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The program of the entrance exams to PhD- doctoral studies in the educational program	Edition №1 02.02.2024	FP 042-2.07-2024


Faculty of engineering and technology
The Department of Food production technology and biotechnology

**The program
of the entrance exams to PhD-doctoral
studies in the group of educational program
D111-Food production**

1 DEVELOPED

Compilers:

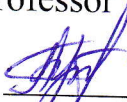
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2 DISCUSSED

At the meeting of the department of Food production technology and biotechnology

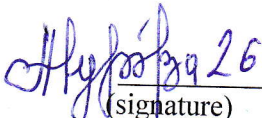
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3 AGREED


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1. Introduction

The entrance exam program for the special discipline of doctoral studies is formed within the scope of the program at the previous stage of higher education (master's degree).

Basic requirements for the level of training of specialists in the group of educational program D111-Food production

An applicant to doctoral studies must have an idea:

- about the latest discoveries in the chosen field, the prospects for their use for the construction of technical systems and devices

know:

- methodology and methods of scientific research;
- means of research and processing of their results;
- methods of collecting and analyzing scientific information;
- methods of teaching special disciplines, pedagogy and psychology of higher education.

be able to:

- develop promising industry technologies;
- develop a research plan;
- conduct bibliographic work using modern information technologies;
- select the necessary research methods, modify existing ones and develop new methods, based on the objectives of a particular study;
- process the results obtained, analyze and comprehend them taking into account the available literature data;
- present the results of the work done in the form of reports, abstracts, articles, designed in accordance with existing requirements, using modern editing and printing tools.

have the skills:

- pedagogical and research work;
- in special terminology;
- working on a PC and solving professional problems;
- calculations using modern techniques;
- working with technical and reference literature, scientific and technical documentation;
- organizing the work of collective performers;
- economic analysis of the economic activity of the enterprise.

be competent:

- in the selection of rational operating modes of technological machines and equipment
- in the field of labor legislation;
- in the selection and placement of personnel.

2. The name of the discipline and its main sections

1. Development of biologically active nutrients with corrective and healing properties.

Types of biologically active nutrients. Macronutrients, micronutrients, non-nutritive substances. Scope of their application. Characteristics and influence of nutrients on the quality and shelf life of products. Selection and development of recipes, technological instructions. Directions and goals for the development of biologically active nutrients. Biologically active food additives (single-component and multi-component). Probiotic products, including microorganisms and metabolites - probiotics. Enterosorbents of natural (dietary fiber) and artificial origin.

Balanced and adequate nutrition. Justification of the optimal values of nutrients and their content in the diet for different levels of physical activity. Amount and ratio of nutrients in the diet. Functional nutrition. Regulating influence on various functions of the body. Methods of nutrition correction: diet, nutrient enrichment, creation of combined products. Food additives and production of food products of artificial origin. Use of industrial waste.

The use of natural antioxidants (and identical natural compounds) in food technology. Use of dietary supplements. General principles for the use of dietary supplements. Modern classification of biologically active additives. Classification of food dyes. Natural and synthetic dyes. Use of food coloring in food production. Non-traditional additives, use in food production.

Topic 1. Characteristics of risks. The concept and essence of risk.

When starting to analyze financial risk in an enterprise, the first step is to define the main concepts used in this paragraph - the concepts of risk and risk management. An analysis of the economic literature devoted to the problem of risk shows that there is no consensus among researchers regarding the definition of the essence of risk, which is not particularly surprising, since people's understanding of risk develops along with the development of the economy and society. Most researchers define risk as the possibility that something undesirable will happen: theft, the collapse of a partner, the emergence of a new competitor, depreciation, bankruptcy, and much more. However, there is always the possibility of particularly favorable events occurring, and this is also a risk.

Topic 2. The role of risk-generating factors in the activities of a business entity, their impact on risks.

The level of risk depends on many factors, both related to the company's activities and independent of it. Risk-forming factors influence specific risks both selectively and are capable of exerting a complex influence on entire groups of risks. The presence of risk-generating factors of integral impact requires the development of a methodology for comprehensive risk research.

Topic 3. Business risk scales and characteristics of their gradations.

The first three gradations of the probability of an undesirable outcome correspond to "normal", "reasonable" risk, at which it is recommended to make ordinary business decisions. Making decisions with great risk is possible if the occurrence of an undesirable

outcome does not lead to bankruptcy. To assess the variability (variability) of risk, the coefficient of variation is used and the following scales are given:

- up to 0.1 - weak;
- from 0.1 - 0.25 - moderate;
- over 0.25 - high.

When assessing the acceptability of the coefficient that determines the risk of bankruptcy, there are several points of view that do not contradict each other.

Topic 4. Basic principles of hazard identification and characterization.

Identification of hazards in structural units is carried out by working groups. The working groups include:

- head of a structural unit (deputy head of a structural unit);
 - OHSMS representative in a structural unit;
 - representative of mechanical and energy services;
 - labor protection service employee supervising a structural unit;
- other specialists at the discretion of the head of the structural unit.

Topic 5. Physical and chemical hazards of products.

Chemical contaminants in food products can be naturally occurring or introduced during food processing (Table 3). High levels of harmful chemicals are responsible for acute cases of food poisoning and foodborne illness and can cause chronic illness at lower levels.

Topic 6. Biological hazards of products

The basic law of rational nutrition dictates the need to match the levels of energy intake and expenditure, therefore, we must reduce the amount of food consumed. However, in this case, we violate the second law of rational nutrition, which requires us to fully cover the body's need for vitamins and other vital (essential) substances.

Topic 7. Modern methods of food production.

Various ways of influencing products of plant and animal origin from the standpoint of modern scientific ideas about the processes occurring in products under the influence of mechanical and thermal cooking. The problem of reducing the nutritional value of a product during culinary processing.

Topic 8. Risk assessment associated with external factors

A hazard or hazard factor refers to factors, characteristics or phenomena arising during the work process that can harm the health of workers, such as a work injury, occupational disease, or cause excessive physical or mental stress. Hazards may include, for example, noise, slippery floors, constant rushing, or forced work postures.

Topic 9. Statistical processing of risk assessment results.

Assessing the magnitude of business risk and its acceptability requires, first of all, knowledge of the main types of losses. Risk losses in business activities are divided into material, labor, financial, time losses, and special types of losses.

Material losses are costs not provided for by the project or direct losses of material objects in kind (buildings, structures, transmission devices, products, semi-finished products, materials, raw materials, components).

Topic 10. Information about risk assessments and ways to minimize them at all stages of development and creation, production, circulation, disposal and destruction of food products.

Article 12. Requirements for food safety and measures to ensure it.

Article 13. Requirements for food safety special purpose.

Article 14. Requirements for food products subject to enrichment (fortification)

Article 15. Requirements for food safety during its development (creation), etc.

2. Modeling of technological processes of food production.

General information about modeling technological processes and food formulations. Goals and objectives of modeling disciplines. Principles of mathematical modeling. Mathematical modeling is a modern method of food research. Classification of modeling methods. General procedure for compiling a mathematical model. Systematic and classical approaches to compiling object models.

Information support for modeling. Methods for solving differential equations. Optimization methods. Software tools for engineering calculations. (Excel, MathCad, Matlab. Matematika packages). Technical support for modeling. Introduction to models and simulation. Classification of mathematical models of technological processes and food formulations. Mathematical modeling and optimization of food industry control objects. Classical optimization methods. Linear programming. Dynamic programming and the maximum principle.

Mechanical processes as objects of modeling.

Mathematical modeling of mixing, dosing, mixing, grinding, cooling and separation processes. Modeling of microbiological, chemical and biochemical processes in food production.

Topic 1. Introduction. Basic scientific and practical provisions of food security
Basic definitions and provisions in the field of food safety.

Topic 2. Legal and regulatory aspects. State regulation in the field of food security

The legislation of the Republic of Kazakhstan in the field of food safety is based on the Constitution of the Republic of Kazakhstan, consists of this Law, technical regulations in the field of food safety and other regulatory legal acts of the Republic of Kazakhstan. If an international treaty ratified by the Republic of Kazakhstan establishes rules other than those contained in this Law, the rules of the international treaty apply.

Topic 3. Quality and safety of raw materials and food products.

Requirements for ensuring the quality and safety of food products, materials and products

Requirements for the safety of food products and the processes (stages) of their development (creation), production (manufacturing), circulation, disposal and destruction, established by the legislation of the Republic of Kazakhstan in the field of food safety, are mandatory for implementation by entities.

Topic 4. International aspects of food security.

Testing of manufactured and supplied products provides evidence of compliance with established requirements and is an integral part of the production process. Often, testing costs significantly exceed all other production costs. In this regard, the initial stage of creating national accreditation systems was associated with the organization of a network of independent testing laboratories (centers), subsequent ones - with the certification of these laboratories (centers) and, finally, with their accreditation.

Topic 5. Contamination of food raw materials and food products with xenobiotics of chemical and biological origin.

Food products are complex multicomponent systems consisting of hundreds of chemical compounds. These compounds can be roughly divided into the following three groups.

I. Compounds of nutritional importance. These are the nutrients necessary for the body: proteins, fats, carbohydrates, vitamins, minerals.

II. Substances involved in the formation of taste, aroma, color, precursors and breakdown products of basic nutrients, other biologically active substances. They are conditionally non-nutritive in nature. This group also includes natural compounds that have antinutritive (prevent the metabolism of nutrients, for example antivitamin) and toxic properties (phasin in beans, solanine in potatoes).

III. Alien, potentially hazardous compounds of anthropogenic or natural origin. According to the accepted terminology, they are called contaminants, xenobiotics, and foreign chemical substances (FCS). These compounds can be of inorganic and organic nature, including microbiological origin.

Topic 6. Methods of individual and collective expert assessments, used in enterprises

Currently, focusing on the interests and requirements of consumers, market conditions and changes in the socio-economic policy of the state, enterprises are trying to develop strategies for their development, designed for both the long and short term. The more accurately future development results are determined, goals are outlined, mechanisms and methods for achieving them are developed, the more confidently current management is carried out, and the more effectively problems are solved.

Topic 7. Product quality assessment

The problem of product quality is universal in the modern world. Much in the economic and social life of the country depends on how successfully it is solved. An objective factor that explains many of the underlying reasons for our economic and social difficulties, the declining rate of economic development over the past decades, on the one hand, and the reasons for increasing production efficiency and living standards in developed Western countries, on the other, is the quality of created and manufactured products.

Topic 8. Method of expert assessment of the level and indicators of product quality

The method of expert assessment of the level and quality indicators of products is used when it is impossible to use analytical or experimental methods with sufficient accuracy and is based on the use of generalized experience and intuition of expert specialists.

The expert method is carried out on the basis of decisions made by experts. This method is widely used to assess the level of quality (in points) when establishing a range of indicators taken into account at various stages of management, when determining general indicators based on a set of single and complex quality indicators, and when certifying product quality. The main operations of expert assessment are the formation of working and expert groups, classification of products, construction of a scheme of quality indicators, preparation of questionnaires and explanatory notes for interviewing experts and processing of expert data.

Topic 9. Main stages of the work of the expert commission

- Appointment of persons responsible for organizing and carrying out work on expert assessment of product quality.
- Formation of expert and working groups.
- Development of classification and determination of the nomenclature of quality indicators of the products being assessed.
- Preparation of questionnaires and explanatory notes for interviewing experts.
- Assessment and survey of experts.
- Processing of expert assessments.

Analysis and registration of the results of expert assessment of product quality.

Topic 10. Sociological method

The sociological method is divided into methods of collecting information and methods of its analysis. The first include various forms of surveys (mass surveys, interviews, expert surveys, etc.), observation, and document processing. Methods for analyzing material include the use of statistical groupings, ranking, scaling, indexing, identifying quantities, dependencies between the variables being studied.

Topic 11. Signs of quality indicators

Quality is a set of characteristics of an object related to its ability to satisfy established and expected needs. Quality requirements are the expression of certain needs or their transportation into a set of quantitatively or qualitatively established requirements for the characteristics of an object to enable their implementation and verification.

Quality is a measurable quantity and, therefore, the non-compliance of a product with the requirements placed on it can be expressed through some constant measure, which is usually money.

Property is an objective feature of a product (or product), manifested during its creation, evaluation, storage and consumption (operation). Product properties can be simple or complex. A simple property is characterized by one feature. Complex is a complex of features that appear together.

Topic 12. Methods for determining product quality indicators

The basis for studying the quality of food products, identifying the influence on their properties of technological processes of production, storage, transportation and sale, as well as the patterns that determine the usefulness and consumer benefits of products, are various methods for determining the values of product quality indicators.

Methods for determining product quality indicators are divided into two groups:

- by methods of obtaining information;
- by sources of information.

Topic 13. Types, methods, principles of control

Product quality control is a means and an integral part of the quality management process. The quality control system must be prompt and effective. The need to create a system of operational quality control is due to the fact that raw materials and finished products are mostly perishable. Quality control of manufactured products is effective if there is a scientifically based system for assessing quality and the dependence of all forms of economic incentives for workers on the quality of manufactured products.

Topic 14. Food poisoning of microbial etiology. Food poisoning.

Pollution causes two forms of disease: food poisoning (food intoxication) and food poisoning.

Food intoxication: it is caused by a toxin produced by a microorganism that enters and develops in foods. Typical examples of food intoxication are staphylococcal poisoning and botulism.

Food intoxications can be divided into bacterial toxicoses and mycotoxicoses.

Topic 15. Food poisoning of non-microbial etiology.

Types, mechanism of action, classification, prevention

According to Academician A. A. Pokrovsky, aptialimentary factors include compounds that do not have general toxicity, but have the ability to selectively worsen or block the absorption of nutrients. This term applies only to substances of natural origin that are components of natural food products. Representatives of this group of substances are considered as unique antagonists of conventional nutrients. This group includes antienzymes, antivitamin, demineralizing substances, and other compounds.

3. Management systems in ensuring the quality and safety of food products

Equipment for the quality of food raw materials and products; internal and external conditions - affecting the safety and quality of products. Quantitative criteria for assessing technological systems for food production based on their quality parameters; methods of qualitative and quantitative research of the risk of disruptions in the functioning of technological systems.

Study of the basic scientific and practical provisions of food security. Legal and regulatory aspects of state regulation in the field of food security. Quality and safety of raw materials and food products. The national importance of developing the food market to ensure food security in Kazakhstan. Aspects of food security of regions and cities of the Republic of Kazakhstan. International aspects of food security.

Modern methods of food research. Polarographic research methods, polarometric research methods, photometric research methods, photometry, spectrophotometry, luminescent research methods. Refractometry, calorimetry, electrochemical research methods.

The main factors determining the biological safety of raw materials of animal origin and food products. The main ways of contamination of food raw materials and food products, biological chain. Toxicity, classification of substances based on toxicity. Basic (main) toxicity indicators: maximum permissible concentration (MAC), permissible daily intake (ADI), permissible daily dose (ADD). Consequences of exposure to toxicants on the

human body (allergenic, carcinogenic, mutagenic, teratogenic). Combined action of toxicants (antagonism-effect and synergism-effect). Sanitary protection and examination of raw materials and food products. Goals and objectives of hygienic examination, stages of its implementation and results (edible and inedible products, standard and non-standard, falsified, surrogate, their further use). Examination of meat and slaughter products at meat processing plants.

Topic 1. Introduction. Methods for studying the properties of raw materials and finished products

Nutrition determines human health, so food must be healthy (contain all the substances necessary for a person), safe, (harmless, economically clean) and moderate in quantity.

In many ways, nutritional culture depends on the level of development of society, national habits, and consists of our knowledge about the physiology of human nutrition, the role of the main components of food in life and understanding of rational nutrition, adherence to its basic principles, as well as the ability to recognize the quality of food in a timely manner. .

You received the basis of these concepts by studying nutritional physiology, general biochemistry and special food technology.

Topic 2. Characteristics of plant and animal raw materials for food production - as objects of research

Food production involves the use of various types of raw materials. At the same time, part of the food industry is engaged in the primary processing of raw materials - flour mills - starch, sugar, starch-molasses, canning, vegetables - drying, alcohol, etc., and part - in the secondary processing of raw materials - bakery, pasta, confectionery, yeast and others.

Raw materials vary in composition and properties, which is determined by their further use and the wide range of products produced by the food industry.

Raw materials of animal origin are a product or secret product of processing by animals or microorganisms (milk, butter, eggs, honey, yeast, etc.). The main raw materials are - raw materials, without which it is impossible to produce a particular food product in bakery - flour, water, yeast, etc., these are grains and seeds, and fruits, water, vegetables, raw materials of animal origin - milk, meat, fish , oil.

Topic 3. Classification of methods and techniques for analyzing the properties of raw materials and food products.

Methods from the Greek “metodos” are, in accordance with GOST, a rule for applying certain principles and means of testing or a strategy for obtaining optimal information about the object of study based on this principle.

The principle of the method is the use of certain phenomena to obtain analytical information. It expresses the interactions that a sample undergoes to obtain analytical data. The principles include:

- physical phenomena
- mechanical phenomena
- chemical phenomena
- biological phenomena

Different methods of analysis can be based on the same principle.

Analysis methodology—a detailed description of all conditions and operations that provide the regulated characteristics of the accuracy and reproducibility of the analysis. The description of the method indicates the material being analyzed, the conditions for preparing the sample for testing, the range of concentrations, the method of obtaining data for constructing a calibration graph, the number of parallel measurements, processing of results, equipment, and reagents.

To conduct state tests when assessing the quality and safety of food products, only metrologically certified (standard) methods are used, approved or approved for use by the State Standard of the Russian Federation or the State Sanitary and Epidemiological Service of the Russian Federation.

Analytical signal. After sampling, the stage of chemical analysis begins, at which the component is detected or its quantity is determined. For this purpose, the analytical signal is measured. In most cases, the analytical signal is the average value of the results of a measured physical quantity at the final stage of analysis, functionally related to the content (concentration) of a certain component. Volume, mass, and optical density are taken as analytical signals.

The intensity of the analytical signal is proportional to the amount (concentration) of the desired component. The signal value is converted into units characterizing the amount and concentration of a certain substance

Topic 4. Methods for determining the physical properties of food raw materials and food products

Functional properties are understood as physical, chemical and other characteristics that determine the behavior of a product during storage and processing, as well as providing the desired structure, technological and consumer properties of finished products. In some cases, the term “technological properties” is used to determine the functional properties of a product.

Physical properties of food products. The physical properties of food products include structural and mechanical properties, flowability, self-sorting ability, porosity, sorption and thermophysical properties.

Structural and mechanical properties are features of a product that manifest themselves under impact, compressive, tensile and other influences. These properties characterize the ability of products to resist applied external forces or change under their influence. These include strength, hardness, elasticity, plasticity, viscosity.

Topic 5. Chemical methods of food analysis.

Using chemical methods, moisture, ash content, titratable acidity, content of table salt, sugars, fiber, pentosan, fat, protein substances, as well as vitamins and enzyme preparations are determined in food products.

Product moisture is the amount of moisture contained in a product. Products consist of water and dry matter, i.e. carbohydrates, fiber, proteins and other nutrients.

Determination of moisture by drying involves heating to the highest possible temperature, at which decomposition of the dried product does not yet occur. Dry at normal atmospheric pressure and high temperature (over 55°) - at low atmospheric

pressure (vacuum and high temperature - at low atmospheric pressure and low temperature below 0°).

The choice of these methods depends on the condition of the product, its strength, amount of water, and time for research.

Topic 6. General information about sensory analysis of raw materials and food products.

Sensory analysis is a purely physiological process in which all human senses are involved.

Analyzers are formations of the central and peripheral nervous system that perceive and analyze information about phenomena both in the environment surrounding the body and within the body itself.

Analyzers that analyze and synthesize environmental phenomena are called external (visual, auditory, olfactory, tactile).

Analyzers that analyze phenomena occurring inside the body are called internal. They provide information about the state of the gastrointestinal tract, nervous system and other internal organs.

The sensory level is understood as an objective reflection of objects and phenomena that directly affect the human senses. During perception, the subject forms holistic images of objects and phenomena from the sensation of individual properties.

The perceptual level is the image of an object or phenomenon displayed by the subject based on past experience in the absence of influence of the object itself on the senses.

The level of representation is characterized by the fact that a person is able to display an image of an object or phenomenon based on past experience, which is preserved in his memory in the absence of the influence of the stimulus itself on the senses.

Memory is the ability of the nervous system to reflect past experience, one of its main properties, which is expressed in the ability to retain information about events in the surrounding world for a long time, in the ability to enter it into the sphere of consciousness and behavior many times. Psychology identifies in memory the processes of remembering, storing and displaying information, which in turn include the processes of recognition and recollection.

3. List of recommended literature

Basic literature

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