

## ABSTRACT AND REFERENCES

## TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

### OPTIMIZATION OF COMPOSITION OF BLEND OF NATURAL VEGETABLE OILS FOR THE PRODUCTION OF MILK-CONTAINING PRODUCTS (p. 4-9)

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The natural vegetable oils (corn, rapeseed and walnut oils) were selected to create the blend, optimized by the fat and acid composition on their basis. This choice of oils is substantiated according to their physical and chemical characteristics, the fat and acid composition, and compatibility with the milk base, availability, and organoleptic parameters. The developed blend of natural vegetable oils should be combined with dairy products of mass consumption for the optimization of their fat and acid composition. In order to solve the stated problem, the calculations in the environment of the MATLAB mathematical package were carried out. We chose the following criteria for optimization: the ratio of 3 main groups of fatty acids (saturated fatty acids to monounsaturated fatty acids and to polyunsaturated fatty acids), as well as the ratio of fatty acids of the  $\omega$ -6 and  $\omega$ -3 groups. The obtained data were proved experimentally using the method of gas-liquid chromatography for the determination of the exact number of all components of the optimization in the examined samples. Partial substitution (50 %) of milk fat in sour milk products with the developed blend of vegetable oils will allow creating dairy products of mass consumption with somewhat optimized fat and acid composition. This design is relevant and appropriate because consumption of such optimized milk containing products will significantly increase the amount of intake of fatty acids from food and will somewhat correct the problem of shortage of the  $\omega$ -6 and  $\omega$ -3 fatty acids in a daily ration.

**Keywords:** optimized fat and acid composition, sour cream product, blends of natural vegetable oils, mathematical blending, chromatographic analysis, substitution of milk fat.

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### SELECTION OF OPTIMAL METHOD OF FORMING A LAYER OF CANDIED FRUITS DURING FILTRATION DRYING (p. 10-15)

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Optimal formation of the layer of candied fruits in a drying zone allows reducing the volume of a dryer, increasing the contact area of the outer surface of a particle with thermal agent and, as a consequence, cutting energy costs.

To determine optimal method of the formation of layer, we conducted experimental studies of the change in hydraulic resistance from the speed of gas flow motion under conditions of forming a layer of candied fruits by different methods. Based on generalizations of experimental and theoretical studies, we obtained estimated dependencies for the calculation of coefficient of hydraulic resistance and losses of pressure in the layer of candied fruits formed by different methods. They represent equations, which include such hydrodynamic parameters, obtained through experimental research and generalization of research data, as: actual speed of gas flow, equivalent diameter and equivalent height of channels between the particles, coefficient of hydraulic resistance. Obtained theoretical dependencies agree well with experimental data and are important for the prediction of kinetics of the filtration drying with regard to energy costs for the process. The dependencies are also important both for numerical simulation of the course of thermal mass exchanging processes during drying and for practical calculations.

Based on the generalizing equations and values of specific surface, received by Authors, the expediency of forming a layer by the method of arranging the particles of candied fruits vertically “with blocking the channels” was substantiated. It is proved that this method allows providing for the maximum speed of thermal agent in the layer and, as a consequence, intensifying the process of filtration drying.

**Keywords:** candied fruit from pumpkin, filtration dryer, hydrodynamics, hydraulic resistance, specific surface, layer formation, the Darcy-Weisbach equation, equivalent diameter.

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## THE EFFECT OF MONO- AND DISACCHARIDES ON STRUCTURAL-MECHANICAL PROPERTIES OF PECTIN GELS (p. 16-24)

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For creating the assortment of confectionery products for children, dietetic or functional designation, we examined the influence of mono- and disaccharides – glucose, fructose, saccharose and lactulose, on the structural and mechanical properties of pectin gel, formed on apple puree. It was determined that effective viscosity of pectin gels on glucose or fructose is larger than the viscosity of pectin

gel on saccharose. This is explained by the formation of the larger amount of hydrogen bonds between monosaccharides and molecules of pectin.

It was found that in the process of storing gels at temperature of 293 K, their strength grows. In this case, in gels on glucose we observed the formation of crystals, connected to the low solubility of glucose. To prevent the growth of crystals and reach necessary structural and mechanical, organoleptic indicators, it is recommended to reduce the amount of glucose in gels by 30 %.

It was determined that lactulose increases the amount of free moisture in the pectin gels on saccharose or glucose, which decreases effective viscosity of their structure. In the pectin gels on fructose, on the contrary, the addition of lactulose reduces the total amount of free moisture, which increases effective viscosity of the structure. This is explained by the larger solubility of lactulose compared to saccharose or glucose, and lower than fructose.

The thixotropic properties of gel systems with mono- and disaccharides were studied and it was established that under production conditions, mechanical method of conducting thixotropy makes it possible to restore the structure of gel by 85...90 % and conduct the process of molding.

We determined the losses of lactulose when storing pectin gels for 7 days, which amount to: 11 % – for gel with saccharose and lactulose, 14,4 % – with fructose and lactulose and 11,8 % – with glucose and lactulose. These data must be included in the formulations of gels with functional properties to provide for the daily need of human organism in prebiotic.

**Keywords:** pectin gels, glucose, fructose, prebiotic lactulose, thixotropy, thixotropic properties, functional products, apple puree.

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#### **DETERMINING TECHNOLOGICAL PARAMETERS FOR TREATING PECTIN-CONTAINING RAW MATERIALS IN THE TECHNOLOGY OF MILK-VEGETABLE MINCES (p. 25-31)**

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We substantiated scientifically and verified experimentally the choice of technological parameters for the treatment of vegetable raw materials to ensure the realization of their target properties as a structure-forming agent in the technology of milk-vegetable minces. A technological scheme of obtaining puree from carrot or pumpkin or zucchini was developed.

The procedure of obtaining puree from vegetables is as follows. Carrot of the Chantenay variety, pumpkin of the Gilea variety or zucchini of the Zolotinka variety are inspected, washed and peeled, shredded in cubes with ribsize  $l=(0,8...1) \times 10^{-2}$  m and are exposed to thermal treatment (TT) with steam at temperature  $t=108...112$  °C for  $\tau=(20...25) \cdot 60$  s – for carrot and pumpkin and  $(15...20) \cdot 60$  s – for zucchini. The vegetables are shredded at temperature  $t=75...85$  °C to the size  $d=(5...7) \cdot 10^{-4}$  m. TT of puree is carried out at temperature  $t=70...80$  °C for  $\tau=(6...7) \cdot 60$  s at pH of the medium – 3,0...3,4.

Puree from vegetables, received by the proposed techniques, has buttering consistence that does not stratify during storage and consequent usage. The accumulation of soluble pectin, which displays the properties of a structure stabilizer and increases viscosity of puree from vegetables, predetermines the expediency of their use in the technology of MVM.

**Keywords:** pectin substances, soluble pectin, structure-forming agent, milk-protein concentrate, milk-vegetable minces.

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### STUDY OF INFLUENCE OF TECHNOLOGICAL FACTORS ON THE SORPTION OF IONIZED CALCIUM FROM SKIMMED MILK BY SODIUM ALGINATE (p. 32-39)

**Raisa Plotnikova,  
Nataliya Grynchenko, Pavlo Pyvovarov**

The possibility of regulating the composition of the salt system of skimmed cow milk for the purpose of regulating the functional and technological properties was investigated. Parameters for the regulation of the composition of the salt system of skimmed cow milk were established. We defined the prospects of using sodium alginate as a natural ion exchanger, the implementation of whose properties for the binding of calcium ions allows using it under conditions of regulating the composition of the salt system of skimmed cow milk or the systems based on it, stable over time and during thermal treatment. The research revealed the influence of technological factors on the process of sorption of ionized calcium by the solution of complexing agent sodium alginate. It was determined that the important factors that affect the process are active acidity and the conditions of conducting the process, namely, a phased introduction of the sorbent, which contributes to the same speed of the process and, as a result, obtaining the same sorption speed throughout the whole process. In addition, the study of influence of the sorption area and temperature indicate that these factors are not determining in this process. Rationalization of parameters of the sorption of ionized calcium leads to the increased thermal stability of skimmed cow milk and the systems based on it. Materials, presented in this paper, are the basis for the development and implementation of technologies of new food products, the composition of which provides colloidal stability under condition of the joint use of dairy and fruit and berries raw materials, which might be used in food industry.

**Keywords:** skimmed cow milk, complexing agent, sodium alginate, ionized calcium, sorption.

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**EXPLORING THE EFFECT OF DRY PROTEIN-CARBOHYDRATE SEMI-FINISHED PRODUCT ON THE STRUCTURAL-MECHANICAL PROPERTIES OF YEAST DOUGH OBTAINED BY THE ACCELERATED TECHNIQUE (p. 39-45)**

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The purpose of the conducted research was the substantiation of rational concentration of dry protein-carbohydrate semi-finished product (DPCS) from the point of view of structural-mechanical and rheological properties of yeast dough.

The research was conducted on the model systems of yeast dough, obtained by the accelerated technique through preliminary activation of yeast in a nutrient medium of the dry additive, obtained from the secondary products of potato processing.

The obtained results demonstrated that the examined additive contributes to the strengthening of gluten properties of flour, which contributes to an increase in the energy of dough in the process of fermentation. The samples of dough with the addition of DPCS have a stable structure, which ultimately ensures the absence of adhesion of dough with the working bodies of technological equipment.

It is proven that the use of DPCS in the concentration of 15 % by weight of flour contributes to an improvement in the structural-mechanical and rheological properties of yeast dough.

The obtained formulation will make it possible to produce a broad range of products at the enterprises with low capacities such as mini-bakeries, flour shops in supermarkets, and restaurants.

**Keywords:** dry protein-carbohydrate mixture, dry potato additive, yeast dough, structural-mechanical properties, rheological properties.

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## EFFECT OF SAUTÉING OF ONION ON ITS STORAGE AT LOW TEMPERATURES (p. 46-50)

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We studied dynamics of freezing and defrosting of sautéed onion, determined its acidic and peroxide number, which was stored during 30 days at temperature of  $-18^{\circ}\text{C}$ . The change in anatomical structure of frozen onion depending on thermal pre-treatment was examined.

The technology of production of frozen vegetable mixes implies the use of thermal treatment; therefore, selecting the method of canning, which will make it possible to maximally preserve useful substances of chemical composition of a product, is relevant.

As the object of experiment we used fresh and frozen sautéed onion

It was found as a result that at temperature of freezing  $-20^{\circ}\text{C}$ , the value of maximum speed of freezing practically does not change; this indicates that the rate of cooling is not limited by thermal and physical properties of the sample. We also experimentally determined the increase in acid number in the process of refrigeration storage during 30 days and the decrease in peroxide number in the examined samples of sautéed and frozen onion.

It was revealed that the cells of onion after sautéing changed their form and structure: they do not have a clear form and orderliness; the breaks are visible at the contours of the walls of cells. The luminescent formations after sautéing of onion change their form as a result of deformation of cellular membranes

The obtained data may be used for providing high quality of the frozen vegetable mixes for soups and for determining rational regimes of freezing and defrosting of sautéed onion in their composition. Adding sautéed onion to the frozen vegetable mixes is expedient and will not change organoleptic properties of a product; it will not accelerate the oxidation processes of fats, but will only help to preserve the integrity of shape and delicate consistency of onion in a soup prepared from such a mix.

**Keywords:** freezing, luminescent substances, sautéing, anatomical structure, acid number, refrigeration storage.

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**TECHNOLOGY OF HEALTHY PROCESSED CHEESE PRODUCTS WITHOUT MELTING SALTS WITH THE USE OF FREEZING AND NON-FERMENTATIVE CATALYSIS (p. 51-61)**

**Raisa Pavlyuk, Viktoriya Pogarska,  
Olga Yurieva, Lidia Skripka Tatyana Abramova**

Authors studied comprehensive influence of the processes of non-fermentative catalysis – cryomechanolysis and freezing of solid rennet cheeses during their preparation for melting, which leads to the cryodestruction of low-soluble paracaseinatcalciumphosphate nanocomplexes into soluble gel form. It was established that there occurs their cryodestruction and transformation of their significant part to the nanoform (by 45...55 %). A nanotechnology of healthy processed cheese products was developed. Mechanisms of the processes were revealed. It was established that during freezing and finely dispersed grinding of solid rennet cheeses before melting, there occurs cryomechanodestruction and non-fermentative cryocatalysis (destruction) of protein molecules to separate monomers –  $\alpha$ -amino acids by 55... 60 %, that is a significant part of amino acid is transformed from the bound state to the free soluble form. A mechanism of the process was revealed; it was shown that in parallel with the destruction of nanocomplexes, nanoasociants of protein, its conformational changes take place: erasing molecules, decreasing in volume, shape, the ratio of hydrophobic and hydrophilic groups in a molecule, and filling the nucleus of a molecule with hydrophobic residues.

Authors proposed and developed the cryogenic nanotechnology of manufacturing processed cheese products based on solid rennet cheeses without melting salts, which includes an integrated influence of freezing and finely dispersed grinding, non-fermentative catalysis. It was established that cheese products, produced by the nanotechnology (fillings for confectionery products “PanCake”, dressing sauces, dipping sauces, ball shaped snacks) and enriched with herbal additives, exceed the known analogs in chemical composition. In addition, a large part of substances (as

BAS and biopolymers) in cheese products is in the nanostructured form (55...60 % of protein) in the form of free amino acids.

New technologies of healthy processed cheese products have been tested under production conditions at a number of the Ukrainian enterprises (TOV VKG “Lisova kazka”, NVP “FIPAR”, NVP “KRIAS-1”). The regulatory documentation (TU, TI for “cheese and vegetable fillings for confectionery products “PanCake” and “cheese dressing sauces”) was developed and approved.

**Keywords:** non-fermentative catalysis, mechanolysis, freezing, low temperature grinding, hard rennet cheese, nanocomplexes, processed cheese products.

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