Section 4. CHEMICAL, PHYSICAL, MATHEMATICAL METHODS OF RESEARCH OF FOOD PRODUCTS QUALITY

OPTIMIZATION OF DAILY AND CYCLIC RATION FOOD SYSTEMS FOR THERAPEUTIC ACTION

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In the present article we are formulated three fundamental problems of creating long-term food systems for prophylactic treatment, and approach their solution. Problems that considerate: balance groups of nutrients that connected between each other by scientifically based relationships; maintenance of high biological value protein in some products and dishes that serve as components of diets, and in most food rations; providing scientifically based daily norms in nutrients and energy values.

Based on the totality of single intake rations of various purpose (for the first and second breakfasts, lunches, dinners etc.), which were designed at earlier stages of the study, we developed an improved algorithm for design and optimization of daily diets that maximize providing daily needs of a large number of nutrients and energy values. Daily rations are combinations of single intake rations for various purposes and are the part of cycle diets that may cover a period from two to three weeks. The set of cycle diets lasting form of long-term ration food system for the prevention and treatment of diseases arising against calcium deficiency.

The difference of the proposed algorithm consist in introducing a new objective function for daily rations optimization and average relative underperformance of daily needs in nutrients and energy values. For the objective function adopted minimum sum of relative underperformance daily needs in nutrients and energy value; proposed index of relative underperformance offered daily needs in nutrients and energy value is the ratio of the minimum value of the objective function to the number of parameters, of which there is a shortfall of daily needs of this diet.

Considered stages of research ends, with appropriate design of single ration sets of various types is completed solve of three formulated fundamental problems of creation health-care food systems.

Keywords: food systems, scarce nutrients, daily rations, cyclic rations, optimization.

CONJOINT APPLYING OF R-FUNCTIONS AND PROJECTION METHODS IN PROBLEMS OF THE DRYING THEORY

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To increase the efficiency intensification of drying of food raw materials the mathematical model of the process in the form of non-stationary partial differential
equations with given initial and boundary conditions were proposed. Presence of the time component and the tendency to take into account the real spatial geometric form of capillary-porous bodies complicate the mathematical model of the problem. These difficulties overcome by the application of R-functions and projection Bubnov – Galerkin methods. The proposed form of solution of initial value problem precisely takes into account the body shape and geometric boundary conditions. The stage of obtaining numerical solutions solving the systems of ordinary differential equations with initial conditions which shaped by projection method came to an end.

The literature review under that topic shows that the solutions of only the bodies which use integral transformations (infinite plane, cylinder, sphere, rectangle) were researched in detail. The article is dedicated to the establishment of a rational modes of drying capillary-porous bodies through the construction physical and mathematical model using the projection method in Bubnov-Galerkin form and design tools of the theory of R-functions.

Thus the development of R-functions method with the use of projection Bubnov-Galerkin method was proposed. An approximate solution of the problem of distributing the temperature and moisture in a spatial capillary-porous body with boundary conditions of the third kind was obtained. The proposed algorithm can be used for the elucidation of the mechanism of heat transfer process during the dehydration of food raw materials.

**Keywords:** food raw materials drying, heat and mass transfer, R-functions, projection method, differential equation system.

**PHYSICAL AND MATHEMATICAL MODELING OF TEMPERATURE FIELDS BY HEAT EXCHANGE FOR THE SOLIDS OF FINITE SIZE**

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The problems of energy efficiency of heat and mass transfer processes, including drying, can be solved by the analysis of experimental data and by physical and mathematical (theoretical) modeling. The last, anyway, should be compared with the experiment to refine the model and its approach (adaptation) to technical solutions.

In particular, during drying of colloidal capillary-porous bodies, which include the majority of food raw materials, it is necessary to record and analyze temperature distribution, which affects both the drying process and the finished product’s quality.

It is necessary to specify the conditions of the experiment and its methods so that the recorded data allow analyzing thermal properties of the dehydrated material and scientifically justify rational modes and methods of drying.

In this paper the mathematical model of heat transfer in the solid of finite size is proposed in a form of non-stationary heat equation, initial conditions and basic types of boundary conditions. The exact solution for any type of boundary conditions is analyzed. Numerical example of the model realization is considered. The best conditions for the approximation of the exact solution, provided as a series, its first expansion member are obtained.
Keywords: energy efficiency of heat and mass transfer processes, drying of colloidal capillary-porous bodies, heat equation.

INVESTIGATION OF REVERSE OSMOSIS OF GRAIN DISTILLERY STILLAGE ULTRAFILTRATION PERMEATE

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This work presents the results of reverse osmosis of ultrafiltration permeate of grain distillery stillage. The problem of complex utilization of distillery stillage is relevant for environmental and economic performance of enterprises. The experiments were carried out in dead-end experimental set-ups. The membrane NanoRo series K were used (ZAO STC “Nanotex”, Russia). The corn stillage was used for the experiments. It was observed, that permeate flux increased linearly with increasing the operating pressure in the range from 2 to 8 MPa. Found that the most intensive separation process of ultrafiltration permeate grain distillery stillage is at a pressure of 4 MPa. Zatrymuvalna ability membrane increases with increasing work pressure caused by a decrease in the concentration of dissolved component in the permeate. This selectivity membrane mineral substances is 95-97%. A concentration ultrafiltration permeate grain distillery stillage. With increasing concentration factor productivity gradually decreases, it is connected with the increased viscosity of the solution forgiveness, as well as gradual pollution membranes. Established that the content of dry des-trances in concentrate increased by 8 times. In the resulting permeate contained no solids and mineral content decreased by more than 20 times. Reverse osmosis can be used for separation and concentration of permeate of grain stillage.

Keywords: reverse osmosis, ultrafiltration permeate, grain distillery stillage.

WHIPPED PASTRY WITH EXTENDED SHELF LIFE

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The purpose of this work was to study the influence of supplements and methods of packaging to extend the guaranteed term of storage of the whipped pastry and the changes of their quality during the storage. During storage of the whipped pastry the complex physical and chemical, biochemical, microbiological processes are undergo due to their characteristics, conditions and storage term. Some of them significantly impact on the change of the quality of products during their storage. For whipped products, which are spumy structures are characterized by a process of becoming hard: products lose moisture, initial texture, harden, changing their structure and form. The intensity of these processes depends on storage conditions, relative moisture and ambient temperature, the recipe of products, the nature and concentration of gelling substances; the quantity of added molasses and degree of dispersion of whipped masses. In the process of studies used generally recognized and modern methods. The number and ratio
of free and bonded water in the new products were determined by derivatograf Q-1500. The Sorption’s properties - on sorption-vacuum system by Mac-Ben.

Represented the results of investigations to determine the activity of water in the marshmallows and whipped lukum. On the basis of these studies was demonstrated that the addition of the whipped confectionery algae increases the number and diameter of the pores, causing more adsorption properties. Porous samples should soft, that are desirable consumer properties for finished products. Arguments the possibility of extending the long-term of storage of the whipped pastry from 30 to 90 days by simultaneous use in Lamidan and Cichorlact. On the basis of these studies the specifications for the new of the whipped pastry with long-term storage developed and approved recipes and technological instructions.

Keywords: active water, the hygroscopic moisture content, hydrocolloids, the whipped pastry, marshmallow, whipped Turkish delight, Lamidan, Cichorlact.

FEATURES OF DEFINITIONS $T_2$ AT THE PULSED NMR

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The relevance of this work is related to the problems of data processing and improvement of the accuracy of the experiment, these problems’ solution requires new methods of processing statistics. Trends of modern science, its orientation to new technologies require a differentiated approach to conducting experiments and training. Using the latest methods of data processing are intended to provide clear and sufficiently accurate results that can be used in the future. In this regard, this article discusses the goals, objectives and requirements posed to the experimenter who works in modern science.

This article presents one of the mathematical methods for improving accuracy of the data and comparative analysis of the described method with other popular methods of mathematical statistics.

The authors studied data processing obtained by pulsed NMR for preliminary assessment of the quality of spin-spin relaxation time $T_2$ measurements. They propose an approach for assessing quality of the measurements by calculating additional coefficient for signals amplitude depending on time. This coefficient will assess accuracy of the results of the study. As example, one of the calculations shows the consistency of the proposed method for data processing. All measurements are carried out in the body of Mathcad softwar, due to its convenience and high accuracy.

The article results in some conclusions and recommendations regarding data processing. Thus an additional method that improves the measurement accuracy is obtained, but it’s worth remember that this method is not absolutely universal and has its own limitations.

Key words: NMR, statistics, Huber method, data processing.