

## ABSTRACT AND REFERENCES

## TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

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**ANALYSIS OF THE INFLUENCE OF ROSEMARY AND GRAPE SEED EXTRACTS ON OXIDATION OF THE LIPIDS OF PEKING DUCK MEAT (p. 4-9)****Nataliia Bozhko**

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The most common way of solving the problem of oxidative damage to meat products is the use of a variety of antioxidant food additives that allow the purposeful regulation of the processes of oxidation of the lipid fraction of meat systems.

The study explores the effect of an antioxidant composition of rosemary and grape seed extracts on the course of oxidative processes in minced Peking duck meat. It has been determined that its introduction in an amount of 0.12–0.36 % helps slow down the hydrolytic oxidation of the minced meat lipids by 10.5–32.5 %. When the composition is introduced, the stabilization of peroxide oxidation of unsaturated fatty acids occurs. The biggest effect was obtained when adding 0.36 % of the additive, which reduced the PV by more than twice. The amount of secondary oxidation products was the smallest at the end of the storage period of minced meat in a sample with a composition concentration of 0.36 %, when the TBA value was  $2.8 \pm 0.11$  mg MA/kg, which is more than twice as low as the control.

The obtained results prove the possibility of adding the composition of the plant extracts (up to 0.36 %) to improve the stability of meat products to the oxidation damage and to prevent the decline in the product quality.

**Keywords:** lipid oxidation, rosemary extract, grape seeds, acid value, peroxide value.

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**EXPLORING THE POSSIBILITY OF PURIFICATION OF WATER-ALCOHOL SOLUTIONS OF DIFFERENT CONCENTRATIONS CONTAINING ALDEHYDES AND ESTERS BY MINERAL ADSORBENTS (p. 10-15)**

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A comparative analysis of adsorption purification of water-alcohol solutions of different concentrations by clinoptilolite and shungite on the example of ethanol impurities such as acetaldehyde and ethyl acetate is carried out. Application of the aforementioned minerals for the adsorption of such simple substances as ethanol impurities is due to the previous positive results and the structure of the adsorbents investigated earlier. The optimum concentrations of water-alcohol solutions and the duration of contact of water-alcohol solutions with adsorbents for effective adsorption of aldehydes and esters are experimentally determined. The prediction of the efficiency of purification of polar impurities by mineral adsorbents based on the known rectification coefficients of the basic polar impurities is proposed. The higher the rectification coefficient, the lower the magnitude of hydrogen bonds of the impurity with ethanol and the easier it is to be sorbed from ethanol by mineral adsorbents. The relationship between the optimum concentration of water-alcohol solutions for effective adsorption of impurities and the rectification coefficient is shown. The expediency of using a mineral adsorbent such as clinoptilolite of Ukrainian origin instead of imported activated carbon in the production of alcoholic beverages is proved. It is determined that clinoptilolite is more useful as adsorbent for the purification of water-alcohol solutions containing aldehydes, which worsen the taste of alcoholic beverages most of all. It is shown that the use of clinoptilolite in the production of vodkas of non-standard rectified alcohol will improve the taste of the final product.

**Keywords:** adsorption, volatile alcohol impurities, ethyl alcohol quality, zeolites, clinoptilolite, shungite.

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## SUBSTANTIATION OF THE USE OF SPICE PLANTS FOR ENRICHMENT OF WHEAT BREAD (p. 16-22)

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Spice, aromatic, volatile-oil-bearing plants are rich in essential aromatic oils, vitamins, minerals that give phytoncidic, prophylactic, therapeutic, functional properties to products, improve food taste and digestibility.

To prepare plant powder, it is necessary to use a certain part of plants, dry, grind in a laboratory mill to a particle size of  $10^{-4}$ – $10^{-1}$  mm and mix to take a weighed prescription sample. In order to prepare the Quinoa flour, it is necessary to use Quinoa seeds, grind in a laboratory mill to a particle size of 30–40 microns and mix to take a weighed prescription sample.

The use of plants in bread production is promising. The efficiency of using plants in the technology of bakery products as both an enhancer of nutrition value and a nutrient medium for yeast, which in turn affected the quality of finished products – porosity, acidity, specific volume was revealed. In order to develop an effective technology for the use of plant additives, create new types of products with the properties that meet today's needs of

consumers in Ukraine and the world, it is necessary to clarify the relationship between the components of spice plants and other components.

The replacement of a part of the prescription amount of flour with dried and milled plants Narrowleaf Mountainmint (*Piknanthemum trifolium* L.), Quinoa (*Chenopodium quinoa* L.), Scarlet Beebalm (*Monarda didyma* L.), Korean Mint (*Agastache rugosa* L.), Hemp Dogbane (*Vitex cannabinum* L.), Mint-shrub (*Elsholtzia Stauntonii* L.), Moroccan Spearmint (*Mentha spicata* Moroccan L.) during bread production was experimentally grounded and implemented.

The developed method of bread production under the new formulations relates to the agriculture and food industry and can be applied during laboratory bread baking.

The expediency of introducing an additive into the wheat dough in a dosage of not more than 5 % into the flour of Scarlet Beebalm powder; up to 10 % of Narrowleaf Mountainmint and Quinoa is revealed.

**Keywords:** Narrowleaf Mountainmint, Quinoa, Scarlet Beebalm, Korean Mint, Hemp Dogbane, Mint-shrub, Moroccan Spearmint, new formulations, bread products.

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### IMPROVING HEAT TRANSFER COEFFICIENT DURING DOUBLE-SIDED MEAT FRYING (p. 23-28)

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Improving the energy efficiency of technological processes and equipment for heat treatment of meat and meat products is a relevant scientific task. A prerequisite for the development of new energy and resource-saving equipment for frying meat is the study of the mechanism of heat transfer in the surface layers of the product.

The aim of the work was to determine the effect of the value of the logarithmic mean temperature difference (LMTD)  $\Delta T^m$  on the value of the heat transfer coefficient  $k$  during double-sided frying of organic meat products by the physical and electrophysical methods.

The study has proved that the LMTD between the frying surface temperature and the temperature of liquid on the capillary

meniscus surface depend on the frying surface temperature. An increase in the frying surface temperature from 393 K to 423 K reduces the LMTD between the frying surface temperature and the temperature of liquid on the meniscus surface from 10 K to 6 K. The specified method of calculating the coefficient of heat transfer through vapor layers takes into account the change in the contact area of the meniscus liquid with the frying surface during evaporation and the area of the meniscus surface in the vapor condensation during double-sided frying of pork under pressure. The study has proved the dependence of the heat transfer coefficient on the LMTD between the temperature of the frying surface and the temperature of liquid on the meniscus surface. The calculated actual coefficient of heat transfer from the frying surface to the product is  $k_{423}=3800 \text{ W}/(\text{m}^2 \text{ K})$  for the LMTD  $\Delta\bar{T}^m=10 \text{ K}$  and  $k_{393}=3800 \text{ W}/(\text{m}^2 \text{ K})$  at  $\Delta\bar{T}^m$  K.

The theoretically substantiated duration of double-sided frying of organic meat under compression is completely identical to the real one.

**Keywords:** frying under compression, temperature rate of the process, heat transfer, temperature difference, vapor layers.

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### OPTIMIZATION OF THE CANNED POULTRY MEAT STERILIZATION FORMULA WITH HYDROCOLLOIDS (p. 29-34)

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In modern conditions, the use of hydrocolloids in the meat industry is one of the promising areas for improving the functional and technological characteristics of meat and meat products, including poultry meat for a long period of storage. For canned poultry meat, in accordance with the minimum specifications for the quality of products of animal origin, a number of specific requirements for functional, technological, physicochemical and organoleptic properties are proposed.

The research was aimed at optimizing the process of sterilizing canned meat with the use of meat of broiler chickens, quail, and hydrocolloids, depending on physical, chemical and organoleptic properties. The study considers features of quail meat in recipes of canned poultry meat using hydrocolloids. The influence of the sterilization process on the characteristics of broiler chicken and quail meat has been determined.

The study has revealed a significant difference of the influence on functional and technological parameters of canned quail meat produced by the use of mixtures of hydrocolloids in comparison with canned meat on the basis of broiler chickens, which is reflected in the change of the WBP values, plasticity and residual salt content in the jelly. Under changing conditions of sterilization, there happen changes in the physical and chemical characteristics of jellies, which correlate with the change in the organoleptic characteristics of the canned food. To ensure high quality of canned poultry meat and to achieve industrial sterility, the sterilization regime for canned meat from chicken broilers should be provided for 500-ml containers with the sterilization time of no more than 90 minutes. For canned quail meat, the duration of the sterilization process must be increased to 120 minutes at 115 °C.

**Keywords:** poultry meat, sterilization formula, hydrocolloids, quail meat, broiler chicken meat.

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## DEVELOPMENT OF WAVE TECHNOLOGIES TO INTENSIFY HEAT AND MASS TRANSFER PROCESSES (p. 34-42)

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The study has proved that in order to improve the heat technologies of food production, innovative principles of energy supply are needed. The hypotheses of using wave technologies for targeted de-

livery of energy to elements of food raw materials are proposed. Classification of the mechanisms of heat and mass transfer intensification in food processing technologies is given. Thermophysical models of the vibrational and barodiffusion mechanisms are presented. The possibilities of a combined action of these two mechanisms are determined. It is shown that vibrational and electromagnetic fields can significantly intensify the processes of heat and mass transfer. Mechanisms, effects and mathematical models of barodiffusion and the action of vibrational fields are justified.

The method of “dimensional analysis” has determined the numbers of wave similarity: modified numbers of Reynolds, Péclet, and Stanton. New numbers of similarity are proposed: the number of energy action and the dimensionless complex that takes into account the ratio of inertial forces caused by vibration and movement of the conveyor belt. On the basis of these numbers, similarities are generalized in the criterial form of a database of experimental data on extraction and drying. The methodological novelty in the processing of these experiments is the use of an effective mass transfer coefficient that takes into account the total effect of diffusion and inertial flows of liquid from the solid phase.

The experiments were carried out to dry sunflower seeds in a vibration dryer. The results of drying wheat seeds and peas on the belt with electromagnetic energy sources are shown in the form of dependency graphs and mathematical models based on the database of the experimental data. The drying speed achieved was 0.4 %/min on the vibrating dryer; on the IR belt dryer, this parameter was 0.75 %/min when drying peas and 1.75 %/min when drying sludge and seeds of sunflower.

The results of the complex experimental research on coffee extraction in a microwave extractor are presented in the paper. The evaluation of the completeness of extraction of extractive substances under the action of the microwave field showed the results, on average, 15 % higher than by the standard thermal method. The prospects of the combined action of the electromagnetic and vibrational fields are shown on the basis of the results for optimizing the microwave extractor.

**Keywords:** food technologies, targeted energy delivery, microwave technologies, intensification of mass transfer, extraction.

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## DEVELOPMENT OF A FERMENTED MILK DESSERT COMPOSITION «MARTYSHKA» (p. 43-49)

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A recipe and technology for the production of a new fermented milk dessert Martyshka of increased nutritional value have been developed. The recipe of the new dessert includes such components (g/100 g): cottage cheese – 54, jam – 23, honey – 8, sesame – 4, cream – 6, and gluten – 5. The determined contents of the main food components (g/1 serving) are the following: proteins – 13.2, fats – 11.6, and carbohydrates – 46.3. The dessert is a source of vitamin C, and it covers 37.04 % of daily human needs. By introducing gluten into the dessert composition, the protein content of the finished product is increased, and it covers an average of 16.92 % of the daily requirement. Besides, the dessert is rich in calcium, so one portion of the dessert covers 25 % of the daily human need.

The obtained data make it possible to claim that the developed dessert is the source of the main macro- and micronutrients, and it meets the demand for them at a high level.

The research findings obtained during the evaluation of the microbiological and organoleptic indices during storage allow asserting that the new dessert «Martyshka» will be competitive on the consumer market of Ukraine. Thus, when the product is stored for 5 days at a temperature of (4±2) °C, the contents of coliform bacteria, Salmonella, mold fungi, yeast, and Staphylococcus aureus correspond to the sanitary and hygienic requirements for fermented milk desserts.

The resulting dessert «Martyshka» can be recommended for children and as gerodietic nutrition.

**Keywords:** fermented milk dessert, commodity evaluation, nutritional value, structural and mechanical properties, technological scheme of production, shelf life.

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## A STUDY OF TOXIC ELEMENTS AND RADIONUCLIDES IN SEMI-SMOKED SAUSAGES MADE WITH LENTILS, THYME, AND JUNIPER (p. 50-55)

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The study determines toxic elements by methods of atomic absorption spectrometry with atomisation in a flame in terms of the colorimetric atomic absorption method. The values of specific activity and volumetric activity of  $\gamma$ -emitting radionuclides are found in sausages using the means of computer technology. The purpose of the research is to determine the safety of semi-smoked sausages made with the use of beef, poultry, lentils, thyme, and juniper as to the content of toxic elements and radionuclides by using techniques developed by Lviv Oblast State Laboratory of the State Consumer Protection Service in Lviv Oblast. A detailed description of the process of conducting research on the sausages is given in the article.

Semi-smoked sausages of modified recipes, namely using beef, poultry, lentils, thyme, and juniper, were investigated according to the methodology developed by Lviv Oblast State Laboratory of the State Consumer Protection Service in Lviv Oblast, using the atomic absorption spectrometry method applying Varian AA240FS Atomic Absorption Spectrophotometer (Agilent Technologies, USA) and Shimadzu AAS-6300 Atomic Absorption Spectrophotometer (Shimadzu, Japan). The use of the developed techniques and this equipment made it possible to determine the contents of lead, cadmium, mercury, arsenic, copper, zinc, and radionuclides and to confirm conformity of the sausages according to these parameters to the requirements of DSTU 4435:2005. Semi-smoked sausages. The research results allowed registering the technical specifications and technological instructions for the semi-smoked sausages Osoblyva Simeyna, Osoblyva Simeyna Spiced, Osoblyva Sambirska, Osoblyva Sambirska Spiced, Osoblyva Stryiska, and Osoblyva Stryiska Spiced.

**Keywords:** test preparation, mineralization, background solution, atomic absorption, spectrophotometer, heavy metals, radionuclides, formulations, semi-smoked sausages, lentils, thyme, juniper.

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**CHANGING THE QUALITY OF GROUND MEAT FOR SAUSAGE PRODUCTS IN THE PROCESS OF GRINDING (p. 56-63)**

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Fine and thin grinding of meat to transform it into a homogeneous mass in sausage making was investigated. It is shown that meat raw materials with the same chemical composition but different degrees of grinding have different structural and mechanical characteristics that directly affect the quality of ground meat and the yield of finished products. The processes of thin grinding lead to high cutting speeds, which causes the raw materials temperature increase, denaturalization of proteins, change in the water-binding capacity and structural and mechanical properties of ground meat.

The physicochemical properties of meat proteins were studied and the relationship between the physicochemical characteristics of ground meat, their effect on SMC, RP of ground meat in the meat grinding for boiled sausage products were determined, which made it possible to determine the optimum grinding duration, taking into account the cutting ability of cutters of different capacities.

To this end, ground meat with different ratios of beef, pork and fatback, as well as production formulas for sausage products were used. It is shown that the degree of meat grinding affects the structure of muscle fibers, fat and connective tissues, protein solubility, strength, structure and moisture content of ground meat, which is crucial for obtaining high-quality sausages.

It is proved that with increasing meat grinding duration above a certain extreme, the solubility of protein fractions decreases, structural and mechanical characteristics deteriorate, the moisture-binding capacity of ground meat decreases, which depends on the state of myofibrillar proteins forming a coagulation structure.

The optimum grinding duration for a doctor's sausage is 13 min at a humidity of WH=0.673 with the subsequent maximum yield and depends on the chemical composition of raw materials, formulation of sausage products, and type of grinding equipment.

Changes in rheological characteristics, water-binding capacity and number of proteins that pass into the liquid phase of ground meat, correlate with each other. The influence of the grinding degree on the microstructure of ground meat from various meat tissues and their combinations was evaluated for the creation of meat grinding control devices and automation of the process.

**Keywords:** cutting, ground meat, rheological indicators of ground meat, muscle structure, meat grinding control, sausage yield, quality.

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