ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

DEVELOPMENT OF CRYOGENIC TECHNOLOGY FOR THE PRODUCTION OF NANO-POWDERS FROM TOPINAMBOUR USING LIQUID AND GASEOUS NITROGEN (p. 4-10)

Raisa Pavlyuk, Olexandr Bessarab, Viktoriya Pogarska, Katerina Balabai, Svitlana Loseva

The cryogenic technology for the production of nanopowders from topinambour, which differs from conventional in applying cryogenic "shock" freezing using liquid and gaseous nitrogen, low-temperature fine grinding and freeze drying, allowing not only to preserve all biologically active substances, but also to extract them better from the bound with the biopolymers of nanocomplexes in the free state and to destroy much of the inulin polysaccharide to its individual monomers - fructose was proposed and developed.

The technology differs from conventional in the fact that it completely excludes the heat treatment of a product and is based on applying the cold treatment of raw materials in the preparation of topinambour, freezing and low-temperature fine grinding followed by freeze drying.

New technology allows to obtain additives from topinambour in the form of fine powders with a particle size dozens of times smaller than in the conventional grinding. Their quality in the content of fructose in the free state and BAS, withdrawn from the bound state, surpasses domestic and foreign counterparts.

Comparison of the amino acid composition of proteins in the free and bound state in the original inulin-containing raw materials (freeze-dried topinambour) and nanopowders from topinambour was performed. It was found that in comparison with initial raw materials, in the fine grinding of frozen inulin-containing raw materials there is a significant mechanical destruction of protein molecules to individual amino acids, their transition from the bound state to the free state. Thus, in nanopowders from topinambour, the mass fraction of bound amino acids decreases twofold in comparison with the initial raw materials. At the same time, there is the 1,7-10-fold increase in the mass fraction of amino acids, which are in the free state.

Keywords: cryogenic freezing, low-temperature grinding, freeze drying, topinambour, inulin, nanopowders.

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THE EFFECT OF MICROBIAL POLYSACCHARIDES ON THE PROPERTIES OF WHEAT FLOUR (p. 11-15)

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The paper presents a comparative analysis of the influence of microbial polysaccharides ksampan and enposan on the technological properties of wheat flour. It is proved that the presence of either ksampan or enposan strengthens the gluten, increases its

firmness, and reduces its extensibility. Alveograms show an increase in the dough firmness, whereas farinograms demonstrate that the dough water absorption capacity and stability grow while its liquefaction and elasticity decrease. This can be explained both by the strengthened fibrinous frame of the flour and a "reinforcing" effect of the hydrated polysaccharide molecules.

It is proved that microbial polysaccharides accelerate the process of starch pasting, increase the viscosity of the flour slurry, and increase the stability of starch paste during thermal and mechanical operations.

Summarizing the findings, we can say that the effect of enposan on the biopolymers of wheat flour is similar to that of ksampan, but slightly smaller. Thus, enposan can be recommended for stabilizing of flour dough systems.

Keywords: wheat flour, microbial polysaccharides, ksampan, enposan, gluten, starch.

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THE STUDY OF FUNCTIONAL-TECHNOLOGICAL PROPERTIES OF ENCAPSULATED VEGETABLE OILS (p. 16-23)

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Functional-technological properties of encapsulated vegetable oils expand the probability of using the product as a semi-finished product of a high degree of readiness in technologies of culinary products such as leafy vegetable salads, different in pH, sales temperature.

Implementation of elastoplastic properties of the product shell ensures the integrity (if necessary) of capsules during mechanical mixing; adhesive properties of the capsule shell provide intactness of the internal oil and fat component, which is effectively practiced in the technologies of extended shelf-life foods.

Using sodium alginate and realizing its chemical potential in the technology provides thermostable properties of the shell of encapsulated oil and fat product, which expands the range of new types of fats and culinary products with improved consumer properties and extended shelf life.

Keywords: oils, fats, encapsulation, system, subsystem, semi-finished product, technology, product, properties, polysaccharides.

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DEVELOPMENT OF NANOTECHNOLOGY OF FINE FROZEN CHAMPIGNON PUREE (AGARICUS BISPORUS) (p. 24-28)

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The nanotechnology of fine-dispersed frozen champignon puree with unique characteristics using the mechanical destruction and mechanical activation processes was scientifically substantiated and developed. The new technology allows to extract the forms of BAS and biopolymers (proteins) hidden in vegetable raw materials and make fuller use of the biological potential of raw materials.

Quality comparison of frozen fine additives, obtained by the innovative technology in the form of nanostructured puree with the feedstock by the content of BAS was performed in the paper. It is shown that in the freezing and low-temperature grinding of raw materials, accompanied by cryodestruction and mechanical activation processes, there is a fuller extraction of BAS from the biopolymers-bound state into the free state. Depending on the type of BAS, the increase is from 1.5...2.5 times with respect to the fresh feedstock.

Comprehensive investigations have shown that the resulting fine frozen puree has fundamentally new properties. It was found that in the fine low-temperature grinding of champignons, there is a destruction of protein-chitin-mineral complexes, mechanical disruption (mechanolysis) of proteins. It was revealed that using mechanical activation in cryogenic mechanical grinding of champignons into fine puree leads to cryodestruction and mechanolysis of proteins of mushrooms to free amino acids by 70...75 %, that is, the protein is transformed (modified) into the nanostructured form, 2/3 of which consist of free amino acids and is much better dissolved and absorbed by a human body.

The end result of the work is the developed and approved regulatory documentation for the product, as well as conducted testing in the industrial environment at the enterprises of the city of Kharkiv.

Keywords: cryodestruction, nanostructured puree, freeze, biologically active substances, protein, low-temperature grinding.

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A LIQUEFIED GAS (Freon R-134a) IN AN IMPROVED TECHNOLOGY OF EXTRACTING PLANT MATERIALS (p. 29-32)

Valery Mikhaylov, Yuri Timohenko, Lyudmila Chuiko, Svetlana Mikhaylova, Andrey Shevchenko

The study is aimed at improvement of the plant material extraction technology via the use of such extractant as ozone-friendly, azeotropic liquefied natural gas (Freon R-134a) and exploitation of adequate equipment for its implementation, which ensures higher process efficiency, resource conservation, and maintains the output quality. We set the following tasks: (1) to improve the plant material extraction technology via the use of ozone-friendly, azeotropic liquefied natural gas (Freon R-134a), (2) to design an extraction plant that would implement the technology, and (3) to use a resource saving technology for processing recycled plant materials in the study of the quality characteristics of the extracts.

The object of the research is an improved technology of plant material extraction based on the use of liquefied gases (Freon types) and implemented due to an extraction plant. The subjects of the research include an extraction plant, grapes seed flour, red grapes peel, and the extracts derived from them.

We have used a liquefied gas (Freon R-134a) to improve the technology of plant material extraction. The technology is based on maintaining a continuous liquefied-gas extraction of natural substances and removal of the solvent by means of a two-stage process of regeneration and condensation. This reduces the time of extraction, provides a better extraction of solvents from raw materials and finished products, increases the volume of a set of raw materials loaded in an extraction plant, and stabilizes the quality of manufactured products.

The designed extraction plant promotes implementation of the appropriate technology of extracting plant materials by means of a liquefied gas (Freon R-134a). The construction comprises two consistently connected systems that include evaporators, condensers, storage tanks, refrigeration units, a receiver, and a vacuum pump. The plant allows continuous extraction of natural substances by means of liquefied gases. It can be used at industrial enterprises for the manufacture of food ingredients, cosmetics, and pharmaceuticals with physicochemical properties that are typical of initial raw materials of plant origin.

The proposed technologies and equipment for extraction by means of liquefied gases provide the process efficiency, resource conservation, and stability of the quality characteristics of the manufactured products.

Keywords: extraction, improved technology, extraction plant, Freon, plant materials.

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USING RICE IN TECHNOLOGY OF NON-ALCOHOLIC FERMENTED BEVERAGES (p. 33-36)

Vitaly Pribulsky, Roman Mukoid, Nguyen Phuong Dong

Industrial production of non-alcoholic fermented beverages in Ukraine is represented by bread kvass only, which significantly limits the consumer needs. Besides, kvass mash concentrate as the main raw material contains compounds that negatively affect the cultures of microorganisms and, consequently, the fermentation process.

The results of research on determining the possibility of using the rice grain extract to intensify the technology of non-alcoholic fermented beverages and expand their range were presented. Physicochemical and organoleptic properties of mash at various proportions of the kvass and rice mash were defined. It was found that replacing kvass mash with rice mash up to 30 % has little effect on its organoleptic characteristics. The fermentation dynamics at different proportions of the kvass and rice mash was investigated. The feasibility of such replacement was proved. However, due to increased amount of nutrients, fermentation duration is reduced from 36 hours (kvass mash) to 18 hours (rice mash). Analysis of the organoleptic characteristics of beverages, made of the mash of the studied samples revealed that replacing the kvass mash with rice mash up to 30 % has little effect on the flavor-aromatic characteristics, typical for the bread kvass. When using the rice mash only, the beverage has original properties that are different from bread kvass. Using various aromatic raw materials at the blending stage will allow to expand significantly the range of this type of beverages.

Thus, the research results show the prospects for using the rice extract for producing non-alcoholic fermented beverages.

Keywords: rice, extract, kvass mash concentrate, yeast, lactic acid bacteria, mash, acidity, fermentation duration.

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IMPROVEMENT OF FROZEN POULTRY STORAGE TECHNOLOGY (p. 37-41)

Vyacheslav Onishchenko, Nataliya Grynchenko, Viktoria Bolshakova

The most effective and most common method to solve the problem of preserving the quality and safety of poultry during long-term storage is freezing. However, from the technological and commercial points of view, freezing of poultry causes some irreversible changes that make it impossible to fully restore its original characteristics and accordingly functional and technological and consumer properties after defrosting. A promising way to minimize negative effects of low temperatures is the use of cryoprotectants – the substances that prevent or slow down the growth of ice crystals during freezing.

The dependence of the viscosity of solutions of selected polysaccharides on their concentration to be used as solutions for pumping was determined. Considering the equipment requirements, including the probability of the injector needle clogging, the xanthan gum concentration of 0.5 %, which corresponds to the solution viscosity of 10.0 Pa·s and is, on the one hand, the maximum permissible given the equipment characteristics and, on the other, is in the recommended concentration range of pumping pickles was taken. The influence of pumping with proposed stabilization solutions on the poultry weight loss during defrosting was revealed. It was proved that due to pumping with proposed stabilization solutions, the poultry weight loss during defrosting significantly reduces (with the maximum selected pumping level of 25 % – by 6.1 % in absolute, by 61.6 % – in relative terms), which may indicate achieving a greater reversibility degree of poultry properties after defrosting.

Based on the results, the measures to improve the technology of frozen poultry (chicken breast), which consist in additional pumping with stabilization solutions, containing cryoprotective polysaccharides, moisture retaining agents, acidity regulators and antioxidants before freezing were developed.

Keywords: poultry, chicken breast, freezing, defrosting, polysaccharides, xanthan, weight loss.

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DEVELOPING THE CRYOGENIC FREEZING TECHNOLOGY OF CHLOROPHYLL-CONTAINING VEGETABLES (p. 42-47)

Raisa Pavluk, Aleksey Pogarskiy, Helena Kaplun, Svitlana Loseva

The paper deals with searching for freezing methods that in comparison with conventional methods allow to preserve as much biologically active substances as possible and significantly reduce the loss of cell sap of chlorophyll-containing vegetables (broccoli and Brussels sprouts) during defrosting. As an innovation, it was proposed to use cryogenic "shock" freezing to the temperatures in a product, lower than is usual in international practice (–35...–40 °C compared to conventional –18 °C), and freezer (–60 °C compared to conventional –32...–40 °C). In freezing, this allows not only to preserve but in 2...3 times more fully extract low-molecular BAS of the feedstock from nanocomplexes with biopolymers and completely eliminate the cell sap loss during defrosting.

Keywords: cryogenic freezing, innovation, chlorophyll-containing vegetables, broccoli, Brussels sprouts, liquid nitrogen.

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EFFECT OF HEAT TREATMENT WITH ANTIOXIDANTS ON OXYGEN RADICAL SCAVENGING DURING STORAGE OF ZUCCHINI SQUASH (p. 47-53)

Olesia Priss, Valentina Kalitka

Despite the proven effectiveness of heat treatment and antioxidants for reducing oxidative chilling injury, their combined effect during storage of zucchini squash was not considered in this aspect. The paper describes the results of investigating the effect of heat treatment with the antioxidant composition on the chilling injury level, the amount of malonic dialdehyde and dynamics of enzymatic antioxidants during storage of zucchini squash.

It was found that application of heat treatment with antioxidants reduces the chilling injury during storage of zucchini squash. The combination of heat treatment and antioxidants allows to reduce or stabilize the amount of malonic dialdehyde at the same level, depending on the chilling sensitivity of the zucchini squash hybrid. Heat treatment with antioxidants induces the activity of superoxide dismutase and catalase in the beginning of storage. The superoxide dismutase activity stabilizes until the 18th day of storage at the same level, and catalase activity reduction slows down by 30...40 % depending on the zucchini squash hybrid. Using heat treatment with antioxidants reduces the growth rate of peroxidase activity compared to control samples by 7...18 %. Close inverse correlations between the level of malonic dialdehyde, the activity of superoxide dismutase and catalase indicate the strengthening of the antioxidant function of these enzymes in experimental groups of fruits.

The combination of heat treatment and antioxidants to prepare zucchini squash for storage allows to effectively reduce oxidative chilling injury.

Keywords: zucchini squash, storage, heat treatment, antioxidants, malonic dialdehyde, superoxide dismutase, catalase, peroxidase.

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