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DETERMINING BIOLOGICAL VALUE AND QUALITY INDICATORS OF BEVERAGES OF THE DRINK-BREAKFAST TYPE (p. 6-14)**Nadya Dzyuba**Odessa National Academy of Food Technologies, Odessa, Ukraine
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We have developed formulations and production technology for beverages of the “drink-breakfast” type with the elevated content of protein and pronounced antioxidant properties. Components of the composition include cottage cheese, non-fat milk, sesame seeds, walnuts, honey, banana, spinach, psyllium, hydrolyzed collagen (glutin). The beverages are the sources of digestible protein, antioxidant vitamins (C, E, PP) and dietary fiber.

By introducing gluten into the composition, a single portion of the developed beverages “Spinach” and “Banana” satisfy a need in proteins by 7.6 % and 7.2 %, respectively. The introduction of spinach and banana to the composition promotes their enrichment with folates. An analysis of mineral composition of the developed beverages allows us to argue on that the beverages are the sources of basic macro- and micronutrients that satisfy the need in them at a high level.

Using psyllium and gluten as active ingredients improves antioxidant activity by 50–60 times, which is explained by the synergy among all components.

We determined the technological conditions for psyllium hydration. It was established that the average size of dry particles of psyllium is 1.79 mm, and that of hydrated is 2.28 mm (5 min, 20 °C). A layer of mucus – soluble food fiber – forms at the particles' surface, which stabilizes the food system. Using gluten as a foaming agent in the beverages enables the formation of a stable aerated struc-

ture. The cell size of foam in the beverage “Spinach” varies in the range 0.05–0.15 mm, and in the beverage “Banana” – from 0.001 to 0.15 mm.

Modeling storage conditions by using the ALST assessment test in terms of change in the microbiological and organoleptic parameters allows us to confirm that the beverages will be competitive in the consumer market of Ukraine. When stored over 36 hours at a temperature of (4±2) °C and at humidity not exceeding 75 % in an airtight container, the content of sanitary-indicative microorganisms complies with the hygienic requirements to milk-based beverages.

The developed “drink-breakfast” beverages could be recommended for children, as well as for the diet of pregnant women, as well as for women in the lactation period.

Keywords: integrated assessment of quality, protein beverage, antioxidant activity, nutritional value, shelf life.

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STABILIZATION OF THE NATURAL COLOR OF SWEET PEPPER (CAPSICUM ANNUUM L.) DURING ITS PROCESSING (p. 15-20)

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The influence of various parameters of technological treatment on the degree of chlorophyll destruction and change in the green coloration of the sweet pepper (*Capsicum annuum* L.) has been investigated. It has been established that the temperature and duration of its effect on sweet pepper during primary heat treatment alter its natural green coloration to yellow with a brown tint. The paper presents experimental spectra of the intensity of light absorption by the samples of sweet pepper, which make it possible to define regularities in the influence of time and temperature on the color and the degree of chlorophyll destruction.

During blanching, from 25.2 to 59.2 per cent of the total amount of chlorophylls of the starting value are destroyed, depending on the water temperature. It was established that the blanching process duration negatively affects the content of chlorophylls as well: depending on the process duration, 20.2–61.7 % of the original content are degraded. The experimental diffuse reflection spectra for opaque objects, provided here, have made it possible to identify the dependence of color of the samples of pepper, treated in the *Xanthium strumarium* decoction, on various factors of the technological process.

It is shown that the use of decoction of the natural plant raw material *Xanthium strumarium* for treating the samples leads to the stabilization of the green coloration of pepper compared to that blanched in water. The influence of the *Xanthium strumarium* concentration, temperature, and exposure time in the decoction, on the color of pepper samples has been investigated. Applying such color-parametric characteristics, calculated on the basis of spectral reflection coefficients using a CIE XYZ method, as dominant wavelength (λ , nm), color clarity (P, %), and brightness (T, %), has made it possible to compare the color of pepper samples with fresh samples (control-1), as well as with the samples blanched in water (control-2).

The multivariate experiment, performed in this research, has made it possible to optimize parameters for the technological treatment of pepper samples in the *Xanthium strumarium* decoction. Basic parameters for treating sweet pepper are a 1-% *Xanthium strumarium* decoction, a treatment temperature of 75 °C, and a treatment duration of 15 minutes.

Keywords: sweet pepper, technological treatment, stabilization of pigments, color-parametric characteristics

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RESEARCH INTO EFFICIENCY OF PASTERIZATION OF BOILED SAUSAGE PRODUCTS IN ORDER TO IMPROVE THEIR STORAGE TERM (p. 21-28)

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We present a study into bacteriostatic effects achieved by re-pasteurization at a temperature of 85–90 °C for 20 minutes in the presence of an oxygen absorber. The applied treatment method makes it possible, on day 94 of storage, to obtain the level of contamination of microorganisms, comparable to the background microbiological contamination of sausages, for the sausages produced without pasteurization.

The study confirmed the effectiveness of protective barrier properties of multilayer polymeric materials manufactured by LLC Sirius Extruzhen (Ukraine) for the storage of boiled sausages for up to 26 days. We established the possibility of storing sausages for 35 days based on the obtained data on the stability of microbiological indicators and compliance with the requirements to organoleptic indicators.

The study presented ways to achieve the shelf life of cooked sausages twice longer than the typical, recommended for sausages with re-pasteurization. We obtained the results for sausages exposed to re-pasteurization at a temperature of 85–90 °C for 15–20 minutes. We packaged the examined samples at the thermoforming lines “Multivac” (Germany) and “Webomatic” (Germany). We performed the pasteurization of products at the “Fessman” (Germany) universal heat chamber.

We confirmed the possibility of combination of protein stabilizers and animal proteins based on pig skin, dairy products, and spices in the formulations of samples of pasteurized sausages made from beef, pork, poultry meat, in particular, poultry meat of mechanical boning. In the study, we established that the grade of boiled sausages does not produce a significant effect on the shelf life of sausages when applying re-pasteurization together with an oxygen absorber.

Keywords: sausages, re-pasteurization efficiency, shelf life, broiler chicken meat, packaging, safety, water activity.

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We studied the effect of the sum of active temperatures above 10 °C, the amount of precipitation, and the hydrothermal coefficient (HTC), on the formation of dry, dry soluble substances, sugars, and ascorbic acid, in cauliflower, depending on special characteristics of the hybrid. It was established that over the years of research the dry soluble substances in the heads of cauliflower hybrids accumulated in the range from 7.2 % (in the hybrid Kul F1) to 8.3 % (in the hybrid Opal F1) on average. An analysis of variance revealed that the special feature of the hybrid affected the content of dry soluble substances in the heads of cauliflower by 10 %, while conditions of the growing season – by 77 %.

Over the years of research, Livingston F1 was characterized, on average, by the high total sugar content. An analysis of variance revealed that a 55 % effect on the total sugar content in the heads of cauliflower was exerted by the special feature of the hybrid. The effect of conditions of the growing season accounted for 4 %. The hybrids differed significantly by the content of reducing sugars. The dependence of influence of weather conditions on the content of the components of the chemical composition in the heads of cauliflower hybrids was established.

The content of dry substances has a strong reverse relationship with the humidity of air during formation of the head: $r = -0.78 \dots -0.93$; a direct average relationship to the mean daily air temperature and the sum of active temperatures, as well as a strong direct connection to the amount of precipitation and HTC of the vegetation period.

The content of dry soluble substances in cauliflower heads has a strong inverse relationship with air humidity: $r = -0.78 \dots -0.97$. The content of ascorbic acid demonstrates a strong direct dependence on air humidity during formation of the head ($r = 0.67 - 0.75$). As regards other weather conditions, the connection was weak. An analysis of variance revealed that the content of ascorbic acid in the heads of cauliflower depended by 56 % on the special features of the hybrid; 15 % accounted for conditions of the vegetation period.

Keywords: cauliflower, dry substances, dry soluble substances, sugars, ascorbic acid.

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INFLUENCE OF GRAPE SEEDS POWDER ON PRESERVATION OF FATS IN CONFECTIONARY GLAZE (p. 36-43)

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The polyphenol composition of grape seeds powder (GSP) and defatted grape seeds flour (DGSF) in water-alcohol (ethanol, isopropanol) extracts was studied by the chromatographic method. There was established the content of antioxidants, which are present in the form of phenolic acids (gallic, ellagic), stilbenes (resveratrol) and flavonoids, first of all, flavanols (catechin, epicatechin) and flavonols (kaempferol, myricetin, quercetin and its derivative glycosides). It was shown that the total content of polyphenols reaches a maximum size of about 4.5 % in gallic equivalent of the powder weight at the extraction of water-ethanol mixture with ethanol content of 50 % (w/w). The effect of phenolic antioxidants on peroxide (PV) and acid (AV) values of confectionery fats of lauric and non-lauric types in the model systems was studied as the markers of the rancidity formation process. It was proved that thanks to a high content of antioxidants in grape powders, the introduction of these powders in the composition of samples significantly slows down the process of auto-oxidation of fats. It was shown that grape powders as vegetable raw material are more stable in terms of catalyzing the process of fats hydrolysis in confectionery glaze. This is evidenced by the data on the activity of lipase enzyme, the magnitude of which is lower in the samples of grape seeds powders – 1.03 and 1.12 cm³/g for GSP and DGSF, respectively, compared with that of different samples of cocoa powder – 0.84 and 1.87 cm³/g. The study into changes in acid value of the samples also showed that the addition of GSP and DGSF as the source of antioxidants significantly inhibits the process of hydrolysis of fats to free fatty acids. The obtained results have a practical significance for the improvement of the process of confectionery glaze production in the direction of partial substitution of cocoa powder with grape seeds powders. This contributes to the creation of a product with a high nutritional value and which is

more resistant to damage as a result of the process of oxidation and hydrolysis of fats.

Keywords: grape seeds powder, polyphenolic antioxidants, oxidative rancidity, hydrolytic rancidity, glaze resistance to oxidation, lipase.

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THE STUDY OF LENTIL FLOUR AS A RAW MATERIAL FOR PRODUCTION OF SEMI-SMOKED SAUSAGES (p. 44-50)**Uliana Drachuk**

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In the production of sausages, soy and products of its processing, varieties of food soy flour are mainly used as an additional component. It has been established in a study of safety of using soy that a large number of genetically modified organisms used as foodstuffs have appeared in recent years. The possibility of using peas, beans, lentils and chickpeas would ensure enrichment of products with high-quality food protein easily absorbed by human organism. Lentil is rich in free amino acids, it contains glutamic and aspartic acids and a large amount of tyrosine.

The study has substantiated technological parameters of lentil sprouting, the degree of grinding of lentil flour was established, influence of sprouting on changes in the lentil amino acid composition was revealed, level of assimilability of lentil protein and the redundancy factor were studied.

The studies were conducted with lentil grains. Sprouting was carried out in a special tank of a round shape which included a grid. A hole in the bottom of the tank was provided for water drainage. The water tank was placed under the grates and filled with water to soak lentil for 8 hours at 17 ± 2 °C until 1 cm long sprouts were formed.

Lentil grains were ground using laboratory mills to a particle size of 1...1.5 mm and 0.2...0.4 mm. It was established that the use of lentil flour with a particle size of 0.2...0.4 mm has resulted in improvement of technological properties of minced meat: an increase in the amount of bound moisture to 83.25 % ensuring plasticity of minced meat of 7.81 cm²/g. All of this contributed to intensification of osmotic processes in minced meat. For disinfection of microflora and to ensure compliance of products with sanitary requirements, a microwave dryer was used. Its operation time consisted of 6 cycles by 6 minutes each for operation of the modules and 7 minutes for switching off the modules.

It was found by the results of the study of amino acid composition that sprouting affected growth of the share of essential amino acids 15 % better compared to non-sprouted lentil flour. The protein assimilability of sprouted lentil was 62.91 % and the redundancy coefficient was 21.25 % which enables its use in the technology of semi-smoked sausages.

It has been established that the use of sprouted lentil flour improved the coefficient of efficiency of protein use by the organism by an average of 30 %.

Keywords: test organisms, plant raw materials, chemical composition, biological value, amino acid composition, microorganisms, semi-smoked sausages.

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INFLUENCE OF GRAIN PROCESSING PRODUCTS ON THE INDICATORS OF FROZEN MILK-PROTEIN MIXTURES (p. 51-58)**Sergii Tsygankov**

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This paper reports a study into the influence of manna groats and extruded manna groats on the qualitative and quantitative indicators of milk and protein concentrates over a freezing–defrosting cycle. A slight change in the quality of protein-plant mixtures after defrosting confirms the cryoprotective properties of carbohydrates of plant components.

The capability to preserve albumin mass at negative temperatures with its subsequent use as the milk-protein basis for semi-finished products was proven.

The feasibility of using a collagen-containing ingredient in the amount of 0.4 % for the intensification of the thermal-acid coagulation of whey proteins was proven experimentally. The process was performed both in native whey and in protein concentrate with a mass fraction of dry substances of (16±2) %, obtained by the ultrafiltration method. It was revealed that coagulation duration is (55±2) min and (40±2) min, respectively, at a temperature of (95±2) °C. A decrease in the duration of the process correlates with a decrease in power consumption. Adding albumin mass, in addition to cottage cheese, to the formulation of semi-products would increase milk protein resources.

We report results of research into cryoscopic temperature of mixes based on cottage cheese with manna groats and extruded manna groats, as well as of the albumin mass obtained with the use of “Collagen pro 4402”. The amount of frozen moisture in milk and protein mixtures with wheat processing products was determined by the calculation method. It was proven that the modification of the carbohydrate complex of grains by means of extrusion ensures an increase in binding free moisture in protein-plant mixtures during defrosting.

Keywords: grain processing products, freezing, defrosting, milk-protein mixtures, cryoscopic temperature, collagen-containing ingredient.

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DEVELOPMENT OF THE NANOTECHNOLOGY FOR WELLNESS PRODUCTS “NatureSuperFood” – FRUIT AND VEGETABLE ICE-CREAM SORBETS WITH A RECORD CONTENT OF BIOLOGICALLY ACTIVE SUBSTANCES (p. 59-68)

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This paper reports the newly proposed and devised technique and nanotechnology for the wellness products “NatureSuperFood” – fruit and vegetable ice cream – sorbets – that make it possible to obtain a product with unique features. The new types of sorbets are in the nano-dimensional form and are distinguished by a high content of natural biologically-active substances from fruits and vegetables (β-carotene, chlorophyll, phenolic compounds, anthocyanins, ascorbic acid, etc.). In addition, there are characterized by the high content of soluble pectic substances, which act in the sorbets as natural thickeners and stabilizers. That provides for a possibility to eliminate the need to use synthetic additives.

Nanotechnologies of the wellness products “NatureSuperFood” – fruit and vegetable ice cream – are based on the application of the cryogenic “shock” freezing and the finely-ground fruits and vegeta-

bles as an innovative method for structure formation and obtaining sorbets with a record content of BAS. A combined effect of the specified factors leads to the activation and extraction of hidden BAS from fruits and vegetables into free form, as well as the transformation of pectin from the inactive form to the active form. A special feature of the sorbet production technologies is the use of natural ingredients only (fruits, berries, vegetables), as well as the absence of artificial food additives (stabilizers, thickeners, emulsifiers, synthetic dyes, etc.). The technologies make it possible to not only retain vitamins and other BAS from original raw materials in sorbets, but to extract from raw materials the hidden, inactive, bound with biopolymers and minerals in nanocomplexes, forms of BAS into the free, easily digestible nanofrom. Mass fraction of BAS in sorbets is 2.5...3.5 times larger than that in fresh fruits and vegetables. In addition, the technologies make it possible to more efficiently (by 3.0...5.0 times larger than in fresh raw materials) extract and transform into a soluble form (by 70 %) those pectin substances that are in the inactive hidden form in fruits and vegetables.

The developed nanotechnologies and formulations of wellness products "NatureSuperFood" include 3 types of sorbets made from chlorophyll-containing, carotene-containing, and anthocyanin-containing fruits, berries, and vegetables. Natural raw materials act as a "five-in-one" in the manufacture of sorbets: a source of BAS, a thickener, a structure-forming agent, coloring, and flavoring. The new types of sorbets are in the nano-dimensional form; they outperform known analogs in terms of BAS content. The technological production modes of ice-cream-sorbets were tested at the bench semi-industrial equipment.

Keywords: nanotechnologies, wellness products, sorbets, cryogenic "shock" freezing, finely dispersed shredding, BAS.

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ANALYSIS OF QUALITY OF GRAIN SHORTBREADS FOR BIOLOGICAL ACTIVITY AND MEDICAL-BIOLOGICAL ASSESSMENT (p. 69-76)

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Quality control of new spelt-based grain crispbreads with the addition of plant additives by the biological activity and medico-biological assessment was examined and analyzed. It was found that plant additives (powders from milk thistle, mountain ash and dog rose fruit) possess a high biological activity. The powders of dog rose and mountain ash are characterized by the high value the activity, which is 2,375 conditional units and 1,250 conditional units, respectively. The value of biological activity of spelt is by 2.55 times higher than that of wheat and is 156 conditional units.

The introduction of additives to the composition of crispbreads increases the biological activity of finished products. The grain loaves with the addition of dog rose and ash has the highest biological activity, which is 300 conditional units. and 265 conditional units, respectively. In terms of biological activity, the synergy effect of BAS of original components was detected, while the effect of antagonism was not recorded. A comparative analysis of biological activity of grain crispbreads and crispbreads of well-

known brands revealed that the new products are characterized by a high value of biological activity. This attests to the prospects of development and bringing out to consumer market of the new spelt-based products.

The results of medical-biological research prove the results of biological activity and indicate that the developed grain crispbreads possess antioxidant activity and hepatoprotective action. This is proved by the indicators of the level of hepatic markers that indicate the hepatoprotective effectiveness of the products. The results of the impact of the additive on dysbiosis degree and on the MDA content revealed that the new products with the addition of milk thistle have antioxidant properties.

Based on the research, the expediency of manufacturing new grain spelt-based crispbreads with the addition of enriching additives was substantiated. This enables us to obtain wellness products with a high biological activity and prophylactic properties.

Keywords: biological activity, synergy, grain crispbreads, spelt, medical-biological research, plant additives.

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STUDYING THE INFLUENCE OF HYDROTHERMAL TREATMENT PARAMETERS ON THE PROPERTIES OF WHEAT FLOUR IN THE TECHNOLOGY OF A CROQUETTE MASS (p. 77-82)

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The paper reports a study into the influence of parameters (temperature and duration) of sautéing wheat flour on its water-absorbing capacity at hydrothermal treatment. It was established that heating the samples of flour slurry in the temperature range of 80...90 °C accelerates the water-absorbing capacity. The samples of wheat flour sautéed at a temperature of 110...120 °C reached the maximal indicators of water-absorbing capacity over 10...20 minutes. Results of this research are important in order to control the degree of swelling of the sautéed flour in the technology of a croquette mass.

We have investigated the viscosity of samples from model systems of wheat flour depending on the temperature and duration of sautéing. It was established that the viscosity of model systems decreases with an increase in the temperature and duration of wheat flour sautéing compared to the native. However, the indicator of a relative coefficient of stability for model systems increases within 0.91...0.98. We have determined the rational zone of viscosity in the samples of model systems of sautéed wheat flour. We have proven the expedience of using in the technology of a croquette mass for culinary products the capability of components of the sautéed wheat flour to form a bound plastic mass at hydrothermal treatment.

The effect has been established of technological parameters on the saturation of color in the samples of model systems of sautéed wheat flour. It was found that sautéing wheat flour with a fat component does not significantly affect the color, though it changes its saturation. It is important that when exposed to specific technological factors, the color of samples of model systems is characterized by sufficient stability and acts as a technological indicator for the croquette mass system.

The results of research provided an opportunity to control and adjust the structural-mechanical characteristics of the croquette mass based on wheat flour.

Keywords: sautéed wheat flour, sautéing parameters, hydrothermal treatment, properties of flour, water-absorbing capacity, croquette mass.

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