ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

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RESEARCH INTO APPLICATION OF ZEOLITE FOR PURIFICATION OF DIFFUSION JUICE IN SUGAR PRODUCTION (p. 6-13)

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The need to intensify the extraction process using the influence of chemical reagents on beet chips was substantiated. The analysis of application of natural sorbents in food production technologies was carried out. The physical and chemical properties of zeolite were explored. The indicators that make it possible to apply natural zeolite for additional treatment of water and juices in sugar production were shown.

The effectiveness of the use of natural zeolite for feed water treatment with the view to enhancing the technological quality of diffusive juice was determined. Experimental research revealed that feed water treatment with zeolite decreases the content of total iron, ammonium, and permanganate oxidation indicator. It was proved that microbial seeding of feed water and diffusive juice decreases in case of treatment with zeolite.

It was established experimentally that the purification of diffusion juice occurs during zeolite application for feed water treatment. We determined the effectiveness of removal of macromolecular compounds, including dextran, from diffusive juice obtained during processing sugar beets of various technological quality with natural zeolite. It was shown that at the zeolite consumption of 0.1...0.4 % to the weight of beets, the content of high-molecular compounds and pectic substances in diffusive juice decreases by 30–40 %, and the content of dextran – by 20–40 %, respectively.

During the zeolite treatment, an enhancement of the quality of purified juice and improvement of filtration and saturation properties of defeco-saturated precipitate are observed. Thus, the average rate of sedimentation of the precipitate of juice of I carbonation S5 m, when using zeolite for feed water preparation increases by 10–50 % for the beet different technological quality.

In the course of research, we designed the technique of zeolite application, which ensures a decrease in coloration, an increase in the purity of the cleared juice, enhancement of filtration and sedimentation properties of the precipitate of juice of I carbonation. High effectiveness of the proposed method is pronounced in processing raw materials of lowered quality. Thus, there are some grounds to claim the effectiveness of zeolite application to enhance the quality of diffusion juice and products in sugar production.

Keywords: diffusion juice, dextran, sucrose extraction, purification of diffusion juice, zeolite.

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OBTAINING THE POWDER-LIKE RAW MATERIALS WITH THE FURTHER RESEARCH INTO PROPERTIES OF EGGPLANT POWDERS (p. 14-20)

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Results of the research into development of the advanced technological and technical solutions for the processing of eggplants are reported. The proposed technology resolves the task on the rational use of eggplants. Owing to the infrared drying, a qualitatively new product is obtained, which makes it possible to maximally retain nutrients. During thermal treatment, the following physical-chemical characteristics of the dried material change: density, heat capacity, elasticity, porosity, chemical composition, and others. Therefore, we studied and report here the results of studying the properties of eggplant powders. The organoleptic, physical-chemical, and structural-mechanical indicators were determined, which makes it possible to calculate the required amount of powder, which could be introduced as an additive, without affecting the structural-mechanical properties of the finished product. The rational conditions for restoring the rehydration of eggplant powders were established: temperature in the range from 45 °C to 60 °C; duration of swelling 10–15 minutes, ratio of powder to liquid 1:3 and 1:4. The content of toxic elements (lead, cadmium, arsenic, copper, zinc) and the microbiological indices (mesophilic aerobic, extra-anaerobic, Escherichia sticks, Salmonella bacteria) were investigated. Compliance with the requirements for this type of raw material is established and the safety of the developed eggplant powders is confirmed. It has been established that the developed food powder has a number of positive qualities, namely: a long shelf life, it does not require additional storage space, it is easily restored.

Owing to the technology of infrared drying, which is one of the methods for eggplant canning, the productivity of the technological process of making powders improves. This is explained by that over the same time interval we obtain twice as much of the dried product compared with convective methods. Taking into consideration the nutritional value of eggplants, powders can be used in various combinations to ensure the predefined properties in the resulting product. That will reduce the time for cooking, and expand the range of functional products.

Keywords: infrared drying, drying process, vegetable powders, eggplant powders, hydro module, swelling coefficient, safety indicators.

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RESEARCH ON FERMENTATION PROCESS OF RECONSTITUTED WHEY-MALT MIXTURES (p. 21-29)

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We report a study into the fermentation of the reconstituted whey-malt mixtures using the lactose-fermenting yeast and saccharomyces. The use of such mixtures for production of fermentation beverages using the appropriate kinds of yeast makes it possible to improve the biological value, compared to traditional (water-based) ones, through the nutrient components of milk whey and fermentation products.

The result of the experiments is the selected optimum ratio of dry rye malt to milk whey for the preparation of mixtures. During our study, we took into consideration the chemical composition, solubility, and possible utilization of carbohydrates by different strains of yeast. It was revealed that the rational ratio of dry malt to whey is 1:2. During fermentation of wort, we observed the greatest increase in the yeast cells Kluyveromyces lactis 469, from 73 to 75.2 thousand/cm^3, with the active phase of the process occurring from hour 4 to hour 16 of fermentation. Such indicators testify to the high fermentative activity to the carbohydrates of milk whey.

Based on the amount of the accumulated ethyl alcohol and the content of reducing substances, we investigated the fermenting activity of other yeast strains. For fermentation, we used wort from the reconstituted dry mixture with the optimal ratio of components. It was revealed that the most active alcoholic fermentation took place in the wort fermented with the yeast Saccharomyces lactis 95. Less effective was the yeast Saccharomyces cerevisiae P-87 in the above-specified environment. At a joint cultivation of lactose-fermenting yeast and saccharomyces the fermentation process is greatly enhanced. No synergism of microorganisms was observed.

Based on the results from a gas chromatographic analysis, we identified the by-products of fermentation from the fermented whey-malt wort. It has been established that the concentrations of methyl

acetate, (11.72±0.59) mg/dm^3, and ethyl acetate, (92.17±4.61) mg/dm^3, in the wort, fermented by the yeast Saccharomyces cerevisiae P-87, are sufficient for creating a harmonious taste and aroma of the fermented beverage.

Keywords: dry milk whey, dried rye malt, lactose-fermenting yeast, saccharomyces, whey-malt wort.

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ASTABILIZING SYSTEM FOR BUTTER PASTES BASED ON THE DRY CONCENTRATES OF MILK PROTEIN (p. 30-36)

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The composition of the stabilizing system for butter pastes based on dry concentrates of milk and whey proteins has been substantiated; that would help reduce the deficiency of protein in the diet of modern human and would make it possible to further improve the balance of the composition of the butter paste.

Considering their functional-technological characteristics, conditions for gelation and synergy, the polysaccharides carrageenan and guar gum were introduced to the composition of the stabilizing system.

The dynamics in the gradient of the limiting stress of protein and protein-polysaccharide systems have been studied. We established that gels based on the dry concentrate of milk protein are the plastic systems, they have sufficient strength and possess thixotropic properties. In order to reduce the quantitative content of the stabilizing system in the production of butter paste with a structural frame similar to that of butter, we introduced carrageenan to the system. However, an increase in its concentration led to the formation of strong cross-linked gels unsuitable for the production of butter pastes. Increasing the stability of the system against the "freeze-defrost" cycles could be achieved by the introduction of guar gum. Based on the indicator of the limiting stress at a variable deformation rate of the model samples, a rational ratio of the components in the stabilizing system was established. Its composition includes: milk protein concentrate: whey protein concentrate: guar gum: carrageenan: 10:3.0:0.3:0.05.

The rational concentration of the stabilizing component based on skimmed milk was determined, which was 13.35 %.

The water activity indicator is determined for the model samples of the selected stabilizing substances and mixtures in certain ratios. Stabilizing substances have been shown to exhibit the pronounced moisture-retaining properties, which increase at their combination.

The effectiveness of the developed system is proven based on indicators for the water activity and enthalpy of the system. The indicator of water activity for the butter paste with a 40 % mass fraction of fat was 0.981, which is close to the respective indicator for the butter with a mass fraction of fat of 72.5 % (control) – 0.979. The enthalpy index of the butter paste was 61.35 J/g; for control, it was 61.13 J/g. This is due to the additional bonding of moisture by the functional groups of components in the protein-polysaccharide complex, indicating the thermodynamic stability of the butter paste.

The efficiency of application of the developed system in the technology of butter pastes has been determined: indicator of heat resistance of the butter paste with a mass fraction of fat of 40 % was 0.87 (control, 091), the size of droplets in the aqueous phase at the cut did not exceed 0.2 mm.

Keywords: butter paste, milk protein concentrate, whey milk protein, protein-polysaccharide complex.

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OPTIMIZATION OF WATER-HEAT TREATMENT WHEN MAKING FLOUR FROM ANCIENT WHEAT (p. 37-44)

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Recommendations for processing spelt wheat into high and first grade flour were developed. The studies of the influence of parameters of water-heat treatment on the yield of flour from spelt wheat grain, its whiteness and ash content were conducted. The hypothesis about the influence of moisture on the properties of spelt wheat grains similar to grain of bare-grain kinds of wheat was proved. A comparative analysis of the yield and quality of the samples that were milled after conducting water-heat treatment and at actual initial humidity of grain from 13.0 % to 14.5 % was performed. The use of the water-heat treatment (humidity of 15–16 %) allow obtaining the total yield of flour that is by 0.6–3.0 % higher, ash content decreases by 0.26 % after the first milling and by 0.22 % after the second milling. Flour whiteness after the first and second milling increases by 10 and 20 units, respectively. During milling, the spelt wheat grain without water-heat treatment, the samples with the highest initial humidity (14.0–14.5 %) demonstrated the best results (total yield of flour is 83.0–83.3 %, ash content is 0.76– 0.91 %, whiteness 25–51 units).

In the production of flour from wheat spelt the recommended way to water-heat treatment implies single damping and softening of grain. Unlike the classical method, there is no damping stage before early break. Grain damping to 15.5 % and softening duration of 30 hours is optimal. The use the proposed treatment makes it possible to obtain the total yield of flour of 85.0 %. By major quality indicators, the resulting product refers to high and first grade flour.

The results, presented in the article, make it possible to adjust reasonably the operation of the units for grain damping and choosing the optimum time for its softening.

Keywords: spelt wheat, water-heat treatment, ash content, whiteness, flour yield.

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DEVELOPING A TECHNOLOGY FOR MAKING GOAT'S COTTAGE CHEESE USING THE PREPARATION YODKAZEINE (p. 45-54)

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In recent years, there has been a deficit of several essential components, with the iodine deficiency of varying degree, from mild to severe, relating to the most common phenomena and is observed in 90 % of the Ukrainian population.

Deficiency of iodine is the cause of many illnesses: disturbance of thyroid gland function, delayed mental and physical development of children, deafness, blurred vision, neurological cretinism. Therefore, one of the most important tasks in the food industry is to provide people with foods containing iodine in the required amount, and to expanding the range of iodine-containing products.

To improve the quality of cottage cheese made from goat's milk and to enrich it with iodine, we have used the iodine-containing protein preparation yodkazeine.

It was established that the enrichment of milk with Yodkazeine in the amount of 0.01–0.025 % by weight in the production of cottage cheese from goat's milk improves its quality. The application of the preparation, which includes a complex of organic iodine, associated with the protein, in the amount of 0.01 to 0.025 % by weight of milk in the production of experimental batches of product (E.1, E.2) helps increase the moisture-retaining capacity of the cheese. This property predetermines an increase in the mass proportion of moisture in the product by 0.87 and 2.37 %. That affects the reduction of the mass share of fat in cheese by 0.5 and 1.74 %, compared with the similar indicator in control. However, under the influence of the above-specified dosage of the preparation, there was an increase in the mass fraction of protein by 0.19 and 0.25 % and a reduction of the total amount of low molecular fatty acids, responsible for the manifestation of the taste and smell of goat's fat and sweat, by 0.18 and 0.31 %, respectively. It attests to the improvement of organoleptic indicators in the experimental batches of cottage cheese, enriched with the experimentally determined rational dosage of Yodkazeine, as well as its saturation with organic iodine.

Keywords: Yodkazeine, goat's milk, amino and fatty acids, goat's cottage cheese.

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STUDY INTO THE INFLUENCE OF OPERATING PROCESSING PARAMETERS ON QUALITATIVE CHARACTERISTICS OF THE CARROT CONCENTRATED PRODUCT (p. 55-62)

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The process of concentrating vegetable juice in an improved vacuum evaporator with a stirrer which is simultaneously a heat exchanger was studied. A mathematical model describing kinetics of product heating combined with constant stirring was obtained. The proposed equations make it possible to calculate duration of the heating process in a steady-state mode taking into account thermophysical and rheological characteristics of the product under study. The resulting dependence differed in that the calculations took into account changes in rheological properties of the liquid being processed, namely, apparent viscosity characterizing the shear properties of the non-Newtonian fluids including majority of food products. The process of drying carrot cake in the developed vibratory vacuum dryer was studied. Dependence of content of beta-carotene on operating parameters of the dryer, namely amplitude and frequency was determined. Based on the obtained results of the study of colorimetric characteristics, it was proved that the proposed method for production of concentrates contributes to preservation and formation of colorimetric characteristics of the final product. It was found that technological processing affects objective colorimetric characteristics of plant materials, namely, deviation of values of the dominant wavelength, color purity and brightness from the values for the reference sample. The determined colorimetric characteristics have made it possible to establish that it is very important to reduce time of the raw material processing and temperature during heating. These studies have shown the prospects for production of concentrated products in a separated way (separation of raw materials into juice and cake, separate boiling of juice and drying of cake, mixing of components in various concentrations depending on technological tasks). This makes it possible to adjust organoleptic characteristics of the final product including color, brightness, consistency, viscosity and physical-chemical properties.

Keywords: heating kinetics, concentrated products, evaporators, dryers, colorimetric evaluation, beta-carotene.

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EFFECT OF FLOUR MADE FROM WAXY WHEAT ON THE STRUCTURAL–MECHANICAL PROPERTIES OF DOUGH FOR HARDTACKS WITHOUT SUGAR (p. 63-70)

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We have analyzed problems arising in the production of bakery products without sugar or with its reduced content. The technological properties of flour made from a new kind of wheat, the waxy wheat variety Sofiyka, which characterize the state of its protein-proteinase complex, were investigated. When evaluating the strength of this flour based on the structural-mechanical properties of the dough prepared from it, it was found that it is characterized as the weaker one compared to baking flour. We have substantiated the advantage of using the weaker amylose-free flour to manufacture products from yeast dough, specifically hardtacks, when substituting sugar with the Jerusalem artichoke powder. The lesser manifestation of the elastic properties of dough prepared from the waxy wheat flour, along with the high gas-forming capability, characteristic of it, would partially neutralize the difficulties arising in the manufacture of products on yeast without sugar. In the course of present research, we determined the effect of flour made from the waxy wheat and the Jerusalem artichoke powder, depending on the stage of its introduction, on a change in the structural-mechanical and surface properties of dough for hardtacks without sugar during its technological treatment – resting-proofing and rolling. During resting, there is a decrease in the shear stress limit and an increase in the stickiness of the dough. Rolling is accompanied by the opposite influence –

an increase in its strength and a decrease in adhesion tension. The expediency of introducing the Jerusalem artichoke powder in equal parts at the stages of kneading the sponge dough and regular dough in the production of hardtacks has been shown – these samples were characterized by the looser structure compared to the sample whose preparation involved introducing the Jerusalem artichoke powder when kneading the sponge dough. It was established that the combined application of flour made from the waxy wheat and the Jerusalem artichoke powder when preparing semi-finished products for hardtacks without sugar contributes to obtaining the dough with lower strength, adhesive properties, and elasticity, and a well-loosened structure, compared to control.

Keywords: waxy wheat flour, structural-mechanical properties of dough, hardtacks without sugar.

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