ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

STUDYING A NEW ANTI-POLARIZATION METHOD IN THE PROCESS OF ULTRAFILTRATION OF SKIMMED MILK (p. 4-8)

Gregoriy Deynichenko, Vasyl Guzenko, Oleg Udovenko, Oleksandr Omelchenko, Olga Melnik

The paper presents an experimental research and new methods of processing the findings on the ultrafiltration concentration of skimmed raw milk with the use of a new method to prevent a polarization layer on the membrane. The paper reveals the research findings on the bubbling method effect on a polarization layer in the membrane processing of skimmed milk and on the performance of ultrafiltration membranes. The devised mathematical models are based on the regression equations of the factorial experiment on the selection of technological parameters of the UF-concentration of skimmed milk with the use of the feedstock bubbling over the membrane surface. We have determined the rational working parameters of the process; these working parameters are as follows: the working pressure is 0.4–0.5 MPa, the skimmed milk temperature – 40–50 °C, the skimmed milk bubbling frequency – 0.10–0.15 min^{-1}, and the bubbling pressure – 0.56–0.58 MPa.

Keywords: skimmed milk, membrane processing, polarization layer, ultrafiltration concentration, bubbling.

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FOUNDATION OF TECHNOLOGY FOR OBTAINING ENCAPSULATED OILS AND PRESCRIPTION DEVELOPMENT OF SHELLS ON THEIR BASIS (p. 9-15)

Olga Neklesa, Evgeniya Korotayeva, Oleksander Nagorniy

The use of sodium alginate and implementation of its chemical potential in the oil encapsulation technology provides thermostable properties of the product shell, which expands the range of new types of oil and fat products with the given geometrical shape, improved consumer properties and extended shelf life.

Stable production process of encapsulated oils is ensured by involving a third substance – white sugar into the prescription of an aqueous solution of sodium alginate.

Scientific and technological substantiation of structured edible shells of dosed encapsulated oils is provided by the parameters of such systems, which determine the technological cycle of production and operation of special equipment for industrial production.

The technology of shells of encapsulated oils, rational concentrations of prescription components are developed. Introduction of white sugar density regulator – at a concentration of 23.0 % into the shell-former solution is substantiated. This helped to determine the organoleptic and structural and mechanical properties E_{el}=(10.0...21.5)×10^3 Pa. Determination of the technological properties of shells of encapsulated oils lays the basis for industrial production, allowing to extend the range of oil and fat raw materials, encapsulated fillers and expand the use of industrial encapsulated products in the catering industry.

Keywords: lipids, capsule, shell, sodium alginate, packaging, spherification, encapsulation, convenience food, polysaccharides.

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RESEARCH INTO MILK HOMOGENIZATION IN THE PULSATION MACHINE WITH A VIBRATING ROTOR (p. 16-21)

Kyrylo Samoichuk, Sergey Kiurchev, Vadym Oleksiienko, Nadiya Palyanichka, Valentina Verholantseva

In the modern dairy production schemes one of the main problems is high energy consumption in the process of homogenization. One of the perspective ways to solve this problem is to research and develop the variety of rotor-pulsation machine – pulsation machine with a vibrating

rotor. Homogenization in such machine allows getting high values of emulsion flow acceleration and using the resonance phenomenon that has a positive impact on quality and energy consumption of the machine.

As a result of analytical researches, the hypothesis is suggested about the key role of emulsion acceleration in the process of milk emulsion fat phase dispersing in the pulsation machine with a vibrating rotor. We received dependences that associate instantaneous and average acceleration of the emulsion with the frequencies of rotation and vibration of the rotor, its diameter and amount of openings. These dependences allow determining conditions for increasing degree of emulsion dispersing. The experimental researches resulted in defining interconnection between acceleration of emulsion and dispersion of fat phase of milk, which confirms the hypothesis about the mechanism of homogenization in the pulsation machine with a vibrating rotor. The middle sizes of fat globules of milk are found to be dependent on the frequency of rotation and amplitude of rotor vibration. With the frequencies of rotation of the crank shaft up to 2880 rpm and amplitude of rotor oscillation 1 mm it is possible to get milk emulsion with the average size of around 0.8 μm. The results of the research prove the use of such machines in the technological processing lines of milk to be promising. The investigated machine allows receiving highly dispersed emulsion that is on the same level as processed in valve homogenizers with considerable decrease in energy consumption.

Keywords: homogenization of milk, homogenizer, pulsation machine with a vibrating rotor.

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THERMOGRAVIMETRIC RESEARCH INTO FISH AND PLANT SEMIFINISHED PRODUCTS MADE OF RAW AND BLANCHED TISSUES OF AZOV GOBY AND WHEAT BRAN (p. 22-30)

Nataliia Prytulska, Dina Fedorova, Maxim Lazarenko, Olena Vasylieva, Tatiana Yudina

According to results of thermogravimetric and differentia-thermal studies, we compared characteristics of the amount of adsorption- and capillary-bound moisture in the experimental samples of fish and plant semifinished products, as well as determined the values of activation energy of the molecules of water at different temperatures of moisture removal. By the results of analysis of the DTG peaks, it is established that the largest amount of osmotic- and adsorption-bound moisture is observed in samples made on the base of raw fish raw materials due to the higher degree of hydration of protein molecules in minces.

It is found that the application of hydrothermal pre-treatment of muscle, connective and skeletal tissue complex of Azov goby leads to the reduction in the amount of adsorption-bound moisture and decreses the energy of its bond with the product. The use of wheat bran somewhat increases the amount of bound moisture in the fish mince structure as a result of increase in the number of available hydroxyl groups and the formation of macroporous structure, which causes the increase in its hydrofilicity. It is established experimentally that the influence of plant raw materials on the increase in activation energy of the molecules of water for the experimental fish and plant semifinished products is less significant than the use of native fish raw material.

The obtained results allow better understanding of the structural changes that occur in the process of drying the fish and plant semifinished products. They might be applied to optimize the drying processs of fish and plant semifinished products and to predict their technological behavior in various food systems, as well as while storing.

Keywords: thermogravimetric analysis, fish and plant semifinished products, Azov goby, dehydration, capillary and adsorbed moisture, activation energy.

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MODELING OF MECHANICAL TREATMENT OF NAPIFORM ONION TO DETERMINE THE RATIONAL PARAMETERS OF ITS CLEANING (p. 30-39)

Oleg Tereshkin, Dmytro Horielkov, Dmytro Dmytrevskyi, Vitalii Chervonyi

In order to improve quality of the process of cleaning vegetable raw materials, development of new equipment is necessary, which will allow processing different kinds of raw materials and manufacturing products with stable quality indicators. When designing new equipment, it is necessary to take into account that the new machinery should have compact dimensions, be versatile and multioperational. This will make it possible to successfully compete in the domestic and international markets.

We designed an experimental installation with appropriate methodology that allows studying the process of cleaning napiform onion with the capacity to determine the impact of all its parameters on the percentage of loss of raw materials and efficiency of cleaning the product. This is provided for by the presence of a working drum that rotates around its axis in an experimental setup. The rotation frequency may be changed in the required range. The working drum has at its surface special openings for cutting inedible part of the bulbs.

A mathematical model of treating napiform onion during cleaning was obtained. Mathematical model takes the form of a system of inequalities, which links the coefficient of filling the drum and central angle of the segment with product. The model proves that the optimal mode of motion of the product in the drum device for cleaning is the mode under which a layer of bulbs lose equilibrium state and there occur sliding forces relative to the inner surface of the drum, which, together with the force of friction, determine the effort for cutting the neck and stem of a bulb.

We received equations to calculate the limiting modes of motion when moving in the drum, which explicitly take into account the friction coefficient, angle of natural bevel of the layer of product and the magnitude of drum load. It was established that the maximum value of degree of cleaning the bulbs is 88...98 %.

Mathematical modeling of the process of mechanical treatment of napiform onion allows us to determine rational parameters of the combined process of its cleaning. These parameters include rotation frequency of the working drum, load factor of the working chamber and the shape of openings in the working drum. On the basis of the conducted theoretical and experimental research, we designed a device for the combined cleaning of napiform onion. The device allows thermal pre-treatment of raw materials with the aim of weakening the bond between husk and a bulb. Subsequent mechanical treatment, which is also implemented in the device, provides complete cleaning of the product from husk.

Keywords: napiform onion, combined process, parameters of cleaning, pre-cooking, mechanical treatment.

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EXPLORING THE PROCESSES OF CRYOMECHANODESTRUCTION AND MECHANOCHEMISTRY WHEN DEVISING NANO-TECHNOLOGIES FOR THE FROZEN CAROTENOID PLANT SUPPLEMENTS (p. 39-46)

Viktoriya Pogarska, Raisa Pavlyuk, Nadiya Timofeyeva, Leonida Bilenko, Tetyana Stukonozhenko

The influence of cryomechanodestruction is examined on the activation and destruction of heteropolysaccharides – protein nano complexes with carotene and other low-molecular BAS, such as L-ascorbic acid, phenolic compounds, which are in vegetable raw materials are in the non-active bound form, when developing the nanotechnologies of plant supplements, in particular, frozen nanopuree from carrot, sweet pepper, pumpkin, tomato, apricot, buckthorn.

We discovered regularities and mechanisms of comprehensive effect of deep processing the carotene-containing vegetable raw materials, freezing and cryomechanodestruction for the preservation and extraction of carotenoids, bound in nano complexes with biopolymers, into free and hydrophilic forms. It was found that in the development of nanotechnologies for cryopuree, there occurs the extraction of β-carotene into free form, by 3...3.5 times larger than in the original raw materials.

The benefits of the research include the fact that, as a result of using comprehensive effect of cryotreatment of raw materials and cryomechanodestruction, the nano complexes of biopolymers with low-molecular substances, such as β-carotene, L-ascorbic acid, low-molecular phenolic compounds, are destroyed and there occurs their transformation from hidden, bound form into the free soluble easily digestible form – the nanoform. This makes it possible to reveal the biopotential of plant cell, tissue more effectively and extract from them the hidden forms of biologically active substances with fundamentally new chemical composition and high consumer properties, which might be used when creating health improving food products.

Keywords: cryomechanodestruction, nanotechnologies, carotenoids, plant supplements, destruction of nano complexes, biopolymers, bound forms.

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THE USE OF CONVECTIVE-THERMORADIATIVE METHOD OF ENERGY SUPPLY IN THE APPLE SNACK TECHNOLOGY (p. 47-52)

Ivan Malezhyk, Igor Dubkovetskiy, Halyna Bandurenko, Ljudmila Strelchenko, Tetyana Levkivska

Snacks based on vegetable raw materials are gaining special popularity in the Ukrainian market. As a result of the conducted research, apples of the Champion variety were selected for snacks production.

To improve organoleptic indicators of apple snacks, we carried out apples blanching in syrup with the sugar concentration of 40 % and with additional introduction to the solution of citric and ascor-

bic acids, which significantly improves organoleptic indicators and contributes to product vitaminization.

In the process of apples blanching and drying apples, peroxidase inactivation takes place. Its activity per 1 g of the finished product is decreased to 3.4 and 0.36, respectively.

Convective-thermoradiative method of energy supply was applied, which intensifies the drying process, contributes to the improvement in quality of the finished product and reduction in energy consumption. In this case, raw material is heated quickly and, due to the use of pulsed mode, is not overheated. It promotes the preservation of original chemical composition of apples, accelerates the drying process by 1.5 times and enables reduction in energy consumption.

Keywords: drying, moisture content, apple snacks, snacks, apples, energy supply, peroxidase, blanching, sugar syrup, convective, vitamin C.

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INFLUENCE OF FUNCTIONAL FOOD COMPOSITION ON THE PROPERTIES OF MEAT MINCE SYSTEMS (p. 53-58)

Ihor Strashynskiy, Oksana Fursik, Vasil Pasichniy, Andriy Marynin, Georgiy Goncharov

The priority direction of innovative activity of meat processing enterprises is the production of affordable products of consistent and high quality. Achievement of the set goal is provided by the introduction during developing the mince systems of various food additives that are supposed to replace a considerable part of basic raw materials and to improve its functional and technological properties.

The influence of the developed functional food composition on functional-technological and structural-mechanical properties of minces for cooked sausages was studied. It was proved that its introduction to the composition of meat minces increases the indicators of moisture binding ability by 3.5–5 % compared with the control sample. The emulgation ability in the experimental samples increases on average by 5 % and the stability of the emulsion by 22.5 %. This is due to the capacity of protein preparations and hydrocolloids, belonging to the composition, as well as meat proteins to encapsulate drops of fat and retain them throughout the entire process.

Determining the influence of the developed functional mix on structural-mechanical properties of minces indicated that the effective viscosity for experimental samples increased on average by 48.5 %, and the indicator of boundary shear stress decreased on average by 40.5 %.

The obtained results prove the relevance of substituting a part of meat raw material (up to 30 %) with the developed composition and the improvement of functional-technological and structural-mechanical properties of minces. This will provide for a consistent high quality of the finished products and will increase the effectiveness of production.

Keywords: minces of cooked sausages, protein containing composition, functional and technological properties, effective viscosity, boundary shear stress.

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