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DEVELOPMENT OF THE TRACEABILITY SYSTEM FOR THE PASTA PRODUCTION

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ABSTRACT

The traceability system is a necessary component for identification the market operator, time, place, an object and other conditions of supply (sale or transfer) sufficient to establish the food origin, materials in contact with food products, or substances intended to be included, or expected to be included in the recipe of food, at all production stages, processing and circulation. The Law of Ukraine «On Basic Principles and Requirements for the Safety and Quality of Food» clause 74 of Article 1, Regulation (EC) No. 178/2002 and ISO 22005:2007 and CAC/GL 60-2006 and GSI provide general requirements for traceability systems, however, each branch of the food industry has its own specifics regarding the implementation of the traceability system.

The article presents the results of the traceability development for pasta production. There is the block traceability diagram production for pasta production, the plan of the internal system and tools for the traceability system implementation are proposed. Implementation of the traceability system for pasta production will allow solving the following tasks: identifying partners in the food chain; carry out a quick search for pasta dangerous for nutrition; control all product components and the entire food chain; promptly remove pasta products from circulation when there is a threat to the consumers health; ensure compliance with specifications; provide an opportunity for the market operator to achieve compliance with the requirements of legislation and regulatory documents; achieve effective management of supply logistics as a whole; help the consumer to get information about raw materials, product composition and production method; perform upward tracing from the consumer to the producer and downward tracing from the producer to the consumer.

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РОЗРОБЛЕННЯ СИСТЕМИ ПРОСТЕЖУВАНOSTІ ПІД ЧАС ВИРОБНИЦТВА МАКАРОННИХ ВИРОБІВ

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Система простежуваності є необхідною складовою, яка надає можливість ідентифікувати оператора ринку, час, місце, предмет та інші умови постачання (продажу або передачі), достатні для встановлення походження харчових продуктів, тварин, призначених для виготовлення харчових продуктів, матеріалів, що контактують з харчовими продуктами, або речовин, що призначені для включення, або очікується, що вони будуть включені в харчові продукти на всіх стадіях виробництва, переробки та обігу. У Законі України «Про основні принципи та вимоги до безпечності та якості харчових продуктів» (п. 74 ст. 1), Регламенті (ЄС) № 178/2002 та ISO 22005: 2007 і CAC/GL 60-2006 та GSI викладено вимоги щодо системи простежуваності, проте кожна галузь харчової промисловості має свою специфіку впровадження системи простежуваності.

У статті представлено результати розроблення системи простежуваності для макаронного виробництва. Розроблено блок-схему простежуваності процесу виробництва, план внутрішньої системи та запропоновано інструменти реалізації системи простежуваності. Впровадження системи простежуваності на макаронному виробництві дасть змогу вирішувати такі завдання: ідентифікувати партнерів у харчовому ланцюгу; здійснювати швидкий пошук небезпечних макаронних виробів; контролювати всі складники продукту та весь харчовий ланцюг; оперативно вилучати макаронні вироби з обігу під час виникнення загрози здоров'ю споживачів; забезпечувати відповідність специфікаціям; надавати можливість оператору ринку досягти відповідності вимогам законодавства та нормативних документів; досягти ефективного управління логістикою постачань в цілому; допомагати споживачу отримувати інформацію про сировину, склад продукту та спосіб виробництва; здійснювати висхідне простеження від споживача до виробника та низхідне простеження від виробника до споживача.

Ключові слова: простежуваність, макарони, безпечність, оператор ринку.

Formulation of the problem. Every year, Ukrainian manufacturers increase the number of manufactured products for export to more developed countries, due to which there is a need to meet international requirements for the quality and safety of products (Прокоф'єв, & Слива, 2011). Currently, Ukrainian legislation is at the stage of active harmonization with European legislation, therefore the implementation of European (international) standards in the field of food safety is mandatory to ensure the products export. In addition, the term traceability is defined by Clause 74 of Article 1 of the Law of Ukraine «On Basic Principles and Requirements for the Safety and Quality of Food».

European legal requirements for the implementation of traceability are contained in

Regulation (EC) No. 178/2002 and ISO 22005:2007 and CAC/GL 60-2006.

In accordance with the GS1 (the global language of business) requirements, the authors of methodological recommendations on the traceability application to control the food safety in the food chain (Касянчук, Бергілевич, Новожицька, Марченко, Єфімова, & Ротаєнко, 2014) distinguish the following objectives and tasks of traceability:

1. Identify partners in the food chain.
2. Carry out a quick search for defective or dangerous food products.
3. Provide guarantees of food safety.
4. Control all product components and the entire food chain.
5. Promptly remove feed and food from circulation when there is a threat to the consumers health.
6. Ensure compliance with specifications and requirements of trading partners or traceability partners.
7. Enable the manufacturer to achieve compliance with the requirements of legislation and regulatory documents.
8. Achieve effective management of supply logistics.
9. Help the consumer to get information about raw materials, product composition and production method (organic or inorganic production).
10. Carry out upward tracing from the consumer to the producer (Tracing).
11. Carry out downward tracing from the producer to the consumer (Tracking).

Therefore, the traceability system at the food enterprise is mandatory in accordance with the modern requirements of both Ukrainian and European legislation.

Recent research analysis and publications. Ensuring the production of safe products is now a duty for every market operator (Белінська, Орлова, & Мотузка, 2011; Касянчук, Бергілевич, Єфімова, & Ротаєнко, 2015). Certification is confirmation in accordance with the requirements of the international standards. The traceability system is a mandatory component of these standards as the company's safety system component (Куклева, 2020; Покидько, & Хіцька, 2020).

Each branch of the food industry has its own specifics regarding the development and implementation of the traceability system. So, in particular, the authors of the publication (Боратко, 2017; Грищенко, 2012) offer traceability for fodder production. The authors (Поварова, & Мельник, 2018) present the traceability system in the meat industry, and the authors (Птиці, 2017) present the traceability system for poultry meat as a basis for ensuring quality and safety. For the production of rye-wheat bread, the traceability system is presented by the authors (Петриченко, 2018).

The authors (Resende-Filho, & Hurley, 2012) determine traceability by its precision that is the probability of finding the problem source. A limitation of potential causes is the important stimulating traceability part. The raw material defects are the first stage.

The concepts of supply chain management and traceability in agriculture, and highlight the technological challenges in implementing traceable agricultural supply chains are presented (Опара, 2003).

The authors (Olsen, & Borit, 2018) presents a structure for describing and analyzing a traceability system. There is the difference between the system mechanisms to the trace units attributes. Classification is based on practical experience from traceability system implementations in the food industry, and participation in international

standardization processes relating to food traceability.

The article (Tian, 2017) presents a food supply chain traceability system for real-time food tracing based on HACCP, Internet of things and blockchain. This system could provide all participants in the chain with honesty, openness, safety and quality.

So, nowadays the development of traceability is quite active in various industries and, in particular, for pasta production, it is quite relevant, as it is not presented in the scientific literature.

The study aim is to develop a traceability system for a pasta enterprise, which will ensure the safe production, as well as the possibility of entering the European market.

Materials and methods. In order to develop a traceability system, general scientific research methods were used, namely analysis, generalization, and systematization. The methodological basis of traceability is given in the GS1 Global Traceability Standard. The completeness of labeling on consumer packaging must comply with the Law «On Information for Consumers Regarding Food Products» December 6, 2018 No. 2639-VIII.

The traceability system development algorithm consists of 11 steps (Касянчук, Бергілевич, Новожицька, Марченко, Єфімова & Ротаєнко, 2014):

1. To get recommendations from experts.
2. Model the supply chain, according to the tasks of the traceability system.
3. Determination of key business needs.
4. Description of the goods physical flow.
5. Establishing traceability partner roles.
6. Identification of the item trade level being monitored.
7. Selection of technologies and tools to support the traceability system.
8. Process validation.
9. Model of internal processes (for a market operator).
10. Final check of the traceability system model.
11. Support of standards.

Presentation of the study main results.

Before developing a traceability system for pasta production, it is advisable to define concepts. Traceability is the ability to identify the market operator, time, a place, an object and other conditions of supply (sale or transfer). The specified data should be sufficient to establish the origin and materials in contact with food. In addition, traceability allows to identify the substances which included or expected to be included in food at all production stages, processing and circulation. This definition is provided by Clause 74 of Article 1 of the Law of Ukraine «On Basic Principles and Requirements for the Safety and Quality of Food». The development of the traceability system will require the fulfillment of the positions given in the definition, which can be achieved through the implementation of 11 steps (Касянчук, Бергілевич, Новожицька, Марченко, Єфімова, & Ротаєнко, 2014).

The identification coding must be unique for a particular product and short enough, must carry enough information to link the product to the documented information.

The following data are required to create a recognition (identification) marking of a pasta batch:

- the state number of the manufacturer (the first 4-6 digits of the marking), which will allow the market operator to have an original, unique identification batch mark;

- date marking, for example, the date «August 28, 2022» can be represented as: «20220828»;

- process/product identifier, which can be represented by line identification number, batch number, batch number.

In addition to the specified marking, pasta must have an identification marking of the internal traceability system. Each market operator must implement documentation (paper or electronic), which includes:

- warehouse accounting;
- variable reports;
- records of the manufacturing process;
- analysis results;
- monitoring of control and critical points;
- accompanying documents;
- information on transport packages (traceability cards which can be replaced by a barcode system);

- labeling on consumer packaging in accordance with the requirements of the Law «On Information for Consumers Regarding Food» December 6, 2018 No. 2639-VIII.

The information which will allow to effectively ensure the system of pasta internal traceability should contain the following information:

- the product name;
- the date of manufacture (batch number);
- the amount of product;
- «Use by» information (expiration date);
- end consumer and shipped quantity;
- on which line it is packed (if necessary);
- the technological parameters of the packaging and labeling process;
- the analysis results;
- the packaging materials in contact with the product were used (name, batch number/date of arrival).

Data on the pasta shipment must contain information about consumers, amount of products and the shipped day.

The identification marking of the external traceability system is characterized by business connections between partners in the food chain and proper informing. Informing can be due to marking, tagging, labeling, application of barcodes, reporting and accompanying documents, etc. The first stage of the traceability system is the information on the consumer packaging, which must comply with the Law of Ukraine «On Information for Consumers Regarding Food» December 6, 2018 No. 2639-VIII:

- the name of the food;
- the list of ingredients;
- the allergen – gluten;
- the food amount in the measurement established units;
- minimum expiration date or «use by» date;
- storage conditions and/or conditions of use (if necessary);
- the name and location of the food market operator responsible for information on the food, and for imported food, the name and location of the importer;
- the instructions for use;

- the information about the nutritional food value.

The traceability system consists of three basic traceability elements: a supplier (external, the step back), processes (internal), a consumer (external, the step forward). Internal traceability consists of data on raw materials, production, transportation for product sales.

The traceability block diagram of raw materials and finished products is presented in Figure 1. The internal traceability plan during the pasta production is given in the Table 1.

Table 1. The internal traceability plan during pasta production

The object	The contents of the process
The raw materials	1. Product accompanying documentation (supplier, name of raw material, quality and safety indicators, date of receiving, expiration date); 2. Journal of raw materials control in the market operator warehouse
The production	1. Recipes and technological instructions; 2. Documentation of the Food Safety Quality Management System (FSQMS); 3. Results of final products manufactured batch quality control
The products	1. Declaration of the manufacturer; 2. Marking of transport and consumer packaging; 3. Conditions for storing products in the manufacturer's warehouse
Transportation of final products	Freight bill of lading

Therefore, in order to create internal traceability, it is necessary to create appropriate basic programs, standard operating procedures and maintain links between input and output data. The presence of operating procedures is mandatory according to the current quality and/or safety system.

In order to implement the traceability system, appropriate instruments are required, which are listed in Table 2.

Table 2. The tools and technologies to support the traceability system

The technology	The instruments
Identification	Stamp, label, mark, accompanying documentation. Human-readable format or machine-readable format (barcodes, RFID tags), etc
Data collection and transfer	Label, Marking, Message, Fax, Internet, Phone, Databases, Physical Inspection, Supporting Documentation, etc.
Data storage	Laptop/PC, database (internal or provided for use by service provider over the Internet)
Monitoring request management	Phone, email, fax

Currently, most market operators prefer paper information carriers.

Conclusions

The developed traceability system is based on the correct technological process organization, clear record-keeping at all stages, conscientious performance of the functional duties of each employee. The traceability system for pasta production makes it possible to prevent the danger occurrence, and also facilitates the maintenance of the effective other systems functioning implemented in production. The periodic review of the traceability system ensures its correct functioning. The more dynamic system the better the result it will provide. The employees professional level is also a necessary component. In addition, the traceability system functioning at the enterprise is a necessary component for the possibility of exporting products.

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