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**INVESTIGATION OF THE EFFECT OF MULTICOMPONENT ACIDULANTS ON THE PRESERVATION OF FRESHNESS AND AROMA OF RYE-WHEAT BREAD (p. 4-9)**

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The accelerated technology to prepare rye-wheat bread at mini-enterprises and restaurants was proposed. The technology involves the use of acidulants. The multicomponent acidulants “Optimum 1” and “Optimum 2” were developed to intensify the technology of rye-wheat bread.

The composition of the acidulants includes the enzyme preparations (EP) Glusim 10000 Mono (glucose oxidase, which contributes to the improvement of structural and mechanical properties of dough, Pentopan 500 BG (a mixture of pentosanase and hemicellulase), which promotes the modification of non-starch polysaccharides and provides elastic crumb in the products.

Citric acid and dry whey (DW) were added to the acidulants in order to ensure proper acidity of dough and intensify the process of its fermentation, while rye fermented malt (RFM) was added to improve organoleptic parameters.

Guar gum was added in order to increase the water-absorbing capacity of dough and to preserve freshness of products during storage.

Optimal dosage of MCA “Optimum 1” and “Optimum 2” in the formulation of rye-wheat bread is 2 % by weight of flour.

Technological aspects of the use of acidulants were considered. The processes were considered related to staling, loss of organoleptic and physical-chemical indicators of bread quality during storage. The positive influence of acidulants on the parameters of crustiness and swelling of bread crumb due to the accelerated technology of its preparation was proved. It was established that the use of acidulants helps to slow down the process of rye-wheat bread staling. The positive effect of acidulants on the taste and flavor of finished products was obtained. The obtained results prove the expediency of using the developed multicomponent acidulants “Optimum 1” and “Optimum 2” in the technology of rye-wheat bread employing its accelerated preparation. The use of the developed acidulants helps to reduce the technological process of baking rye-wheat bread by 2.5–3 times and ensures preservation of freshness, taste and flavor of the finished products.

**Keywords:** acidulant, rye-wheat bread, staling, starch retrogradation, nutritional supplements, organic acids.

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**STUDY INTO COLLAGEN HYDROLYZATE APPLICABILITY AS A STRUCTURE FORMING AGENT (p. 10-17)**

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The study of foaming properties of collagen hydrolyzate has proved availability of its use as a structure forming agent in production of aerated drinks.

The foaming dynamics obtained in a wide range of pH values have shown that gluten forms a stable foam at pH values within 5.8...7 in a temperature range of 8–10 °C. Microscopy of the obtained foamy structure has shown that it is characterized by the presence of dispersed particles with sizes of various orders and an average radius of a disperse particle equal to 1.53 mm.

The IR spectroscopy data have shown presence of free groups capable of hydration. The lowest degree of hydration was observed at pH=10.1 and the highest one at pH=7.0 after 3–3.5 hours of incubation.

Optimum technological parameters of making aerated milk drinks with the use of gluten were obtained: pH=5.2, gluten concentration of 5 %, agar or apple pectin concentration of 1.5 %.

**Keywords:** collagen hydrolyzate, gluten, foamed food systems, foam formation, food system stabilizers.

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## RESEARCH INTO EFFECT OF THE SYMBIOTIC COMPLEX ON THE QUALITY OF A FAT FILLING FOR WAFFLES (p. 18-25)

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A new technique was designed for obtaining the symbiotic additive, which consists of the immobilized bifidobacteria and inulin. Technological approach implied a partial replacement of the filler of confectionary fat with inulin, and the introduction of bifidobacteria in the amount of 107 cfu/g. We have proven the need for conducting the process of immobilization for the bifidobacterial cells.

We examined effect of the symbiotic complex on the structural-mechanical properties of samples of the fat filling, in particular, on effective viscosity, penetrating properties, adhesion and density. The introduction of the additive contributes to an increase in the viscosity of the mass, which, in the course of the technological process, will lead to a better application and uniform distribution of the filling on the surface of a wafer sheet. It was proven that the duration of structure-formation is reduced for all examined samples by 2...6 minutes in comparison with control. The adhesion strength of waffles also increases, which contributes to a better adhesion between the filling and wafer sheets. It was established that the application of the symbiotic in the technology of waffle production exerts a positive effect on the organoleptic properties of finished products. We have received samples of waffles with a homogeneous and tender filling, without the fat taste.

**Keywords:** immobilized bifidobacterial, inulin, symbiotic complex, structural-mechanical properties, waffle products.

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#### FORMATION OF BIOFILMS ON DAIRY EQUIPMENT AND THE INFLUENCE OF DISINFECTANTS ON THEM (p. 26-33)

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Scientific studies show that microbial biofilms formed on the surfaces of dairy equipment negatively affect safety of the finished products and constitute a danger to the human health. This is due to the fact that the biofilms, in addition to the saprophytic microflora, may contain pathogenic micro-organisms as well. The present paper reports results of the studies into composition of the

microflora of dairy equipment and finished products, the process of biofilm formation on stainless steel with different surface roughness, with the effect of disinfectants on the planktonic and biofilm forms of bacteria determined.

It was established that bacteria of the genera *Bacillus*, *Lactobacillus* and the Enterobacteriaceae family are most often isolated from dairy equipment and finished dairy products, with staphylococci, enterococci, streptococci, and pseudomonads isolated in a lesser degree. The isolated bacteria mainly form biofilms of high and medium density. It was found that the *Escherichia coli* biofilms of lower density form on the surface of stainless steel of brand AISI 321 with a surface roughness of 0.16  $\mu\text{m}$  compared to the surface with a surface roughness of 0.63–0.955  $\mu\text{m}$ . This process takes place at a temperature of 17 °C, over 6–24 hours, followed by the formation of a high-density biofilm regardless of the surface roughness. It was established that the disinfectant Argenvit proved to be inefficient for the biofilm and planktonic forms of bacteria. The disinfectants P3-ansep CIP, Eco chlor, Medicarine and Maxidez demonstrated bactericidal effect on the planktonic bacteria; they, however, did not act on the biofilm forms. The most effective disinfectant in terms of action on the bacteria in biofilms proved to be the disinfectant P3-oxonia active-150 based on hydrogen peroxide and peracetic acid.

Thus, the data obtained indicate that in order to efficiently sanitize dairy equipment, it is required to use the disinfectants that affect bacteria in the biofilms. This in turn will ensure production of safe dairy products.

**Keywords:** bacteria, biofilms, matrix, adhesion, dairy equipment, stainless steel, roughness, disinfectants.

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#### DETERMINING THE EFFECT OF LUPIN FLOUR AND INULA ON THE FLOW OF METABOLIC PROCESSES IN THE ORGANISM (p. 34-39)

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The authors carried out research on white mice into toxicity of lupin flour, inula root and functional cutlets containing 5 %, 10 %, 15 % of lupin flour with the replacement of meat share and 0.5 % of inula as a spicy-aromatic additive. Toxicity of lupin flour, inula and functional cutlets was determined under conditions of intragastrical introduction of 0.5 ml of the extract. Toxicity of the finished 10 % functional cutlets was studied under conditions of feeding white mice on them as the main feed for 10 days. Blood sampling was conducted in the control and experimental groups of mice for hematologic research.

It was found that lupin flour and inula do not cause catarrhal or hemorrhagic inflammation of gastrointestinal tract and the death of mice, therefore, they are non-toxic. While feeding mice on cutlets with 10 % content of lupin flour and 0.5 % of inula, it was established that during pathoanatomical dissection, macroscopic changes in the organs and tissues were not found,  $p < 0.05$ , which is within the nor-

mal range. Therefore, this product is non-toxic and it can be included in the diet of people.

**Keywords:** minced meat, lupin flour, inula, functional cutlets, pathoanatomical dissection.

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### A TECHNOLOGY DEVELOPED TO PRODUCE HOT FISH MARINADES FOR A JELLYLIKE FILLING OF PROLONGED STORAGE (p. 40-45)

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Aquaculture is a promising way of developing fisheries worldwide and in Ukraine. Aquaculture products should form the basis of a complete nutrition of the population of Ukraine in accordance with the world tendency. About 44 % of freshwater catches in 2015 were those of the silver carp. The range of food products from the silver carp is limited, which is due to the low activity of its enzyme system, which does not facilitate maturation in the production of salty fish products. Therefore, new kinds of silver carp products are suggested in jellylike marinade fillings of prolonged shelf life.

The results of the statistical processing of complex organoleptic tests have determined the rational parameters of the hot smoked salty semi-finished product. It is proposed to conduct drying at a temperature of 60...70 °C for 25 minutes; evaporation is advised to be performed for 25 minutes at a temperature of 100...110 °C. The stage of the actual hot smoking should be carried out at a temperature of 90...100 °C for 45 minutes. The samples studied, which were smoked according to the above parameters, received the highest score. In order to provide stable structural and mechanical properties of the jelly during refrigeration, the formulation of the filling was substantiated. A combination of LEP and alginic acid in a ratio of 1:1 with

a mass fraction of 1.5 % forms a jelly as strong as 112 g and with no synergetic changes. The developed technology helps obtain safe fish marinades in a jellylike filling with a shelf life of up to 90 days.

**Keywords:** freshwater fish marinades, jellification, low-esterified pectins, alginic acids, sodium benzoate, potassium sorbate.

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### STUDY INTO EFFECT OF PLANT SUPPLEMENTS ON THE QUALITY INDICATORS OF GINGERBREAD AND SIMILAR SPICE-CAKES (p. 45-54)

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The use of vegetable supplements in the technology of gingerbread and similar spice-cakes was theoretically substantiated and experimentally confirmed. An analysis of the results of research into dependence of the boundary shear stress of gingerbread and similar spice-cakes on the content of vegetable supplements revealed a decrease in the given parameter, which was evaluated as an increase in the softness of spice-cakes according to organoleptic parameters. This tendency can be explained by the higher water retention power of vegetable supplements, as they promote the binding of free moisture and obtaining of a more structured system. It was established that the alkalinity decreased with an increase in the amount of vegetable supplements within the investigated additive. The influence of vegetable supplements on the strength of gingerbread and similar spice-cakes shape stability was substantiated. It was found that the baked semi-finished gingerbread and similar spice-cakes with supplements had, in comparison with the control sample, better structural and mechanical parameters, with density of the products decreased, the structural strength reduced, with the humidity slightly increased.

A sensory evaluation of organoleptic parameters of the finished products was carried out and the profiles of organoleptic evaluation of gingerbread and similar spice-cakes were constructed. It was established that vegetable supplements contribute to the improvement of quality of gingerbread and similar spice-cakes.

A comprehensive research was performed, which allowed us to theoretically and experimentally substantiate the expediency of using vegetable supplements as a highly effective raw material for the regulation of organoleptic parameters and for the formation of functional properties of gingerbread and similar spice-cakes.

The application of ecologically safe non-traditional supplements of plant origin for the targeted correction of the composition and for creating flour confectionery products for special purposes is a key task for enterprises in food industry.

**Keywords:** cedar oilcake, sesame flour, phyto-powder made from snakeweed, gingerbread and similar spice-cakes, organoleptic evaluation.

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## OPTIMIZATION OF TECHNOLOGY FOR SHREDDING THE BEE POLLEN (p. 55-60)

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We conducted optimization of the technology for shredding bee pollen based on the results of evaluation of technological and physical-chemical indicators in order to obtain powder of high quality.

It was established by the results of performed studies that by using modern types of shredders, it is possible to shred bee pollen to particles the size of 12–8 μm. We identified influence of the powder dispersity on the phytochemical activity of bee pollen based on the results of determining a content of flavonoids. The amount of flavonoids in the pollen increases in the case of shredding to particles the size of 15±5 μm, and decreases at dispersity ≤10 μm. We recommend shredding the bee pollen to particles the size of 15±5 μm. Based on the results of estimating the dispersity and homogeneity of the finished product, it was substantiated to apply a mill-mortar in the technology of shredding bee pollen. We optimized technological parameters of shredding bee pollen in a mill-mortar: speed of the working body is 70–80 rpm (min<sup>-1</sup>), duration of treatment is 6 minutes, weight of the batch is 150 g.

The obtained results could prove useful when manufacturing new, or improving already existing, food products of high quality, or when applying in pharmacology and biotechnology.

**Keywords:** flavonoids of bee pollen, powder dispersity, technological properties of the bee pollen powder, phytochemical activity.

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**INFLUENCE OF THE POLYFUNCTIONAL FOOD SUPPLEMENT “MAGNETOFOOD” ON THE QUALITY OF THE WHEAT-RYE BREAD “KHARKIV RODNICHOK” IN THE STORAGE PROCESS (p. 61-70)**

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The issues of preserving the quality of wheat-rye bread “Kharkiv Rodnichok”, enriched with the polyfunctional food supplement “Magnetofood”, in the process of storage are considered. The organoleptic analysis was carried out, physico-chemical, microbiological and structural-mechanical indices of the experimental samples of bread “Kharkiv Rodnichok” were compared with the control, which in complex most fully characterize the preservation of bread freshness during storage and the accompanying processes.

Organoleptic analysis has revealed that the introduction of the food supplement “Magnetofood” slows down the processes of staling of wheat-rye bread “Kharkiv Rodnichok”. The difference in the degree of freshness of the samples – 2 points was noted after 12 hours.

With the help of physico-chemical methods, a change in the quality indices in the process of staling of the experimental samples of bread “Kharkiv Rodnichok”, enriched with the food supplement “Magnetofood” was investigated. It was found that the most intense loss of moisture occurs in the first 24 hours of storage of bread: 12.5 % – in the control and 6.25 % – in the bread “Kharkiv Rodnichok” (2 times less).

The swelling of the crumbs of bread “Kharkiv Rodnichok”, enriched with the food supplement “Magnetofood”, is, on average, 1.5 times higher than in the control; and crumbliness – on average 2.0 times lower.

The structural-mechanical indices of the experimental samples of bread “Kharkiv Rodnichok” in the process of its storage were determined. It has been experimentally shown that in the process of storage, the compressibility and elasticity of the crumb of wheat-rye bread is reduced for all the samples, and for bread “Kharkiv Rodnichok” up to the end of storage by 6.5% (elasticity) and 2.5 times (compressibility) is lower than for the control.

It is found that in comparison with the control, the specific volume in bread “Kharkiv Rodnichok” is higher by 27.0 %; and dimensional stability – by 30.5 %.

It has been experimentally proved that the porosity of wheat-rye bread decreases with time: after 24 hours after baking – by 1.0 % and

0.5 %; after 72 hours – by 5.0 % and 2.75 % (for the control and bread “Kharkiv Rodnichok”, respectively).

The microbiological parameters of the experimental samples of bread “Kharkiv Rodnichok” in comparison with the control are determined: after 72 hours QMAFAnM in bread “Kharkiv Rodnichok” is 4 times smaller in comparison with the control, and the number of *Bac. subtilis* spores after 10 days is 1.5 times lower.

The information analysis showed that all known food nanoadditives have a narrow effect and do not show a complex effect on the quality of wheat-rye bread. In addition, synthetic nanoadditives often have a toxic effect on the human body.

It has been experimentally found that “Magnetofood” can be used as a polyfunctional food supplement, which has a complex action: it has a beneficial biological effect on the human body; possesses sorption, complexing, emulsifying, moisture and fat-retaining properties; due to bacteriostatic and bactericidal action, it exhibits antimicrobial activity, which leads to improved quality, preservation of freshness and prolongation of the shelf life of bakery products. In addition, the food supplement “Magnetofood” at the expense of  $Fe^{2+}$  can be recommended as an antioxidant and a source of easily digestible iron and antianemic agent. Thus, the introduction of the polyfunctional food supplement “Magnetofood” in wheat-rye bread increases its quality and shelf life.

From this point of view, the results of the research are of interest not only for Ukraine, but also for the scientific world of other countries.

**Keywords:** magnetofood, wheat-rye bread “Kharkiv Rodnichok”, antimicrobial action, swelling, crumbliness, elasticity, porosity, moisture content of crumb.

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## RESEARCH OF EXTRACTION OF BIOLOGICALLY ACTIVE SUBSTANCES FROM GRAPE POMACE BY THE SUBCRITICAL WATER (p. 70-80)

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The process of extracting biologically active substances from the grape pomace of grape variety Moldova has been studied. The presence of gallic acid and furfural was identified. It is shown that the temperature of the extraction process has the greatest influence on the yield of biologically active substances from grape pomace. The influence of process parameters of extraction (the size of the fraction of dry grape pomace, temperature, pressure, liquid-solid ratio) on the antioxidant activity of the extracts, the

yield of dry matter, the total yield of polyphenols, tartaric (wine) compounds, reducing substances is determined. It was established that the use of dry grape pomace of 3 mm fraction ensures the maximum yield of target products. Rational parameters of this process are determined. The maximum yield of dry substances during the SCW extraction of GP is provided by the following process parameters: T=150–160 °C, τ=90 min, P=12 MPa and liquid-solid ratio of 1:10. Rational process parameters of SCW extraction of GP during the extraction of total polyphenols: T=100–110 °C, τ=60 min, P=12 MPa and liquid-solid ratio of 1:10. The extracts obtained with these parameters have a high antioxidant activity – 94.01 %. Rational process parameters of SCW extraction of GP during the extraction of reducing substances: T=150–160 °C, τ=90 min, P=12 MPa and liquid-solid ratio of 1:10. These parameters provide extraction of up to 50 % of reducing substances. The high titrated acidity of the extracts obtained (6.649, 0.1 mol/l NaOH per 1 g of extract, ml) is provided by the extraction of GP with the following process parameters: T=150–160 °C, τ=90 min, P=12 MPa and liquid-solid ratio of 1:5.

**Keywords:** grape pomace, biologically active substances, extraction, subcritical water, antioxidant activity.

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