ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

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IDENTIFYING PATTERNS IN THE EFFECT EXERTED BY A COOLING PROCESS AND THE FINE GRINDING MODES ON THE QUALITATIVE INDICATORS OF A MEAT AND BONE PASTE (p. 6–12)

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This paper describes a technology for obtaining a homogeneous meat and bone paste made through a multi-stage grinding at a chopper grinder and the micro-grinder "Supermasscolloider". The relevance of the study relates to that the meat and bone raw materials are processed for food purposes, thereby improving a non-waste technology in the meat processing industry. The effect of a cooling process and the parameters of fine grinding on the quality indicators and the microstructure of meat and bone paste after grinding has been studied. The research results have established that a decrease in the diameter of a chopper grinder's mesh leads to an increase in the temperature of meat and bone mince, from 16 °C to 26 °C. A change in the temperature of output raw materials has been investigated at the micro-grinder "Supermasscolloider" with different gaps between the grinding wheels (0.25 mm, 0.10 mm, 0.02 mm), depending on the amount of added water. It has been established that following the grinding at a micro-grinder with the addition of water the temperature of the raw materials at the output decreased, at gaps of 0.25 mm and 0.10 mm, from 34 °C to 17 °C; at a gap of 0.02 mm from 37 °C to 19 °C.

When studying the functional and technological properties of a meat and bone paste with the addition of 50 % of water, it was found that the meat and bone paste had high moisture-binding (75.63 %) and fat-retaining (73.38 %) capacities. The moisture-binding capacity of the meat and bone paste was 65.3 %, the emulsifying capacity was 55.8 %. The microstructure and granulometric composition of the meat and bone paste with the addition of 50 % of water have been studied. The result of the conducted analysis of the geometric dimensions of bone particles has revealed that when the minced meat and bone are processed at a micro-grinder, the size of the bone particles was within the set gaps between the grinding wheels, while the consistency of the meat and bone paste was uniform and ointment-like.

Keywords: meat and bone paste, fine grinding, chopper cutter, micro-grinder, slaughtered cattle bones, functional and technological properties.

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DEVISING THE TECHNOLOGICAL PRINCIPLES FOR MAKING A GRANULATED FILLER OBTAINED THROUGH IONOTROPIC GELATION (p. 13–23)

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This paper reports the development of technological principles for making granulated fillers. Our study involved model systems (granules), which has made it possible to determine the conditions for forming alginate-calcium complexes. It has been established that the basic principle for obtaining the granules is the ratio of mannuronic to guluronic residues in the composition of sodium alginate, which should equal χ=0.4...0.6 to implement the process of granulation. It has been proven that the content of G-blocks in the composition of sodium alginate should be within 20...25 %, which, at the content of ionic calcium within the range of 80 to 120 mg %, ensures the formation of stable alginate calcium complexes. It has been determined that the increase in the module of elasticity of the structured systems depends on the concentration of sodium alginate, the conditions for implementing its sorption properties relative to calcium ions, and the quantitative content of charged particles.

The reduction of the sorption capacity of sodium alginate has been proven under a condition of the lowered pH, as there occurs the exchange of ions of sodium for the ions of hydrogen, that is the formation of alginic acids (HAlg), which have a low ability to dissociation and ion exchange. It has been experimentally confirmed that the use of low pH raw materials in the technology of granulated fillers based on sodium alginate would not only reduce the module of elasticity of the granules but could also contribute to the loss of the system transparency.

The influence of sugar syrups, pH of the medium, as well as heat treatment, on the module of elasticity and a change in the weight of granulated fillers have been investigated. It has been determined that under the impact of the above factors there is an increase in the module of elasticity of granulated fillers and a decrease in their mass due to a partial release of moisture. Taking the specified technological principles into consideration, a model of the technological system for making granulated fillers has been devised. Specific features of the technological process have been defined under a condition for the use of dairy raw materials, alcohol-containing raw materials, as well as low pH raw materials.

Keywords: granulated fillers, sodium alginate, ionic calcium, alginate-calcium complex, ionotropic gelation.

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PRESERVATION OF WINTER GARLIC DEPENDING ON THE ELEMENTS OF POSTHARVEST TREATMENT (p. 24–32)

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The aim of the current research was to scientifically substantiate the influence of the elements of postharvest treatment on the preservation of winter garlic.

Long-term storage of garlic from harvest to harvest is a prerequisite for the continuous supply of the population with garlic. There is a need for postharvest treatment of winter garlic, aimed at reducing the losses and extending the storage duration. An important link in this is the postharvest period (additional drying). Dried garlic has increased resistance to the damage by microorganisms and loses less weight during storage. The use of biopreparations during postharvest treatment makes it possible to reduce the losses of winter garlic from microbiological diseases during storage.

It was theoretically grounded and experimentally proven that natural losses for the entire period of drying of topped garlic were 15.9 % in Diushes variety, 21.8 % in Merefians'kyi white variety. The same regularity was observed when drying garlic with the stem, the weight losses were 38.7 and 49.0 %, respectively. The losses of the weight of non-dried bulbs were from 11.09 to 14.4 %, depending on the variety, which was the largest part in the structure of garlic losses. The losses from the damage by diseases range from 5.28 to 12, 15 % and have a strong correlation r=0.98.

The yield of marketable products after six months of storage depends on the moisture content of a bulb neck. At drying up to the neck moisture content of 25±1 %, the yield of the marketable products accounted for 76.33 % for the variety of Merefians'kyi white and 78.59 % for the variety Merefians'kyi pink (Diushes). The garlic dried up to the neck moisture content of 14±1 % increased the yield of marketable products up to 82.98–80.15 %, while the non-dried garlic decreased it up to 72.25–63.45 %, respectively.

The pre-storage treatment of bulbs of the garlic variety Merefians'kyi pink (Diushes) with 2 % gliocladine increased the yield of the marketable products by 10.1 %, and that of the variety Merefians'kyi by 10.2 %.

The treatment with 2 % phytosporine increased the yield of marketable products by 10 and 9.5 %.

Keywords: garlic, postharvest treatment, bulb drying, biopreparations, weight loss, storage duration.

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NUCLEATION INTENSIFICATION IN THE ICE CREAM PRODUCTION (p. 33–38)

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In ice cream production, the dispersal of ice crystals – an important organoleptic indicator – depends on the number of water

crystallization centers at the first stage of freezing (nucleation). At the subsequent freezing, the remaining water crystallizes at existing centers. This paper reports the results of studying the substantiation of nucleation intensification by increasing the rate of freezing in nitrogen and by employing a germ-forming effect, predetermined by the presence of particles. The nucleation initiators considered are suspended particles of the fat phase and a partially soluble stabilizer (microcrystalline cellulose) and coagulated protein. It has been established that the largest dispersal of ice crystals was achieved when the freezing rate increased while using nitrogen. At a fraction of the frozen water of 40–50 % under immersion freezing and subsequent aerial pre-freezing the size of ice crystals over 6-month-storage did not exceed 37 μm. It has been shown that the fatty particles were an additional factor in initiating the nucleation at immersion and contact-free freezing in a freezer.

We have established a positive effect of the suspended particles of microcrystalline cellulose and coagulated protein on the dispersal of ice crystals in the process of ice cream production and over a 6-month-storage. The average diameter of ice crystals during storage when using microcrystalline cellulose in the creamy ice cream was 39 μm, in fermented milk ice cream containing yogurt – 32–34 μm.

The study results make it possible to define new directions in the intensification of nucleation, based on the principles of the increased rate of freezing and the intensification of nucleation using additional crystallization centers.

Keywords: nucleation intensification, freezing, dispersal of ice crystals, liquid nitrogen, microcrystalline cellulose, coagulated protein.

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IMPROVEMENT OF ZEFIR PRODUCTION BY ADDITION OF THE DEVELOPED BLENDED FRUIT AND VEGETABLE PASTEINTO ITS RECIPE (p. 39–45)

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A method has been developed for the production of a fruit and vegetable paste-like semi-finished product based on an Antonovka apple, Muscat pearl pumpkin and Bona beet. The method is characterized by concentration in gentle temperature conditions (50...55 °C) in a rotary film apparatus to content of 45 % dry matters lasting 1.25...2.0 min. The structural and mechanical characteristics of the mashed potatoes of the components of raw materials and blended concentrated pastes by the developed method are determined. The structure of the developed fruit and vegetable paste was confirmed to be strengthened, since its maximum dynamic viscosity is 283 Pa·s, which is 1.9 times more compared to the control (apple paste). Thus, a rational composition is selected for further research with the following components in the paste: apple – 60 %; pumpkin – 20 %, beets – 20 % (composition 1). This paste in comparison with the control has a high content of functional physiological ingredients and has good organoleptic properties.

The feasibility of using the developed fruit and vegetable paste in composition of zefirs (composition 1) in the amount of 75 % replacement of apple puree is confirmed. The selected zefir sample differs in its original organoleptic properties. This ensures an increase in the effective viscosity (η_{ef}, Pa·s) of zefirs with the replacement of 75 % of apple puree with blended paste, compared to control (zefirs without additives) from 391 to 782. The plastic strength (P_k) also increases depending on the duration: 75 % – 54.2 kPa (control sample – 47 kPa), which is generally a positive phenomenon from a technological point of view. Such a solution will provide consumers with food products with physiologically functional ingredients of natural origin, subject to the partial or complete replacement of individual raw materials with blended fruit and vegetable compositions, providing an increase in their functional value.

Keywords: fruit and vegetable paste, blending, structural and mechanical properties, physiologically functional ingredients, foamy mass, structure formation.

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INFLUENCE OF THE STRUCTURE OF SOME TYPES OF FILLERS INTRODUCED TO THE YOGURT RECIPE ON CHANGES IN ITS RHEOLOGICAL INDICATORS (p. 46–51)

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The data set is obtained regarding changes in viscosity, water-holding capacity, active and titrated acidity of yogurts using natural fillers. The possibility of using vegetable fillers with different types of structure (powder, solid and pasty) in the technology of yogurt is analyzed. The studies are relevant in view of improving the quality of yogurts and giving them the status of natural ones due to removing stabilizers, flavors and aromatic additives from their composition. In addition, the introduction fillers into the recipe of yogurts, as a rule, leads to a deterioration of their rheological parameters: a decrease in viscosity, separation of whey and deterioration of the taste properties of the product. This causes an increase in the amount of flavors and stabilizers introduced into their composition, which negatively affects the population of "living microflora" and the biological value of the product. It is found that all the fillers (strawberry powder, candied beets and strawberry jam) had no negative effect on the fermentation process. The influence of dietary fibers that are part of fillers (candied beets, strawberry powder and strawberry jam) on the rheological properties of the product is investigated. Changes in viscosity, water-holding capacity, active and titrated acidity of yogurts with different types of fillers were determined and analyzed immediately after production and during storage. The positive effect of pectin-containing fillers on the hydrophilic properties of yogurts, which increase the water-holding capacity of the product by 2–3 %, is experimentally shown. Based on the data obtained, the feasibility of using the proposed types of fillers, namely strawberry powder and candied beets, in yogurt production without the use of stabilizers, flavors and other food additives is proved. Storage capacity is found, yogurts are developed and shelf life specified in the regulatory documents is determined.

Keywords: natural yogurt, effective viscosity, structure stabilizers, strawberry powder, candied beets, strawberry jam.

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HARNESSING THE TECHNOLOGICAL POTENTIAL OF CHIA SEEDS IN THE TECHNOLOGY OF CREAM-WHIPPED CANDY MASSES (p. 52–60)

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The technological properties of chia seeds have been studied. It has been established that the degree of their swelling depends on the type of a medium (water, albumin solution, fat) and the state of seeds (whole seeds or ground seeds). It was noted that the whole seeds have a higher capacity to retain water than the ability to retain an albumin solution or fat, by 1.87 and 17.28 times, and the ground seeds – by 1.75 and 17.49 times, respectively. Their capacity to swell improves after grinding regardless of the type of a medium. In addition, the ground seeds have a better fat-emulsifying ability but they do not demonstrate the foaming properties. The whole chia seeds have good foaming properties. It is possible to obtain a whipped protein mass, which is not worse than the control sample in terms of stability and foaming capacity, in case of replacing 40 % of dry albumin with whole chia seeds.

We recommend adding the whole chia seeds at the stage of the whipping of protein mass, and the ground seeds – at the stage of obtaining a fat emulsion semi-finished product in the production of cream-whipped candy masses. Thus, the formulation amount of dry albumin and fat decreases. The addition of 30 % of whole seeds and 30 % of ground seeds helps reduce the density of structured cream-whipped candy mass by 6.7 %. A further increase in the dosage of the additive leads to a slight increase in the value of the density indicator. In addition, an increase in the content of chia seeds causes an increase in the strength indicator of samples. The organoleptic analysis showed that the structured cream-whipped candy masses with the most studied dosage of chia seeds have the densified structure, uneven porosity, and strong, viscous

consistency. It was found that the dosage of whole seeds should equal 40 % by weight of egg albumin, and the dosage of ground seeds – 40 % by weight of fat to ensure the high quality of cream-whipped candy masses.

The obtained results are of practical importance for improving the technology of cream-whipped candy masses towards decreasing the formulation amount of albumin and margarine. The addition of chia seeds would improve the nutritional and biological values of cream-whipped candies.

Keywords: chia seeds, functional and technological properties, cream-whipped candy masses, quality indicators, confectionery.

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IDENTIFICATION OF PATTERNS IN THE PRODUCTION OF A BIOLOGICALLY-ACTIVE COMPONENT FOR FOOD PRODUCTS (p. 61–68)

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The study reported here has established patterns in the intensive technology for making a biologically active component (the sprouts of legumes) whose germination involved natural fruit acids (citric, malic, grape). The choice of high-quality and safe stimulants is important for the germination of different grain raw materials. Such substances are the fruit acids of natural origin. Their application has made it possible to obtain a high-value component for healthy foods, namely, the sprouts of a variety of legumes.

The experimental research has proven the effectiveness of using fruit acids as the effective intensifiers and disinfectants for the process of obtaining the legume sprouts. It has been shown that their use makes it possible not only to intensify the germination of legumes but also contributes to the more active formation of sprouts, and disinfects the seedbed. Thus, the use of aqueous solutions of fruit acids at the concentration of 0.25–1.25 % led to an increase in the following indicators: the germination energy, by 4–7 %; the ability to germinate, by 5–8 %; the length of the sprouts, by 3–11 mm; the weight of the sprouts, from 1 to 12 % depending on the crop. In addition, the composition of the sprouts has been investigated, which confirmed the biological usefulness and rationality of their introduction to the composition of food products as a biologically active component. The reported study has shown that they contain the elevated content of amino acids (by 3–50 %

depending on the amino acid), vitamins(B_1, B_2, B_3, B_6, B_{12}, PP, E, C, A), the high content of protein (32 %) and extractive substances (44 %). This testifies to the biological and nutritional value of the sprouts obtained using intensive technology.

The investigated technology for making legumes sprouts is innovative. The sprouts obtained can become highly nutritious components for new health food products.

Keywords: biologically active component, fruit acids, citric acid, malic acid, grape acid, legume sprouts.

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