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STUDYING THE EFFECT OF SESAME FLOUR ON THE TECHNOLOGICAL PROPERTIES OF DOUGH AND BREAD QUALITY (p. 6-16)**Olena Bilyk**National University of Food Technologies, Kyiv, Ukraine
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It has been proven that the sesame seed chemical composition when compared with wheat flour is distinguished by the larger content of mono- and polyunsaturated fatty acids, mineral substances, protein, valuable for its amino acid composition, dietary fiber, and vitamins. In order to extend the assortment of bakery products with health properties, it is recommended that formulations of wheat bread should include sesame flour in the amount of up to 10 % to the weight of flour. It was established that the developed product with added sesame flour better satisfies the body need in proteins, when compared with wheat bread, by 7 % on average, and provides the body with a larger amount of fat, by 15.5 % with the predominant content of unsaturated fatty acids, particularly ω -6 and ω -9 acids, minerals, specifically calcium, magnesium – by 26 % and 30 %.

We have established patterns of influence of sesame flour on the formation of the structural-mechanical properties of dough. It was found that the introduction of sesame flour to dough leads to a decrease in the amount of gluten in the dough and its elastic properties, improves the plastic properties of dough, which leads to a shorter duration of dough kneading. Given the reduction in the specific volume of the dough with added sesame flour after 180 minutes of fermentation, it is recommended that the duration of dough fermentation when using a straight-dough technique should not exceed 120 minutes.

It was established that following the introduction of 10 % of sesame flour the finished products contain up to 3 % of fat. Based on that, we can recommend replacing up to 3 % of margarine in the existing formulations of bakery products with sesame flour.

It has been proven that the products with added sesame flour are better in retaining freshness, which is confirmed by the decrease in the friability of the crumb, an increase in its overall deformation and

hydrophilic properties; they also contain more aromatic compounds than the bread baked from wheat flour.

Keywords: wheat bread, sesame flour, staling, gluten, structural-mechanical properties of dough.

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ANALYSIS OF BACKGROUND AND DEVELOPMENT OF TECHNOLOGICAL PRINCIPLES OF MILK PROCESSING BY COUPSULATION (p. 17-24)

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It was proved that milk possesses unique potential as a raw material. It was determined that the most effective way of using the potential of dairy raw materials, in particular the potential of calcium ions, is application of a technical solution for preparation of encapsulated forms of dairy raw material based on sodium alginate. This process was realized by the principle of drop extrusion of the dairy raw material through air into solution of a high molecular polyelectrolyte,

such as sodium alginate compound. It was confirmed that the calcium potential of the “milk” system is low-dynamic and inefficient. It has been established that activation of this potential is possible both by reducing pH of the “milk” system during fermentation and blending it with the “whey” system. It has been revealed that blending of milk and whey with emergence of a new “milk-whey” system having the necessary concentration of calcium ions does not affect colloidal stability of milk. On the other hand, it provides the “milk” system with a highly effective low-energy potential in a form of potential of calcium ions which effectively realize the encapsulation process. It was substantiated that the open technological “milk” system can be transformed to the “milk-whey” system with a limited availability in an encapsulated form and hence with a minimized influence of perturbing factors, that is, with an increased controllability of the technological processes. It has been experimentally confirmed that blending of the “milk” and “whey” systems in a 70:30 ratio is a prerequisite for accumulation of a critical concentration of ionic calcium (24–25 mg %). This ensures production of encapsulated products with a regular spherical shape. At the same time, this ratio of components does not significantly affect the mixture pH which is also an important criterion for realization of the encapsulation process. A model of processing milk by encapsulation has been developed. It was proved that the developed approach makes it possible to realize the potential of milk with obtaining of food products featuring new consumer properties.

Keywords: milk raw materials, milk processing, thermodynamic potential, ionic calcium, sodium alginate, encapsulation, encapsulant.

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EFFECT OF BLANCHING AND TREATMENT WITH A SALT SOLUTION ON THE BIOLOGICAL VALUE OF BROCCOLI (p. 25-31)

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We studied and analyzed the components of the biological value of broccoli, the variety of Parthenon, cultivated in the regions of Ukraine. The research results are reported, the changes in the content of ascorbic acid, isothiocyanates were analyzed, as well as a pigment composition: chlorophyll and β -carotene in the freshly harvested broccoli, as well as after its pretreatment before freezing: by blanching and aging in a solution of food salt.

It was proved that the best technique for the pre-treatment of broccoli before freezing, which allows its original consumer properties to be maximally preserved, is its aging in a 3-% food salt solution for 20 minutes. Compared with blanching, aging in a salt solution contributes to the maximum retention of the biological value of broccoli.

It was established that broccoli of the variety Parthenon contains 116.4 mg/100 g of ascorbic acid. After blanching, losses are 19.3 %. We confirmed a significant reduction in the content of isothiocyanates, by 43 %, as compared to the content in the original raw

material. The loss of chlorophyll is 26 %, specifically a-chlorophyll – 10 %, b-chlorophyll – 16 %. The ratio of the a- and b-chlorophyll forms changes as well.

The results indicate that when aged in a food salt solution, the losses of ascorbic acid are 5 %, isothiocyanates – 28.2 %. The content of β -carotene does not change in comparison with the original raw material, while the chlorophyll content increases by 6.3 %. There are no changes to the ratio of the chlorophyll forms. Stabilization of the content of ascorbic acid is due to the lack of high-temperature treatment and a partial inactivation of ascorbate- and polyphenol oxidase, which is explained by the capability of chlorides to remove copper ions from copper-containing compounds to which these enzymes belong.

The insignificant losses of vitamin C are due to the water solubility of ascorbic acid. A pre-treatment in a food salt solution induces an increase in the content of a-chlorophyll and b-chlorophyll, which is predetermined by the compensatory reaction.

Keywords: broccoli, biologically active substances, vitamin C, isothiocyanates, chlorophyll, pre-treatment.

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DEVELOPMENT OF A TECHNOLOGY OF VITAMINIZED BLENDED VEGETABLE OILS AND THEIR IDENTIFICATION BY THE FATTY ACID AND VITAMIN CONTENTS (p. 32-43)

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Due to the comparative analyses of physicochemical properties and fatty acid composition of vegetable oils, a reasonable choice has been made. Namely, sunflower, pumpkin, flaxseed, and camelina oils have been found optimal for the preparation of blends with a rational ratio of ω -6: ω -3 fatty acids in two-component (10:1, 5:1) and three-component (5:1) mixtures.

A reasonable combination of vegetable oil blends with a rational ratio of ω -6: ω -3 fatty acids has been substantiated. Since oils belong to polyfunctional physiologically active products with a wide range of technological properties, they can be used with fat soluble vitamins (tocopherol and β -carotene). This reduces the oxidation processes in the vitaminized blended vegetable oils (VBVOs).

A blended vegetable oil is a system in which PUFAs of the ω -6 and ω -3 groups are present in certain ratios and are subject to oxidative damage, to a greater extent due to the increased content of PUFAs. In accordance with the specifics of the blended oils as enriching ingredients, fat-soluble vitamins E (tocopherol) and β -carotene were used, which are not only physiologically important components for the human body but also active natural antioxidants. It has been

found that adding a 0.2 % solution of β -carotene in the amount of 3.75 g and 1 % of tocopherol solution in the amount of 2.5 g provides 30 % of the daily requirement of these vitamins for the human body.

The appropriateness of the joint use of tocopherol and β -carotene is based on the finding that it stabilizes oxidation and increases the induction period 1.5–2 times.

The fatty acid composition of the created recipes of the blended systems with the ratio of PUFAs of the ω -6 and ω -3 families, in particular for healthy people's nutrition with a ratio of ω -6: ω -3 being equal to 10:1; for adequate nutrition the ω -6: ω -3 ratio should be 5:1, which indicates the expediency of the selected vegetable oils for the creation of blended systems, balanced on the fatty acid composition exactly in the proposed ratios.

The technologies of blending and vitaminizing vegetable oils have been developed and introduced at the Odesa Stone Fruit and Vegetable Oils Plant, AVA Ltd. (Ukraine).

When solving the problems of substantiating the blending and vitaminization technologies, it has been proven that these operations can be performed with equipment that is present in almost all oil and fat processing factories. The proposed blending technology involves only two stages: stage 1 is the dosage of the prescription amount of oil 1 in a temperature-maintaining container; stage 2 is the dosage of the prescription amount of oil 2 in the container with oil 1 and mixing for 5.0...10 min at $t=28...30$ °C. It does not require much time and allows the preparation of oil and mixing within 10–15 minutes.

Keywords: vegetable oils, refined oils, unrefined oils, vitaminized blended vegetable oils (VBVOs), fatty acid composition.

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THE STUDY OF INFLUENCE OF NATURAL ANTI-OXIDANTS ON QUALITY OF PEANUT AND LINSEED OIL BLENDS DURING THEIR STORAGE (p. 44-50)

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Influence of various natural antioxidants (oil extracts of sage and black currant leaves, garlic and hips) on in-storage quality of oils has been studied. Dynamics of the acid and peroxide numbers of fat of the developed oil samples was studied. Influence of natural antioxidants on preservation of polyunsaturated oleic, linoleic, linolenic fatty acids in peanut and linseed oil blends was established.

When developing blended oils with an optimal fatty acid composition, it is advisable to use linseed oil which is characterized by a high content of ω -3 fatty acids. Since polyunsaturated fatty acids have a high degree of oxidation and degradation, they are unstable. This causes certain difficulties both in production and storage of vegetable oils and solving the problem of improving the product quality.

It was established that the use of natural antioxidants affects preservation of quality of peanut and linseed blends, namely, organoleptic properties, acid and peroxide numbers of fat. It was proved that introduction of the studied oil extracts in an amount of 5 % increases the oxidation resistance of peanut and linseed oil blends by 1.2–1.7 times.

It was shown that to evaluate the effect of plant extracts on quality of the developed blends, it is expedient to use the content of polyunsaturated fatty acids as the main criterion. It was established that natural antioxidants contribute to preservation of 69.0–73.0 % of linoleic acid, 73.5–78.9 % of oleic acid and up to 82 % of linolenic acid from the initial content in peanut and linseed oil blends. The ratio of polyunsaturated fatty acids ω -6: ω -3 in all samples remained at the level of ratio of these acids in fresh blends, namely 4:1.

The use of plant extracts in the formulations of peanut and linseed oil blends significantly slows down the processes of hydrolysis and self-oxidation which ensures in-storage preservation of consumer properties of new oils with an optimized fatty acid composition.

Keywords: peanut and linseed blend, natural antioxidants, AN and PN of fat, storage of oils.

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SUBSTANTIATION OF THE DEVELOPMENT OF FORMULATIONS FOR ORGANIC CUPCAKES WITH AN ELEVATED PROTEIN CONTENT (p. 51-58)

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In order to develop the formulations for organic cupcakes with an elevated protein content, we examined and analyzed the amino acid composition of four samples of flour: wheat flour, organic wheat flour, organic rye flour and organic buckwheat flour. It was established that the highest biological value was demonstrated by the sample of organic buckwheat flour (68.69 %). A quite high biological value was demonstrated by the proteins of organic rye flour – 67.85 %. Based on data from the study into raw materials, we developed two formulations of organic cupcakes: “Grechanyk” and “Zhytnitsa”. We used organic buckwheat flour in the formulation of the cake “Grechanyk”, as well as the organic ingredients: cane sugar, agave syrup, butter, sesame oil, dried fezalis, raisin, dried eggs, flax bran. In the cupcake “Zhytnitsa”, we used 66 % of organic wheat and 34 % of organic rye flour, as well as sugar cane, rice syrup, butter, sesame oil, dried cranberry, dried mulberry, eggs, rye bran.

It was established that the developed cupcakes were characterized by high organoleptic indicators. We determined the following physical-chemical quality indicators: a mass fraction of moisture, alkalinity, and a mass fraction of ash. The following safety indicators were determined: the content of toxic metals and aflatoxin B1. The samples of new cupcakes met the standards in terms of quality and safety indicators. The highest protein content was demonstrated by the cupcake “Grechanyk”, 7.1 g/100 g, and the lowest – by control sample based on wheat flour (4.9 g/100 g).

These results indicate that the use of organic buckwheat flour in the confectionery and baking industry is promising for creating functional environmentally-friendly products. Given the fact that Ukraine is the main supplier of organic raw materials, rather than finished products, the results obtained could be utilized at the enterprises in confectionery industry to extend the range of organic products.

Keywords: amino acid composition, safety, protein composition, organic buckwheat flour, organic rye flour.

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SUBSTANTIATION OF THE MECHANISM OF INTERACTION BETWEEN THE CARBOHYDRATES OF RYE WHEAT FLOUR AND NANOPARTICLES OF THE POLYFUNCTIONAL FOOD ADDITIVE “MAGNETOFOOD” (p. 59-68)

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Moisture-retaining capacity (MRC) is one of the most important functional-technological properties. The food additive «Magnetofood» produces a comprehensive effect, including MRC. That explains the importance of studying the MRC mechanism of «Magnetofood». We have established the mechanism of interaction between nanoparticles (NP) of the food additive «Magnetofood» and the functional groups of biopolymers of the carbohydrate complex of rye-wheat flour. A «cluster-capillary» MRC model of «Magnetofood» with dough carbohydrates is proposed. Water molecules are initially adsorbed, particularly at the surface of starch grains and in micro capillaries. The «Magnetofood» NP, due to their nano dimensions, active and ionized surface, biocompatibility with the polymeric molecules of carbohydrates, easily penetrate their pores (micro-capillaries). The «Magnetofood» NP possess a high chemical potential; they, consequently, activate, for example, the surface of starch grains and the inner surface of capillaries. The nanoparticles of «Magnetofood» form complexes with the OH-groups and ether of oxygen of amylose and amylopectin of starch through coordination bonds. There emerge the supramolecular ensembles «Magnetofood»-carbohydrate» of the «cluster» type. The «Magnetofood» NP electrostatically interact also with the dipoles of water. Strong aqua complexes thereby form. The H₂O molecules then penetrate the least organized sections of chains of polysaccharide macromolecules. They are retained there by the hydrogen bonds with the «Magnetofood» dipoles and the ionogenic groups of carbohydrates: atoms of hydrogen and oxygen of the OH-groups of D- glucopyranose residues. Aqua complexes form around the «Magnetofood» NP; solvato associates form in the «clusters». Polymer chain diverge thereby improving the penetration of H₂O dipoles inside the carbohydrate. Such water absorption weakens the intra-macro-molecular bonds in the dense layers of the polysaccharide and contributes to the pen-

etration of moisture inside. We have experimentally determined that the food additive «Magnetofood» produces a comprehensive effect: sorption, complexing, moisture- and fat-retaining. That leads to an increase in yield and improves quality of bakery products. In this context, the research results are of interest not only for Ukraine but also for the scientific community in other countries.

Keywords: polyfunctional food additive, carbohydrate complex of rye-wheat flour, mechanism of interaction, «cluster-capillary» model.

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