Section 1. NEW TECHNOLOGIES OF FOOD PRODUCTS

THE CAROTENOID «SUNROLL» BUNS VITAMINIZED BY NATURAL NANOADDITIVES FOR HEALTHFUL NUTRITION

R. Pavlyuk, V. Pogarska, N. Maximova, K. Balabai, S. Loseva, T. Kotyuk

The carotenoid buns «SunRoll» vitaminized by natural nanoadditives with a record content of β-carotene and other BAS are developed for enterprises of restaurant industry and catering enterprises which can be used in health-giving nutrition. It is shown that the developed buns contain a high quantity of natural β-carotene (4.5 – 5.5 mg per 100 g), which covers the daily need of human organism.

It is shown that the natural nanoadditives, which are obtained by cryogenic treatment, steam-thermal processing in a modern apparatus (steam-convection oven) and fine-dispersed grinding of raw materials, differ in a record amount of β-carotene in a free state: in particular, the mass fraction of β-carotene in cryopuree from carotene-containing vegetables is 3.0–3.5 times more than in the raw materials, in the heat-treated nanopuree is 2.0–2.5 times more in comparison with raw materials. It is shown that the nanopuree contains also more low-molecular phenolic compounds and L-ascorbic acid comparing with their amount in the bound (hidden) form in the raw materials.

It is shown that the new carotenoid buns «SunRoll» for healthful nutrition with the use of natural nanoadditives as fortificants by BAS, have a record amount of natural β-carotene, L-ascorbic acid and low-molecular phenolic compounds (almost daily human need in 100 g of product). The carotenoid buns «SunRoll» exceed the world-known analogues by the content of BAS. So, they can be recommended for the population with the purpose of immunoprophylaxis.

Keywords: health-giving buns, natural carotene-containing herbal nanoadditives, β-carotene, vitaminizing, bun, carrot, pumpkin.

NATURAL HEALTHFUL FRUIT AND VEGETABLE NANOBEVERAGES WITH A RECORD AMOUNT OF BAS FOR ENTERPRISES OF RESTAURANT BUSINESS, TOURISM AND FITNESS

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The new natural functional healthful juicy nanobeverages with a record amount of BAS (L-ascorbic acid, β-carotene, chlorophyll, anthocyanins, phenolic
compounds) and prebiotics (cellulose, pectins) in a soluble ion-molecular form are developed. As an innovation in technology of nanobeverages the authors used the herbal carotene-, chlorophyll- and anthocyanin-containing cryopuree from fruits and spices in the nanoform as fortificants of BAS, colorants and structure formers. The beverages are aimed for immunological prophylaxis and recommended for the use at the enterprises of restaurant business, tourism and fitness centers.

It is shown that the frozen cryoadditives from fruits and vegetables (apples, cherry, black currant, lemons with a peel, spinach, apricot, sea buckthorn, pumpkin) are found in the nanostructured form (on 70%) and have a particle size ten times smaller than in traditional puree. It is determined that the cryopuree has fundamentally new properties and chemical composition, in comparison with puree, which are made by the traditional technologies. In particular, they differ by a higher content (2.5–4 times) of vitamins, carotenoids, anthocyanins, chlorophylls, phenolic compounds and other BAS in the free state in a soluble and easily digestible form comparing with the fresh fruits.

It is shown that the new healthful juicy nanobeverages, obtained with the use of frozen nanoadditives from fruits and vegetables and phytoextracts from natural spices, differ in a record amount of vitamins (L-ascorbic acid), β-carotene, chlorophylls a and b, anthocyanins, low- and high-molecular phenolic compounds, aromatic substances and other BAS. They have a pronounced natural color (yellow, green, pink-and-cherry), original taste and aroma, do not contain synthetic components. The nanobeverages exceed the world-known analogues by the content of BAS, and they are recommended for use in immunoprophylaxis of the population.

**Keywords:** healthful nanobeverages, natural nanopowders, carotene-, chlorophyll-, anthocyanin-containing additives, fruits, vegetables.

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**SENSATIONAL FACTS AND THE DISCOVERY OF HIDDEN FORMS OF PROTEIN IN MUSHROOMS DURING THE OBTAINING OF NANOPRODUCTS IN AN EASILY DIGESTIBLE FORM**

R. Pavlyuk, V. Pogarska, R. Tauber, V. Pavlyuk, M. Jasiurkowska

The unique method of obtaining of nanoproducts from champignons with the use of new generation of equipment is developed. This equipment is used at the restaurant business enterprises and allows extracting the hardly digestible protein of raw materials from the hidden, bound with the other biopolymers form in nanocomplexes to a free condition (1.7–1.8 times more than in the start raw materials) and transform it into the digestible aminoacids (65–70 %). The authors of the article for the first time in the international practice made a revelation and discovered the hidden protein in fresh mushrooms. It is shown that the content of protein in puree from champignons is 2 times higher than in the start raw materials and it is in a soluble form.
It is found that, the enzymatic processes (particularly their activation) during the processing in a steam convection oven occur with a lower intensity than during the using traditional method of heat treatment of champignons (particularly boiling). Thus, the activation of oxidative enzymes (peroxidase and polyphenol oxidase) after 10 minutes of boiling in a traditional apparatus increases 3–3.5 times, in a steam convection oven – 2–2.1 times. Primarily it can be explained by the different temperatures during the steam-thermal treatment and by the different amounts of kinetic heat energy that participates in these processes. It is shown that during the steam-thermal treatment of champignons in a steam convection oven, the loss of aromatic and other BAS is 1.8–2 times less than in the traditional cooking.

It is shown that the extraction of hidden forms of aromatic substances and L-ascorbic acid from the raw materials occurs more completely after the steam-thermal processing and fine-dispersed grinding during the obtaining of mushroom puree in the nanoform. The mass fraction of the 70–75% of substances is in a nanoscale and easily-digestible form due to the fine-dispersed grinding of mushrooms obtained by traditional cooking.

It is determined that the complex use of steam-thermal treatment (in the steam-convection oven) and fine-dispersed grinding of champignons allows obtaining the nanopuree and pates on their basis with the high quality, which exceeds the known analogues several times (particularly the content of free α-amino acids and aromatic substances in pates is 2 times higher than in the raw materials).

**Keywords:** champignons, hardly digestible proteins, thermal destruction, mechanolysis, healthful nanoproducts, inactivation of enzymes.

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**THE DETERMINATION OF OPTIMAL MODES OF APPLES DRYING IN THE PRODUCTION OF FRUIT CRISPS**

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A new form of dried products for Ukrainian consumers is fruit and vegetable crisps. These include crisps from apples, pears, persimmons, quinces, bananas, beets, carrots, white roots, etc. Fruit or vegetable crisps are thin lamina of fruits or vegetables obtained without frying. Fruit or vegetable crisps obtained by drying to low residual moisture. Their characteristic is the lack in the composition of cholesterol, carcinogens and more.

Scientific development technologies drying crisps involved in many countries (USA, China, Korea, Thailand, Serbia, Poland, Hungary, Russia and Belarus), but Ukraine does not pay enough attention to such studies.

The article describes the innovative technologies that are used in the world for the production of fruit and vegetables crisps, in particular apple crisps. The main disadvantages of the methods for producing crisps are also indicated. Objects of research were Reinette Simirenko apples. The optimal degrees regimes of drying
of apples in the production of fruit crisps are presented in the article. The drying
curves Reinette Simirenko apples and organoleptic properties apple chips are
analyzed. The obtained energy-efficient mode of drying apples with thermal and
humidity of the drying agent parameters: temperature 80...60°C, speed of 1.5–2 m/s,
moisture content of 10 g/kg dry air. The proposed regime will reduce energy
consumption by 10–15%. The proposed regime allows to obtain a quality product
with maximum preservation of vitamins, minerals, nutrients, flavor and color.

The results used to develop energy efficient production technology of apple
crisps, developed and approved technical specifications "Chips fruit and vegetable".
The technology is protected by 9 patents of Ukraine.

**Keywords:** apple crisps, thermal and humidity parameters of the drying
agent, phasic dehydration, energy efficiency.

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**DETERMINATION OF WATER-CONSISTENT ABILITY
OF FOOD SYSTEMS BASED ON SODIUM ALGINATE
AND POLYSACCHARIDES**

O. Neklesa, Ye. Yarantseva, P. Pyvovarov, V. Vovk, K. Kostugov

Today, the development of culinary products and their manufacture with the
use of industrial methods in a simplified technological process is the producers’
main task, which is solved by the specialists of food industry.

One of the directions in food industry development is solving the tasks of
extending the terms for the implementation of food lipids by technological measures
such as sealing packaging, the introduction of antioxidants to the technology, use of
new technological principles for the application of antioxidant properties of raw
materials that are part of the prescription composition of the product, etc. In
addition, the creation of new food forms of food that inhibits lipid changes is a
prerequisite. The solution of this task is to bring it into a "water shirt" that will
provide decontact between air and water during the implementation and storage of
the product.

The manufacture of encapsulated lipids with the given geometric,
physicochemical, structural-mechanical, elastic-elemental, organoleptic indicators
is one of the directions that requires substantiation of functional and technological
properties of a high-quality capsular semi-finished product in technological
processes of culinary production. Improvement of the technology of encapsulated
products with a hydrophobic internal component through the development of a new
envelope technology will provide practical solution to these issues. This is possible
by determining the properties of each of the elements of the model of encapsulated
lipids, namely the shell and the internal lipid component.

At the same time, improvement of the technology of encapsulated lipids
should economically affect through the introduction of technological solutions in
technological flows for expanding the direction of economic efficiency of the
existence of technologies at the enterprise.

The implementation of functional and technological properties of semi-
finished product of encapsulated lipids increases the possibility of its use in culinary
dishes.

The development of a new technology of the encapsulated formulation
technology of encapsulated lipids allows to improve the technological process of its
production by eliminating the operation of capsule dehydration, which allows to
increase the efficiency of the technology in the direction of economic efficiency of
the technologies existence.

**Key words:** system, polysaccharide, sodium alginate, agar, pectin, glycerol,
calcium alginate.

**RESEARCH OF EMULSIFYING CHARACTERISTICS OF ADDITIVES OF HYDROBIONTS**

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Functional food products intended for the systematic use in composition of
food rations by all age groups of healthy population belong to the new generations
of food products that have emerged as a result of the fundamental research
development in number of science fields.

Such products reduce the risk development of many diseases associated with
nutrition, preserve and improve the health due to the presence of biologically active
functional food ingredients in their composition. For the emulsion fat products (such
as mayonnaise, sauces, spreads), the spectrum of physiologically functional
ingredients which is enriched is greatly expanded due to the presence of fat and
water phases.

Therefore, the research aimed at the technologies development and
functional emulsion fat products range extension enriched with physiologically
important components is actual and relevant. The purpose of the article was to study
the emulsifying characteristics of additives from hydrobionts. As an object of study,
it has been chosen the parameter of the emulsifying ability of additives of
hydrobionts of vegetable and animal origin. The emulsifying ability of additives was
evaluated by the phase inversion point determination. The obtained data indicate
that the additives of hydrobionts of vegetable origin manifest in the interval from 1
to 10% of the emulsifying properties. Additives of both types of kelp show the
greatest emulsifying properties in the concentration range 3–5% for which the
phase inversion point are Laminariae thalli (laminaria saccharina) and Alga
Kombu (laminaria japonica), respectively, 18,5–21,5 points ) and 27,3–28,2 points.
Additive Cystoseira barbata doesn’t inferior to emulsifying properties of laminaria
additives, but its optimal concentration is in the range of 6–8%, which corresponds
to 27.8–28.1 points. High results (46.5–48.1 units) in the concentration range of 7–9% show the samples of duckweed (Lemna minor).

According to the obtained data, the emulsifying characteristics of the additives of animal additives is 1.5–2.5 times higher than those of vegetable origin. In the range of collagen concentrations 1.0–4.0%, there is a gradual increase of the emulsifying capacity; at collagen concentration 4.0–8.0%, the emulsifying ability is maximum (38.7–41.6 units). Hydrolyzate from mollusks shows the maximum emulsifying ability in the range of 6–9% and it is 52.5–54.1 points. The perspective of further researches is emulsions stability determination with additives of hydrobionts with the purpose of further development of the emulsion systems of food products with their use.

**Keywords:** emulsion, hydrobionts, phase inversion point, fat products, algae.

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**RHEOLOGICAL PROPERTIES OF FOOD FILM-FORMING GELS ON THE BASIS OF UROCANATE POLYSACCHARIDES**

N. Kondratjuk, Y. Pyvovarov, A. Padalka, Y. Polyvanov

The effect of the composition of a mixture of uronate polysaccharides on the rheological properties of food film-forming gels was studied. The rheological features of 2% solutions (based on the total solids content) of sodium alginate with a high content of guluronates and low-esterified amidated pectin were investigated. The investigation systems are presented by the viscosity of the plastic matter and possess all the rheological properties of non-Newtonian fluids. In the course of the study we have got to know that the rheological characteristics of such liquids do not depend on the duration of the shear flow and remain constant in time. The dependence of the dynamic viscosity on the time of deformation of food gels at a constant shear rate was studied. From the analysis of the obtained rheological parameters it can be concluded that the structure of the gels is almost completely restored at low shear rates, even in the samples with the highest viscosity. As the shear rate increases, the destruction of the structures begins to predominate over the reduction process, and therefore the viscosity decreases. It is noted that the flow rheograms are non-linear over the whole range of the velocity measurements, which indicates that significant deformation stresses must be applied to destroy the structures. The rheogram shows that taking into consideration both a certain ratio of polysaccharides and the fact that due to the realization of the effect of the electrostatic interaction between the groups having a partially negative charge (\(-\text{COOH}, -\text{OH}\)) and partially positive charge (\(-\text{COO Na}, -\text{CH}_3, -\text{NH}_2\)), we can observe the effect of gel consolidation, based on the redistribution of the functional groups within the polysaccharide matrix. At the same time the compounds of hydrogen and water molecules are destroyed and they are removed into the outer layers of the gel matrix. It was shown that the composition of sodium alginate and

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low-esterified amidated pectin with the ratio of 1.6:0.4 respectively, turned out to be the most optimal by the values of the rheological parameters. The rheological parameters of this system are able to ensure the efficient fluidity from the dosing mechanisms, the ability to spread along the flat surface, and the adhesion to solid food surfaces aimed to fulfil a number of technological and production tasks.

**Keywords:** pectin, sodium alginate, food gels, rheological properties, uronate polysaccharides.

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**DEVELOPMENT OF SAUSAGES FROM THE MUSK DUCK MEAT**

N. Bozhko, V. Tishchenko, V. Pasichnyi, E. Miz

In today’s market, the production of high-quality, cost-effective production is not possible without the use of advanced technologies and innovative solutions in the field of poultry processing. In recent years there has been interest in commercial production of duck meat. Duck meat has a high nutritional value and provides the body’s need for proteins, lipids, minerals, vitamins. Musk ducks have certain biological features; their primary advantage is their excellent meat quality.

A promising direction of research is the use of waterfowl meat in the technology of meat products. To expand the range was developed recipes meat-containing sausage with musk duck meat and protein-containing raw materials. The analysis of research results shows the possibility and perspectives of using musk duck meat in recipes meat-containing cooked sausage products and in particular sausages. It is established that the inclusion in the recipes meat-containing sausage musk ducks and a protein-containing raw materials allows to obtain meat-containing product of high nutritional value with protein content at the level of 23–24 g/100 g, fat – 20,09–21,23 g/100 g, dietary fiber 2 g/100 g. Research of functional-technological parameters of stuffing on the model developed formulations showed a positive upward trend. The combination in the recipes musk duck meat, hydrated soy protein isolate and the protein stabilizer from pig skin allows to improve on 14,88–46,15% water holding capacity, water binding capacity in the studied model meat by 9,94% to 12,4%. Developed recipes meat-containing sausages with musk duck meat have high functional and technological properties and enable the production of high and stable quality.

**Keywords:** meat-containing sausage, musk duck meat, protein-containing raw material, functional and technological properties, water binding capacity, water-holding capacity.
DETERMINATION OF SAFETY INDICATORS OF FROZEN FRUIT SEMI-FINISHED PRODUCTS FOR THE PRODUCTION OF SMOOTHIES

D. Odarchenko, E. Sokolova, O. Aksonova, A. Ababova

The actual level of toxic elements content, namely heavy metals, mycotoxins, nitrates, pesticides and radionuclides in dried apples, strawberries, oat flakes is established. And as these indicators are set in fresh and frozen semi-finished products for smoothies made from these ingredients.

Investigation of the content of toxins and mycotoxins in fresh samples showed that the content of residual quantities of these indicators does not exceed the established standards. To determine the content of toxic elements and their changes during storage, the studies were carried out immediately after the manufacture of the semi-finished product, and then after 30 days of storage at -18 ± 2 °C. The study of fresh and frozen fruit semi-finished products confirms their compliance with the requirements of the state system for quality control of food products.

Requirements to the maximum permissible concentrations (MPC) of nitrates in semi-finished products for smoothies of similar composition are not available, but comparing the content of nitrates in the product with the requirements for baby food products makes it possible to consider that the product obtained meets even these stringent requirements. So for canned fruit on the basis of MPC is 50 mg / kg, while the resulting semifinished product contains 47 mg / kg. It is noted that smoothies of similar composition contain ascorbic and folic acids, synergism of these vitamins strengthens the body's ability to excrete nitrates.

Frozen fruit semi-finished product for the production of smoothie drinks successfully combines those nutrients that reduce the intake of radionuclides into the body and increase the body's resistance to radiation. These substances include apple pectin, which binds radionuclides and prevents their absorption in the intestine, natural antioxidants, which increase the body's resistance to various infections and negative environmental effects.

Given the safety indicators, it can be argued that a frozen fruit semi-finished product for the production of a smoothie is safe for the human body.

**Keywords:** safety, toxic elements, nitrates, pesticides, radionuclides, semifinished products, smoothies.

ASSESSMENT OF THE COMPETITIVENESS OF THE «BULBASHKA» FANTASTIC CONFECTIONERY

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The article describes the classification of factors of competitiveness that affect the quality of the product. It is shown that this assessment is not only an information base for making strategic decisions and checking the effectiveness of their implementation, but
also helps to develop recommendations for the application of managerial influence. The development of an active competitive strategy is based on the results of managerial examination of the factors of competitiveness of the goods.

The calculation of the perspective competitiveness of the developed flour confectionery product with high content of gluten and expressed bioprotective properties was estimated, which was estimated using the modeling method, which includes indicators of product quality, information about the analogues of the developed products, the principle of conducting innovations.

Models of Mafina "Bubble" and control are presented. The section shows that when the collagen is added to the hydrolyzate, the structure of the finished product significantly changes in the formulation. This increases pore size, significantly improves color. The "Bubble" maffin has a glossy surface with crunchy crust, unlike control, which is characterized by a darker surface.

It has been shown that the introduction of collagen hydrolyzate contributes to the uniform distribution of moisture, thus, the bulk density of the dough reaches readiness for 10 minutes faster than in the control sample.

As the consumer first of all pays attention to organoleptic parameters and nutritional value, so these criteria of competitiveness were assigned the largest weight factor.

The scale of the competitiveness of the flour product, which includes organoleptic parameters, nutritional value, indicators of innovation and marketing research is presented. According to the results of the calculation of the competitiveness index, it has been established that "Bubbles" with high gluten content and pronounced bioprotective properties will be competitive on the Ukrainian consumer market by improving organoleptic parameters, increasing the nutritional and biological value due to the content of essential amino acids, minerals, vitamins, fats, carbohydrates, fiber and pectin, the presence of preventive properties, which is very important in children’s and hereditary nutrition.

Keywords: competitiveness, quality indices, mafin, bioprotective properties.

QUALITY AND CRYORESISTANCE OF FROZEN STRAWBERRIES PRETREATED IN THE SOLUTIONS WITH STRUCTURE-MAINTAINING PROPERTIES

I. Zamorska

The quality of frozen Dukat strawberries pretreated in the solutions with structure-retentive properties was studied: 1,2 and 3% solution of potato starch and 1 and 2% sugar-pectin solutions. The quality was estimated by organoleptic indicators, mass changes and their cryoresistance, which was determined by the difference of frozen and defrosted berries and expressed in terms of percents to fresh berry mass.
It was established that the treatment of berries in structure-retentive solutions favored considerable preservation of mechanical berry firmness, and it resulted in the increase of consistency rating by 0.2–0.8 points compared with the control. The use of sugar-pectin solutions had a positive effect on a strawberry color. With the mentioned treatment berries preserved an attractive red color and had a shining glossy surface. The total organoleptic rating of frozen berries was increased by 0.6 point.

While freezing strawberries their mass losses appeared to be at the level of 2–3.6% of the initial one. Pretreatment of berries in structure-retentive solutions facilitated the decrease of berry mass by 0.9–1.6% which was due to the formation of a protective layer on a berry surface. After three-month storage in plastic bags the losses were 0.1–1.2%. The berries which were frozen without pretreatment had a much higher indicator of mass loss.

It was proved that the berries, pretreated in structure-retentive solutions, had cryoresistance which exceeded the control by 0.4–2.5%. The berries which were pretreated in 2% sugar-pectin solution had much higher cryoresistance than others, namely 98.3%. Cryoresistance gradually decreased during the storage of frozen strawberries.

2% sugar-pectin solution appeared to be very efficient for pretreatment of berries before freezing.

**Keywords:** freezing, strawberry, solution, cryoresistance, weight loss.