on the development and implementation of the HACCP plan; to support this system. According to the results of research conducted in 2021 as part of the project "Food Safety in Ukraine", implemented at the initiative of the IFC (International Finance Corporation) in partnership with the Ministry of Finance of Austria, the estimated cost of implementing HACCP at domestic enterprises may vary (from \$7,300 . USA up to 250 thousand USD) and depends on the starting level of sanitary and hygienic conditions.

In Ukraine, as in other countries, the costs of prerequisite programs represent the largest item of costs for the implementation of the system of analysis of dangerous factors and critical control points, and on average for an enterprise they amount to about UAH 250,000. The development and implementation of HACCP will cost about 225-250 thousand UAH, and system support - about 250 thousand UAH, and this figure will depend on the number of critical control points determined by the HACCP plan [8].

In general, the implementation of the HACCP system for enterprises producing food products is a rather costly process and requires significant initial capital investments, but the benefits of using this food safety management system are obvious. Therefore, the lack of competitiveness of Ukrainian goods, non-compliance with food quality and safety standards, as well as legal and practical obstacles to trade should prompt the state to create the necessary regulatory and legal framework that would regulate food safety issues in accordance with international standards and would make it possible to increase the level of export of food products to other countries. Manufacturers, already guided by their own initiative, would implement the HACCP system, which contains a number of benefits and possible prospects for business development. As for the consumers of food products, they only benefit from the application of the system of analysis of dangerous factors and critical control points, because it guarantees them the safety of the purchased products.

Conclusions from this study and prospects for further research in this direction

The need to introduce HACCP is due to consumer demand for safe, environmentally friendly, high-quality products. In addition, using HACCP, food industry enterprises should focus on the production of ecologically clean, natural products, which will ensure a stable high place in the domestic and foreign markets. In the future, it is planned to improve the application of the HACCP system not only for processing enterprises, but also for enterprises that are directly engaged in the production of raw materials, but in Ukraine, first of all, a number of measures should be taken:

- Raise the level of hygiene culture. It is very important to understand that it is impossible to achieve a 100% guarantee of the safety of food products, since the human factor is crucial in food production. Reducing the impact of this factor is the task of any manufacturer.

- Make changes in legislation and the structure of control bodies. For example, it is necessary to create a single department (or combine two key ones into an integrated system) that would be responsible for the safety of food products in Ukraine, maintain a single register of producers and maintain a single database of their inspections.

- To create an understanding in business that food enterprises, and not the state, are responsible for the products they produce. And the role of the state is to establish a system of control over the safety of these products.

Therefore, the development and implementation at domestic enterprises of the food industry of the system of quality and safety of food products based on the concept of HACCP will allow them to provide them with sustainable competitive advantages in the conditions of sharp aggravation of competition both in the domestic and foreign markets.

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