ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

STUDY OF MICROSTRUCTURE OF PHYSICALLY MODIFIED STARCHES TO JUSTIFY THE USE IN SAUCE TECHNOLOGY (p. 4-8)

Svitlana Andreeva, Marina Kolesnikova

The results of studies of the microstructure of physically modified starches are discussed in the paper. Data on the gelatinization dynamics of physically modified starches from the impact of technological factors (heat treatment duration, pH change) were experimentally obtained. Fractional composition of starches, which are characterized by monodispersity of starch grains was investigated and substantiated. According to the particle size distribution of starch grains, PMS from waxy maize "Endura" and tapioca "Indulge" are optimal in terms of monodispersity. Experimental data and theoretical principles on the rheological properties of starches allow to assess the gelatinization dynamics at the microscopy level. The results obtained indicate the possibility to use physically modified starches, which meet the functional and technological properties of thickeners, in particular, thermal and acid stability. The results obtained are the basis for developing the technology for new food products – sweet sauces based on fruit and berry raw materials using physically modified starches.

Keywords: physically modified starches, starch grains, microstructure, fractional composition, pH.

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PURIFICATION AND SEPARATION OF SUNFLOWER-SEED OIL IN THE TRAVELING ELECTRIC FIELD (p. 9-13)

Igor Nazarenko

The results of experimental studies on the purification and separation of sunflower-seed oil in the traveling electric field were presented. Studies were conducted on a pilot plant, which is the processing unit and power supply. In processing unit, there is a multilayered system of cylindrical electrodes, creating the traveling electric field.

The possibility of the purification process of sunflower-seed oil from nonoleaginous impurities and phosphatides and separation of these fractions in the traveling electric field was shown. Technological parameters of the process: time; voltage and frequency of the electric field that allow to obtain the purification rate of oil from nonoleaginous impurities of 98 %, and from the hydrated phosphatides – 75 % were justified. During the separation of these fractions, the separation factor of nonoleaginous impurities reaches 90 % and phosphatides – 68 %.

Keywords: electricity, field, voltage, purification, separation, oil, electrode, dielectric, phosphatides.

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FERMENTATION OF GRAIN MASH OBTAINED FROM ACTIVATED WATER (p. 13-16)

Nataliya Pankiv, Liubov Palianytsia, Ruslana Kosiv, Nataliya Berezovska

The paper proposes using the electrochemically activated water (catholyte and anolyte) in producing alcohol from starch raw materials, namely spelt, which possesses various functional properties. Catholyte and anolyte with the pH values of 10.7–11.1 and 2.1–2.8 respectively, were used at the batching stage. For the control sample, tap water with pH 7.4–7.8 was used. Batches were prepared with different spelt and water ratios – 1: 3 and 1: 2.2.

Conditions of hydro-enzymatic batch treatment were as follows: dilution was conducted at 86–89 °C for 2.5 h, saccharification - at 55–60 °C for 30 min. Dry alcohol yeast Saccharomyces cerevisiae were used as alcoholic fermentation activators. Mash fermentation was carried out at 33 °C.

As a result of the research, the expediency of batch preparation from spelt based on catholyte and anolyte was proved since solids content in the mash increases by 2.1–4.3 %. Brew, obtained from this mash has good technical and chemical characteristics. The alcohol content in it increases by 3.7–11.4 %, so does the alcohol yield.

Keywords: electrochemically activated water, catholyte, anolyte, spelt, mash, fermentation, brew, alcohol.

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INFLUENCE OF EXOGENOUS TREATMENT WITH ANTIOXIDANTS ON DYNAMICS OF PHENOLIC COMPOUNDS DURING STORAGE OF APPLES (p. 17-22)

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The changes in the content of phenolic compounds in apple fruits during maturation on the maternal plant and storage in the refrigerator were studied.

It was found that the average content of phenolic substances in picking-maturity apples, grown in the south-steppe subzone of Ukraine was at the level of 192.41 mg/100 g. Analysis of variance has confirmed that the accumulation of phenolic compounds in apples is significantly influenced (with a share of 37.3 %) by weather conditions for fruit formation. The main weather factor that most affects the content of phenols in picking-maturity apples is the average sum of effective temperatures above 10 °C.

During storage of fruits, phenolic compounds also undergo significant changes. In the first 4–5 months of storage, in apples there is an increase in the content of phenolic compounds, which is caused by post-harvest ripening of fruits. The maximum amount of phenols was observed on the 120th day of storage in control fruits for grades Idared and HoldenDelishes and on the 150th day – grades Reinette Simirenko and Florina. These periods coincide with reaching full harvest maturity and the highest P-vitamin value of apples. Further, overripening processes of fruits, accompanied by a reduction in content of phenolic compounds begin.

Treatment with antioxidant compositions lowers the activity of polyphenol oxidase and slows down the oxidation of phenolic compounds.

Analysis of variance has revealed that the final content of phenolic compounds at the end of storage of apples was predominantly influenced by weather conditions for the fruit formation with 40.5 % share of influence. Exogenous treatment with antioxidant compositions eliminates the influence of many weather factors on saving phenolic compounds and simplifies forecasting.

The models for forecasting the content of phenols in picking-maturity apples and after the storage process, depending on weather factors were developed.

Keywords: apples, storage, antioxidants, treatment, phenols, loss, weather, temperature, precipitation, humidity.

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EFFECT OF PARTIAL REPLACEMENT OF SODIUM CHLORIDE BY THE PROTEOLYSIS IN THE PRODUCTION OF BRYNZA (p. 23-27)

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The possibility of partial (20 %; 30 %) replacement of NaCl by KCl in the production of brined cheese brynza from sheep's milk and the impact of such change on the content of free amino acids

was investigated. Since it is necessary to reduce the salt content in foods in order to decrease the risk of many diseases, our goal was to make a product with a reduced amount of salt, but preserve all the quality parameters of the product. Because the reduction of salt leads to a deterioration in the quality of cheese, the alternative was a partial replacement of sodium chloride by potassium chloride. As a result, brynza with partial replacement of sodium chloride by potassium chloride in the brine during ripening was made. The content of free amino acids in cheese was studied. The results of the experiment have shown positive effects of partial replacement of NaCl in an amount of 20 % and 30 % on the content of free amino acids in brynza. The number of essential amino acids has increased. The content of histidine, which causes the appearance of bitterness and ammonia has decreased. Brynza, made with partial replacement of salt is characterized by organoleptic parameters that are fully compliant with current standards. Consistency in the experimental samples was denser compared with a control sample. The cheese was characterized by a more pronounced cheese flavor, but was less salty, which did not worsen the taste. It should be noted that the protein content has also increased due to using potassium chloride in an amount of 20 % and 30 %. The results show the feasibility of the research.

Keywords: brynza, free amino acids, organoleptic parameters of cheese, sodium chloride, potassium chloride.

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INFLUENCE OF THE TRANSGLUTAMINASE ENZYME ON PROPERTIES OF FLOUR PROTEINS (p. 28-33)

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The effect of transglutaminase in the presence of different commodity forms of animal protein on the aggregating ability of gluten, ion-binding ability of proteins in gluten-free flour was studied. Given that increase in the strength of the hydrate layer around the protein molecule allows to reach an increase in the aggregation stability of protein, it was considered appropriate to investigate the effect of additives on the aggregating ability of gluten. To prove the mechanism of interaction of additives with gluten-free flour, potentiometric titration method was used.

Increase in the aggregating ability of gluten and ion-binding ability of flour proteins in the presence of the studied additives was proved. Nonadditive binding of hydrogen ions and hydroxyl ions by gluten-free flour proteins, which indicates the interactions among different proteins was found. Also, the peculiarities of the process of aggregation of gluten proteins in solution in the presence of the mentioned additives, which lie in increasing the overall degree of aggregation and its rate were determined.

The results are aimed at improving the structural and mechanical properties of flour dough, pasta and flour formed products, gluten-free bread. Improved quality of gluten-free bread - a noticeable increase in the volume and porosity of bread, better shape and appearance was confirmed experimentally. Herewith, enzyme together with gelatin have the greatest impact. Also, the structural and mechanical properties of pasta dough and cooking properties of prepared pasta are improved.

Keywords: transglutaminase, enzyme, celiac disease, gluten-free flour, gluten, aggregation, pasta, bread.

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TECHNOLOGY OF DRINKS BASED ON WATER EXTRACTS OF ROSEHIP, SEA BUCKTHORN AND VIBURNUM (p. 34-37)

Tatjana Kaplina, Denis Mironov

The results of developing the technology of drinks, fruit drinks and fizzes, made of plant extracts of rosehip, sea buckthorn and viburnum, previously processed in the vortex layer of ferromagnetic particles are presented in the paper. Plant extracts were prepared by the traditional infusion at a constant temperature. Processing in the vortex layer of ferromagnetic particles allows to reduce the infusion time by 4-6 times in comparison with the industrial extraction technologies.

Based on the studies, technologies of drinks “Shypshynka”, “Zhyvynka”, “Kalinka” fruit drinks “Syla”, “Badyorist”, “Energiya”, fizzes “Shypshynoviy”, “Oblipykhovyi”, “Kalynovyi” were developed. Previous studies have shown an increase in the content of biologically active substances in drinks, made using the developed technologies in comparison with traditional methods. In addition, the patterns of preserving high quality drinks, based on extracts from plant raw material, processed in the vortex layer of ferromagnetic particles were determined. A project of TU U “Soft drinks based on plant extracts” and technological instruction TI “Technological instruction for the production of soft drinks based on plant extracts” was developed.

Keywords: technology of soft drinks, vortex layer of ferromagnetic particles, water plant extracts.

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INTEGRAL ASSESSMENT OF ANTIOXIDANT STATUS OF FRUIT VEGETABLES (p. 38-41)

Olesia Priss, Vera Malkina, Valentina Kalitka

The integral assessment of the antioxidant status of fruited vegetables can be a key when choosing a product suitable for storage. Making the integrated assessment of the antioxidant system of fruited vegetables taking into account the differences in units of measuring the system components is a difficult task. For solving complex multicriteria informal problems, the hierarchy analysis method was used. The method for determining the generalized integral assessment of the antioxidant status of fruited vegetables based on the hierarchy analysis method was proposed. The components of the antioxidant system of protecting fruited vegetables tissues were ranked. The integral assessment showed that among the studied fruits pepper had the highest antioxidant status (I_{AO}=0.43), squash had the minimum (I_{AO}=0.12). Due to a powerful system of high antioxidants, cucumbers had higher integrated assessment (I_{AO}=0.25) than tomatoes (I_{AO}=0.20). Low-molecular antioxidants make the main contribution to the antioxidant status of solanaceous vegetables. Enzymatic antioxidants play a leading role in antioxidant protection of tissues in pumpkin vegetables.

Keywords: integral assessment, antioxidants, fruited vegetables, hierarchy analysis method, ranking.

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RESEARCHES OF SYSTEM WATER OF FOOD RAW MATERIALS BY THERMODYNAMIC AND MOLECULAR-KINETIC METHODS (p. 42-46)

Micola Pogozhikh, Andrey Pak, Micola Chekanov, Egor Ishtvan, Igor Pavliuk

The paper deals with developing views on the humidity of food raw materials and products from them that allow to predict and scientifically justify functional and technological role of a particular component of food raw materials or product in terms of its interaction with water.

It is noted that despite the variety of humidity research methods and plenty of information, obtained using them, the content of the concepts of “free” and “bound” water is not clear enough, their role

in the material, absolute and relative content is not investigated fully and accurately. The aim of the research was to obtain new scientific data about the condition and structure of water in various food products and raw materials, depending on their processing technologies; define correlation between the results of studies of humidity in food raw materials and products, obtained by different thermodynamic and molecular-kinetic methods.

Within the main concept of the paper, the notion of "system water" was introduced, and expediency of calculating molar concentrations for the food system components was justified. Using different thermodynamic and molecular-kinetic methods, system water of different food raw materials and products was investigated. The patterns of changes in the condition and structure of water in food raw materials and products, occurring in their processing were determined by compiling information on the water condition and structure during interaction with the components that make up food raw materials and products.

It is noted that the research results and obtained patterns for the system water of food raw materials and products allow to visualize the processes of humidity change under different external factors.

Keywords: system water, food raw materials, thermodynamic and molecular-kinetic methods, molar concentration.

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STUDY OF INTERPHASE ADSORPTION LAYERS TO DEVELOP MILK PRODUCTS (p. 46-51)

Svetlana Omel'chenko, Andrey Goralchuk

The paper considers forming interphase adsorption layers in emulsions and foams using a surfactant mixture and milk proteins. The main objective of the study is to substantiate using the surfactant mixture and milk proteins, which define the dispersed system stability. The emulsion formation process at temperatures above the fat crystallization temperature was carried out by determining the boundary shear stress, formed interphase adsorption layers, which was performed in 4×3600 s (interphase adsorption layer formation time that has the largest value of the boundary shear stress at a temperature of 20±1 °C. Behavioral mechanisms of surfactants and milk proteins on the interphase surface were substantiated in the paper in order to determine their rational concentrations. The presented method allows to define the layer strength of the system without surfactants and, with introducing the surfactant mixture, determine the rational composition of the surfactant mixture, which allows to vary the strength of interphase adsorption layers and as a result produce foam-emulsion systems with the high foaming ability, stability and ductility. Research results can be applied by food technologists, as well as technologists specialized pastry shops to create foam-emulsion systems such as creams, souffle, ice-cream, etc. We propose to use milk proteins and surfactant mixture to control the stability of dispersed systems such as foams and emulsions, as well as stable foam-emulsion systems.

Keywords: foam, emulsion, stability, interphase adsorption layer, foam-emulsion system, surfactant

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PREPARATION AND CHARACTERIZATION OF IRON COMPLEXES BASED ON POLYSACCHARIDES FROM AGARICUS BISPORUS (p. 52-57)

Natalya Cherno, Sophya Ozolina, Nikitina Nikitina

According to WHO, correction and prevention of iron deficiency are one of the global problems of mankind. Under these conditions, the immune response dysfunction develops. Therefore, for the prevention and correction of iron deficiency it is advisable to use drugs and dietary supplements that combine antianaemia and immunomodulatory properties.

This problem can be solved by preparing iron complexes based on polysaccharides of mushroom (Agaricus bisporus), in which β–(1→3)/(1→6)–D–glucans – active immunomodulators predominate.

Complexes were prepared by mixing polysaccharide solution, separated from mushroom and ferric (III) chloride solution when heating. The pH value was adjusted by adding concentrated alkali solution. The mass ratio of iron: polysaccharides was varied from 1:0.25 to 1:3.00 by changing the polysaccharide solution concentration from 0.019 to 0.230 %.

The possibility of preparing soluble iron complexes based on mushroom polysaccharides was shown. It was found that their yield and composition depend on the process conditions. The maximum yields of complexes with a high iron content can be obtained at a mass ratio of the inorganic and organic components of 1:1.0 at pH=12.0 and 1:2.5 at pH=8.5.

Using IR and UV spectroscopy, gel filtration chromatography it was confirmed that the resulting products are nanosized complexes of polycyclic ferric hydroxide and mushroom polysaccharides. It is possible to predict the polyfunctional effects of produced iron complexes – along with antianemic, they can exhibit immunomodulatory activity.

In Ukraine, analogs of such drugs are currently unknown, their further comprehensive study is of interest for both Nutritiology and Medicine.

Keywords: complex, iron, polysaccharide, glucan, Agaricus Bisporus, iron deficiency, anemia, immunomodulator

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DEVELOPMENT OF TECHNIQUES FOR CAPILLARY CHROMATOGRAPHY OF TERPENE HYDROCARBONS AND OXYGENATED COMPONENTS OF ESSENTIAL OILS (p. 57-62)

Natalia Frolova, Olena Usatiuk

The analysis of existing techniques for chromatographic study of essential oils has shown that under the same chromatography conditions of terpenes and their oxygenated derivatives, poor separation of peaks in the chromatogram, their imposition or masking of one peaks by some other is observed.

The paper presents the study of the conditions of the gas chromatographic analysis of essential oils on capillary columns with a maximum separation of terpene hydrocarbons and oxygenated components. When developing techniques, stationary phases were chosen, gas-carrier and its rate, heating temperatures of columns, detector, injector were selected. According to the results of experiments, Carbowax 20M capillary column with a polar stationary phase was used in the separation technique of oxygenated aromatic components of essential oils.

For the separation of terpene hydrocarbons, a column with a nonpolar stationary phase – HP-5MS (crossliness 5 % PHME siloxane) FilmThickness: 0,25 mm, lenght 30 m, phaseratio 250, column ID 0,25 mm was used in the technique.

Both techniques are characterized by high separation efficiency of the essential oil components and allow to determine their quantitative ratios with the total error j=15 %, with p=0,95.

The developed techniques can be implemented on the flame ionization detector chromatograph, contain all the necessary data to study the composition of essential oils of both essential oil plants and aromatic plants of the new selection.

Keywords: essential oil, stationary phase, terpene hydrocarbons, oxygenated components, gas chromatographic analysis.

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EFFECT OF HEAT TREATMENT ON THE MOLECULAR MOBILITY IN THE TRIACYLGLYCEROL (p. 63-67)

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Relevance of the work is caused by the widespread introduction of new technologies in the food industry processes, requiring the use of modern techniques for the quality analysis of products at all stages of their processing and storage. Therefore, the purpose of the paper is to study the physicochemical properties of refined sunflower oil to select rational modes of cooking healthy foods.

Thermophysical and dielectric properties of a number of refined sunflower oil samples with different thermal history were investigated. The samples were kept in an air thermostat at isobaric conditions at heat treatment temperature of 433 K. Temperature dependences of oil specific heat in the temperature range 173–423 K were obtained by the thermophysical method on dynamic calorimeter with a heating rate of 3 K/min. Complex permittivity of oil samples in the temperature range 173–323 K at frequencies f=1, 5, 10, 50 kHz was studied using an automated system based on AC Bridge R5083.

Molecular mobility and nature of relaxation and phase transitions was considered and, based on this, the changes in the structure and chemical composition of sunflower oil as a result of heating in the normal use conditions were studied. This is of great applied importance since under these conditions (at T > 373 K in air) processes of thermal and thermooxidative degradation of oil with the formation of harmful substances (fatty acid peroxides, acrolein, etc.) that can go into food are possible.

Keywords: triacylglycerol, specific heat, complex permittivity, relaxation transition, phase transition.

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