Supervision and security over the production process as well as machines and devices

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ABSTRACT

Production processes and their proper identification depend to a large extent on properly prepared quality and technological documentation as well as its proper supervision over the production process as well as machinery and equipment. Proper packaging significantly affects food safety.

Keywords: packaging, safety, food, production process

1. THE CONCEPT OF PRODUCTION

Production is a set of correlative work processes with the conscious and purposeful activity of people transforming work items into products and services. The concept of production is identified with the production process that occurs in the branches of economic activity satisfying human needs. The area where the production is carried out is a plant, a company also called as a production system. The production system is a specially designed material, energy and information system for the production of specific products and services to meet the needs consumers. Simply put, the production system is a set of specific activities carried out to process raw materials into finished products. It consists of production processes defined as the total of activities necessary to produce a given product. The processes differ among each other due to the diversity of the manufactured products. Properly selected
Supervised processes allow to produce products with high health, sensory and nutritional quality [Picture 1].

Sanitary requirements and production hygiene were already included in the legislation in the interwar period. They mainly concerned raw materials and food of animal origin. The presidential decree from 1928 on the control of food products and objects was the basis for issuing various legal provisions defining sanitary and hygienic requirements in production and trade. A lot of space is devoted to these issues by the 1970 Act on health conditions of food and nutrition and the Act with the same title from 2001 and its later amendments from 2003 and 2005. They specify requirements regarding production conditions and ensuring proper health quality of food products. The health security of food is supervised by appropriate units of official food control as an external control. On the other hand, the internal control is taken by the manufacturer based on the Good Hygienic Practices and Good Manufacturing Practices mentioned above. Supervision of the production process consists in controlling and conducting tests confirming the product's compliance with the requirements [Picture 2].

The requirements are included in the product specification, where its properties and parameters are specified. The manufacturer defines the stages of the production process, the scope, frequency and methods of tests carried out during production, defines the persons responsible for conducting inspections and tests, provides appropriate instructions and procedures at workplaces and provides equipment for carrying out measurements and tests. Control activities should be documented and in case of non-compliance corrective action should
be taken immediately. After removing the defect, the control must be repeated to confirm that the incompatibility has been eliminated.

Picture 2. Using gloves for food

Machines and devices used in the production process are a determinant of hygiene prevailing in the production plant and food safety. Very often, there are infections and food contaminations caused by poor sanitary and hygienic condition of machines and devices, their improper operation or poorly effective cleaning and disinfection process. It is important to locate machines and devices that will allow you to operate in accordance with the intended use and ensure the proper level of hygiene and order. Machines, devices and other necessary containers and utensils for food contact should be made of corrosion-resistant chromium-nickel sheet or of non-toxic materials that do not react in contact with food and do not cause organoleptic changes. They should be designed in a way that ensures effective cleaning and disinfection. Every machine and device must be serviced according to a set schedule and subject to periodic calibration control. These are necessary steps to ensure their proper technical condition [Picture 3].

Another determinant of safe food is the washing process involving the removal of sediments, physical and chemical contamination, microorganisms and preparation of the surface for disinfection. Disinfection is a process that eliminates pathogenic microorganisms by appropriate means. Detailed information is contained in the cleaning and disinfection procedures as well as the instructions developed in the plant based on information obtained from the manufacturer or distributor of washing and disinfecting agents. Procedures and instructions determine the time and place of the process, the type of measure, its concentration
and operation, the rules of conduct and the person supervising the process. The main stages of cleaning and disinfection are: preparation or preliminary rinsing removing remains, cleaning with chemicals, rinsing, disinfection, subsequent rinsing and drying. The chemicals used for cleaning and disinfection must meet the requirements contained in the regulations, should be selected for the type of contaminants present, as well as surfaces and be stored in a designated room for this purpose. Verification of the effectiveness of cleaning and disinfection is based on visual assessment and on conducting appropriate tests confirming microbiological and chemical purity. In the case of a negative assessment, a second washing is carried out.

![Image of food packaging]

**Picture 3.** Food packaging

The disposal of waste generated during production is of great importance for food safety. It should be done efficiently and selectively, minimum once a day from production rooms. Accumulation until permanent removal should be done in specially designed containers placed in a designated place, protected against the entry of pests, separated from the production premises and intended for storage. Containers for collecting waste must be marked, sealed and easy to clean and disinfect.

Effective and safe pest control in food production plants should be included in the quality assurance system. The plant must keep documentation confirming the proper protection of the plant against pests. The protection consists in the use of preventive methods and the removal of pests through disinsection and deratization treatments. The inspection should be preventive and cover the entire site. Devices that monitor pests are byte stations, insecticide lamps, deratus
feeders, insect detectors, lepers and pheromone traps that allow you to quickly detect and eliminate the threat. The insecticide treatment can be carried out after the production stops and the rooms are properly prepared. Just as important as destroying insects is to fight rodents in production plants. Rodents cause significant losses in stored food, contaminate with droppings, damage packaging, transfer microbes, and cause other damage associated with the destruction of installations and other components [Picture 4].

![Picture 4. Safety on the production line](image)

An important threat to food safety are physical impurities that can enter the product in an unintended or conscious manner. These are so-called foreign bodies getting together with raw materials such as sand, stones, sticks, foreign bodies from raw materials, for example stones, bones, bones, packaging, machinery and equipment, metal, glass, plastic, as well as being negligent employees - hair, decorations, jewelry, buttons and other items161. They also happen intentionally by employees as part of sabotage.

Physical contaminants are the most common cause of complaints often combined with reports of injuries or illness after consumption of the advertised product. The presence of any foreign body in food that may cause a threat to life or health or injury must be considered as a serious threat to food safety.

The source of the threat of food contamination with foreign bodies are improperly developed and controlled production processes, personnel not complying with the principles of Good Hygienic Practice and contaminated raw materials used for production. Preventing the occurrence of physical hazards consists in ensuring proper hygiene of production processes based on compliance by employees with the principles of Good Hygienic Practice, elimination of the use of wood and glass in production and storage rooms, proper technical condition of equipment and production machines. It is also important to set appropriate specifications for
raw materials and packaging, as well as to implement a system for detecting and eliminating hazards, such as metal detectors, sieves, filters, magnets and vision systems as well as x-ray inspection.

2. THE IMPACT OF PACKAGING ON FOOD SAFETY

The packaging is every product made of various materials, intended for storing, protecting, transporting, delivering and presenting from the producer to the consumer all goods, raw materials and processed products.

The packaging is in most cases an indispensable element used in the food industry and in the trade in goods. It affects the prolongation of the shelf life of the product while maintaining its quality and nutritional value. It protects food from the adverse effects of external factors and also maintains proper humidity, structure and shape. Perfectly designed graphically, the product stands out on the store shelf and draws the consumer's eye. It is therefore an element of marketing, but also a place of information about the product.

Various materials such as paper, glass, metals and plastics are used for the production of packaging, including polyethylene terephthalate (PET), polyvinyl chloride (PVC), polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyamide (PA). These plastics have good mechanical properties such as strength, tensile strength and heat-sealability. They are a good barrier for oxygen, carbon dioxide and aromatic substances. These features as well as high availability and low cost cause that the demand for their use is constantly growing. It is estimated that global consumption of plastics is what at least 200 million tons per year and increases by around 5% each year.

Synthetic materials used for many years have caused serious ecological problems, hence intensive research on new degradable materials has begun. The attempts are aimed at creating packaging from environmentally friendly materials, however their ultimate goal will always be food safety.

In accordance with national and international legislation, the manufacturer is responsible for the safety of products and materials allowed for contact with food. The act in force in the European Union regarding materials and articles intended for contact with food is Regulation 1935/2004. The key information contained in this legal act is quoted below: “all materials or products intended for direct or indirect contact with food must be sufficiently inert, so as not to cause the passage of food into the food in quantities that may pose a threat to human health and cause unacceptable changes in the composition of such food or deterioration of its organoleptic characteristics. Article 3 of the abovementioned regulation says that materials and articles intended to come into contact with food should be manufactured in accordance with good manufacturing practice, labeling them, advertising must not mislead the consumer. The Polish Act on Food Safety and Nutrition regulating issues related to materials and products intended for contact with food, says that they should ensure the inviolability of food status until it reaches the final consumer.

Food stored in the packaging undergoes various physical, chemical and biochemical processes, as well as sensory changes. The packaging is designed to protect it against microorganisms, adverse effects of light, oxygen, and at the same time do not interact with it. However, the packaging intended for contact with food is not always indifferent. It happens that between the product and its packaging there is an interaction between them which includes migration, penetration and sorption. Migration is the penetration of packaging components into
the product. It is a phenomenon already known in ancient times, in ancient Rome leaded with migrating lead water installation in aqueducts supplying water for the fall of the Roman Empire. There are still cases of excessive migration of lead, for example from soldered cans, from bottle stoppers, as well as from glass and ceramic packaging. Therefore, migration is a very important factor in assessing the quality and safety of packaging due to its impact on food and thus on consumer health. When conducting a global migration study, the degree of migration of chemical substances from the packaging material to the product is determined. The test fluid is a model fluid that imitates food. Depending on what type of food the packaging will be used, appropriate modeling fluids such as distilled water, 3% acetic acid, olive oil, 10% ethanol and others are used. According to the above, the model fluid corresponds to the type of food that will come into contact with the packaging material, while the test parameters such as time and temperature should take into account the conditions in which the packaging will be.

The packaging market is a dynamically developing sector offering increasingly sophisticated food packaging methods. Previously, it was required that the packaging did not affect the product, however, currently this requirement changes in relation to active and intelligent packaging, which positively affect the food product. According to the Regulation 1935/2004 referred to earlier, active materials and products for contact with food are materials and products that extend the shelf life of the product for sale or improve its condition. They contain ingredients that can absorb or release substances into the packaged food or its surroundings. The ability to extend the shelf life of packaged food is made possible by the absorption of water, the high content of which in the product causes the growth of bacteria, mold and yeast. Such packages are often used for packing meat, poultry and fish [Picture 5].

Picture 5. Using metal food packaging

Longer storage of such products is possible by adding appropriate chemicals to the surface of the packaging or attaching a special, soaked sachet. Intelligent materials and products approved for contact with food monitor the condition of the product in the packaging or in its
surroundings. They do not release their ingredients, but provide information to the consumer. Intelligent and active packaging can be used in Europe, however, manufacturers are obliged to respect more stringent framed regulations than in other parts of the world safety of using these materials, specific requirements have been specified in Regulation No. 450/2009

4. THE TRACEABILITY PROCESS

Regulation 178/2002 defines traceability as tracking the history of a product from the time of receipt of raw materials, to production, distribution and subsequent sale. It has been in force in the European Union since January 1, 2005 and applies to all food products and food for animals. Traceability includes information related to the origin of materials, production history, distribution and location of the product after delivery. The producer of food or feed is responsible for food safety, hence he is obliged to prepare and keep appropriate documentation that will allow to identify suppliers of raw materials, any additional substances, semi-finished products and packaging used to produce and pack the finished product. Each plant that participates in the food and feed chain is obliged to create a system that will allow to recreate the fate of each batch of the product and its relationship with the batches of individual raw materials. The system should act in a manner allowing the entrepreneur who participates in the food chain to identify the entrepreneur from whom a given product comes from or from which it is delivered.

Accordingly, an establishment operating on the food market must identify each supplier from whom he purchased the raw material or food. Reconstructing the entire chain by applying the "one step back - one step forward" procedure, allows the reproduction of the origin of the product, starting from the raw materials it consists of and ending with the location to which it was delivered in Great Britain, followed by dioxins detected in poultry meat and eggs from Belgium, as well as other shameful abuses related to growth hormones and poisoning by pesticides. The affairs caused a change in the behavior of food consumers, shook their confidence, caused that some information, such as the origin of products, began to take on special significance.

Events have proved that it is not enough to comply with the HACCP system limited only to the processing plant. It was found that the food chain should be sealed by providing information on the origin of raw materials and products throughout the logistics chain and archiving documentation related to the origin of the product.

The main requirements and principles of traceability are included in the PN-ISO 22005: 2007 standard. The key elements of this process are data and administration, through acquisition, storage and retrieval. It is very important to use appropriate tools, which should be characterized by durability, reliability, the ability to repeatedly measure and collect and transmit data. Food or feed products placed on the European Union market should be appropriately labeled so that they can be monitored. An importer establishing commercial relations with third countries should also easily identify from whom the product was exported. The traceability is an important process affecting the safety of the product, its aim is primarily to protect the consumer, but also the manufacturer.

Traceability started with the crises of the 1990s associated with the threat to health security. One of them was the BSE epidemic among cattle
The identification is of great importance for consumer protection, it is necessary in the case of food withdrawal and the provision of accurate information about products affected by the defect. In the event of a threat to life and health safety, identification will allow to retrieve the necessary information in order to immediately and effectively carry out the withdrawal of the product from the market. According to art. 19 of the aforementioned Regulation 178/2002, where a food-producing producer or entity considers or suspects that a foodstuff that has placed on the market is not in line with food safety requirements must immediately start the recall procedure and notify the competent authorities. The national authorities shall in such cases decide on a possible notification to the Early Warning System about Hazardous Products Food and Animal Nutrition (RASFF). In a situation where the product has already been able to reach the final consumer, the producer or the introducer should effectively communicate the reasons for the withdrawal and pick up the product when it is necessary.

**Picture 6.** Best Food Safety Posters images- Safety posters

An effective traceability system guarantees efficient product withdrawal from the market and limits its quantity to the necessary minimum. In addition, it streamlines the processes of production and logistics, improves the flow of information, leads to effective operations in
quality management systems and increases the level of consumer safety. It allows you to raise the company's image and gain an advantage over the competition, which is why the cost of implementing the system should be treated as an investment yielding measurable profits [Pictures 6 & 7].

![Picture 7. Best Food Safety Posters images- Safety posters](image)

5. CONCLUSIONS

International trade in food makes it necessary to establish uniform criteria related to ensuring food safety in order to protect human health and life. Previous conservation activities were aimed at increasing the efficiency of trade, however, over time, they turned towards
providing quality and safe food. The growing globalization of the economy, in addition to positive features, also affects the increase of the number of threats. They are created by contaminated, falsified products that have a negative impact on the health of consumers. Allergens contained in foods that are badly labeled or do not have any information about their presence pose a risk even if they are life-threatening. Genetically modified foods also raise hopes and fears caused by the lack of support from the experience of generations and long-term scientific research that would dispel doubts about the health effects resulting from the consumption of this type of food.

The basic requirement of modern civilization is the need to ensure food safety. The basis for the implementation of this need are integrated actions to provide legal protection, i.e. legal standards specifying relevant food requirements and methods for their control and enforcement. Legislation must be harmonized and effective in order to fulfill its overriding objective of ensuring human health and life as well as protection against harmful factors threatening the safety of food products. For this purpose, institutions and offices have been established that control the activities of entities producing or introducing food to the market. They verify the compliance of activities with the applicable requirements, remove deficiencies and introduce improvements.

In the era of dynamic globalization and growing threats, the great concern of everyone is to ensure the quality and safety of food products. Quality management standards are the instruments of the broadly defined quality policy food safety, international standards and certificates, possession of which is a necessary condition in the international trade. Implementation of them undoubtedly contributes to the increase of competitiveness of food sector entities. Also activities in the area of food production and marketing, such as the supervision of the production process and machinery and equipment, marking and securing of goods, the use of appropriate, food-approved packaging and traceability are key to ensuring food safety on a global and national scale.

Current activities aimed at achieving and maintaining the state of food safety and food law legislation are effectively countering the introduction of dangerous food on the market. Administrative and financial penalties are very important to effectively combat unfair practices. Growing consumer awareness and ongoing activities for its education also play a significant role. A good solution for improving the level of food safety is the Regulation of the European Parliament and the EU Council No. 1169/2011, which forces producers to include on the labels of food products more and more mandatory information that gives the consumer a proper picture of its composition and properties.

References


