ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

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IDENTIFICATION OF CRONOBACTER SPP (ENTEROBACTER SAKAZAKII) FROM RAW MILK AND ENVIRONMENTAL SAMPLES OF DAIRY FARMS (p. 4-10)

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The aim of this study was to identify the presence of Cronobacter spp (formerly Enterobacter sakazakii) in bulk tank milk and facilities of dairy farms in Sumy Region (Ukraine). A total of 418 samples of bulk tank milk, udder secretion of cows with a subclinical form of mastitis, and environmental samples were collected from 5 local dairy farms of Sumy region (Ukraine). All samples were analyzed for the presence of Cronobacter spp using the United States Food and Drug Administration (FDA) method. Twenty isolates were selected that had typical morphological, cultural and biochemical properties of Cronobacter spp and then they were subjected to a molecular analysis by polymerase chain reaction (PCR) amplification of 16S rRNA. The results indicate that the dairy farm environments, including the cows and the milk are a potential source of Cronobacter in raw milk. This is the first report of Cronobacter spp prevalence in bulk tank milk and environmental samples in the dairy farms of Sumy Region, Ukraine, indicating potential health risk associated with cow's milk. These data will be valuable for microbiological risk assessment and help authorities to develop strategies to mitigate health risk for humans.

Keywords: Cronobacter spp (formerly Enterobacter sakazakii), bulk tank milk, dairy farms, PCR, 16S rRNA.

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STUDY OF QUALITY INDICATORS OF FERMENTED-MILK CHEESE OBTAINED FROM SKIMMED MILK AT A CONTROLLED CONTENT OF CALCIUM (p. 11-21)

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The results obtained in the study of influence of calcium content in skimmed milk on organoleptic, physical, physical-chemical and technological properties were summarized. A method for regulating calcium content in milk using a natural ion exchanger, sodium alginate, was proposed. It has been shown that the use of natural sequestrants allows producers to reduce calcium content in milk to 50 %. In the framework of the conducted studies, a correlation between the degree of milk decalcification and the physical and chemical properties of the fermented clot and whey has been established. It was shown that removal of calcium from milk results in the destruction of caseinate-calcium-phosphate complex with a simultaneous decomposition of the casein micelles to submicelles. The found effect manifests itself by formation of a characteristic fermented clot and an increase in the weight fraction of soluble protein in whey. The influence of calcium content in milk on qualitative parameters of fermented-milk cheese, its microstructure and dispersion of protein particles was established. The boundary conditions of decalcification of milk were substantiated which allows producers to obtain fermented-milk cheese with high qualitative indicators. It was proved that decalcification of milk in a rational interval and at specified parameters enables production of fermented-milk cheese which is characterized by a spreadable consistency, absence of crumbs and whey separation. The organoleptic properties of fermented-milk cheese completely correlate with the indicator of moisture retaining ability which regularly grows with an increase in decalcification within a rational interval. Dispersion of fermented-milk cheese and the size of protein particles were established. A direct relationship between the size of protein particles and sedimentation stability of systems was revealed. An increase in colloidal stability was observed at a reduced calcium content resulting in a growth of the fraction of particles with a smaller diameter. The results obtained in the study completely reflect the theory of decomposition of casein micelles at a reduced calcium content in milk.

Keywords: skimmed milk, regulated calcium content, decalcification, sodium alginate, fermented-milk cheese, casein micelles, microstructure, dispersion.

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STUDY OF THE STATE OF MOISTURE IN THE CURD PASTE WITH SUMACH EXTRACT AND THE ADDITION OF BUCKWHEAT GROATS (p. 22-26)

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We investigated the state of moisture in the curd paste with sumach extract with added non-toasted buckwheat groats (buckwheat groats) using a method of differential-thermal analysis. The base for curd paste was soft dietary curd. 10 % of extract of the spice sumach on milk whey (5 % of extractive substances) and 25 % of a buckwheat-whey mixture were added to the acid-milk base.

The content of the adsorption moisture in the buckwheat-whey mixture is higher compared with the soft dietary curd. The highest value of pre-exponential factor and activation energy of the buckwheat-whey mixture predetermines the capability of retaining free moisture and serve as the moisture-binding component.

A comparative analysis was performed for the state of moisture in the curd paste with buckwheat groats, in the curd paste with a moisture-retaining component, modified starch (E 1410) (dosage is 1.3 %). The amount of adsorption moisture in the curd paste with buckwheat groats was 32 %, whereas the curd paste, stabilized by modified starch, contained 32.5 %, which proves the efficiency of using buckwheat groats as the moisture-binding component.

Keywords: state of moisture, differential-thermal analysis, curd paste, non-toasted buckwheat groats.

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EFFECT OF ABIOTIC FACTORS ON THE RESPIRATION INTENSITY OF FRUIT VEGETABLES DURING STORAGE (p. 27-34)

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The influence of abiotic factors on the respiration intensity of vegetables during storage is investigated. Considerable variability of respiratory metabolism was established over the years of research for cucumbers (27.51 %), zucchini (36.40 %) and pepper (exceeding 37 %); it is the lowest for tomato (up to 13.29 %). For all vegetables, regardless of the varietal specificity, we found a positive correlation between the intensity of respiration and the total of active temperatures during fruit formation period. The inverse correlation was established between respiratory activity and the amount of precipitation during vegetation season. A two-factor variation analysis revealed that the influence of abiotic factors on the level of respiration is essential, varying from 24.29 to 90.68 %.

We analyzed the degree of influence of varietal and species specificity on the intensity of respiration. It was found that this indicator plays a key role in respiratory activity. Vegetables that are treated thermally with antioxidants are characterized by the deeper delay in respiratory activity. For tomatoes, thermal treatment can reduce the level of climactericx by 9 % compared to control. The duration of storage of the treated vegetables is extended by 1.3–1.7 times.

Keywords: storage, vegetables, thermal treatment, antioxidants, intensity of respiration, abiotic factors, correlation.

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ANALYTICAL STUDY OF THE MODEL OF CAPSULE FORMATION OF THE SYSTEM "FOOD LIPIDS – CALCIUM ALGINATE" (p. 35-40)

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At present, a direction of the encapsulation of raw materials, different in origin, is very important in the food and pharmaceutical industries, as evidenced by numerous scientific studies into this issue the world over. The use of ionotropic polysaccharides makes it possible to provide lipid food systems with fundamentally new properties. They enable obtaining traditional oils, fats, and mixtures in the dosed form and in individual edible packaging. This promotes perception of lipid raw material as a product with fundamentally new properties that may change the structure of many technological processes. We substantiated a technique for obtaining seamless capsules with the contents of food lipids, which allowed us to determine physical parameters for the formation of a thermally-stable capsule. It was established that the formation of the resulting lipid capsule with preset organoleptic indicators is possible under conditions of individual structural design of an extrusion head for encapsulation. We derived dependences of the time of formation of the thermodynamic stable capsule "food lipids – Alg_2Ca" on the magnitudes that serve as parameters of technological process – the concentration of AlgNa, calcium ions, dimensional characteristics of a capsule, mass ratios of a shell-former and the lipid contents, design features of the device that enable capsule rotation around its axis.

This makes it possible to receive a stable controlled technological process. It was found that the axial rotation of a capsule in the laminar flow of accepting medium at speed ω/60, which is ensured by a special design of the device, allows the formation of capsules with preset organoleptic, product, technological properties over the analytically determined time.

Keywords: encapsulation process, sodium alginate, calcium alginate, extrusion head, surface mass exchange.

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INFLUENCE OF THE PROCESSES OF STEAM-THERMAL CRYOGENIC TREATMENT AND MECHANOLYSIS ON BIOPOLYMERS AND BIOLOGICALLY ACTIVE SUBSTANCES IN THE COURSE OF OBTAINING HEALTH PROMOTING NANOPRODUCTS (p. 41-47)

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We studied the impact of processes of steam-thermal cryotreatment and mechanolysis during finely dispersed grinding on biopolymers and BAS of fruits and vegetables during obtaining health promoting nanoproducts. It was established and scientifically substantiated that during integrated influence of steam-thermal or cryo- treatment and finely dispersed grinding on fruits and vegetables, activation of non-soluble nanocomplexes of heteropolysaccharides (in particular, pectic substances) with other biopolymers occurs. Activation occurs due to the processes of thermo-, cryo- and mechanodestruction. This leads to a release of mass fraction of pectic substances from the hidden, bound form into the free condition and its increase by 4.5...4.8 times and by 3.6...3.9 times during cryo- (or steam-thermal) treatment and finely dispersed grinding, respectively, in comparison with the original raw materials. Simultaneously, non-enzymatic catalysis of 70 % of non-soluble pectic substances to individual monomers, that is, a transformation into the soluble, easily assimilated form occurs.

The impact of integrated processes of cryo- (or steam-thermal) treatment and finely dispersed grinding on content of BAS was studied. It was found that in comparison with fresh raw material, mass fraction of BAS in finely dispersed frozen and thermally processed puree from the studied raw materials (black currants, apricots, lemons, apples, spinach, pumpkin) increased. An increase is by 1.5...4.0 times and by 1.5...3.0 times, respectively.

The quality of the obtained new kinds of finely dispersed puree surpasses the known analogues in content of BAS and technological characteristics. New kinds of puree are in the nanodimensional, easily assimilated form.

With application of new types of finely dispersed additives, a wide range of products for healthy eating with a record content of natural BAS was developed. New kinds of nanobeverages, nanosorbents, dairy-vegetable cocktails, fillings for confectionery and extruded products, cottage cheese desserts, bakery products, snacks, such as falafels, creams, etc., were developed. New additives were recommended for using at large and small food enterprises, institutions of restaurant business, trade, and for individual nutritional needs.

Keywords: non-enzymatic catalysis, mechanolysis, steam-thermal treatment, cryotreatment, nanocomplexes, heteropolysaccharides, pectic substances.

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DESIGN OF TECHNOLOGY FOR THE RYE-WHEAT BREAD "KHARKIVSKI RODNICHOK" WITH THE ADDITION OF POLYFUNCTIONAL FOOD ADDITIVE "MAGNETOFOOD" (p. 48-58)

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We investigated effect of the polyfunctional food additive "Magnetofood" on the physical-chemical, technological and organoleptic indicators of rye-wheat dough and finished products – the bread "Kharkivski rodnichok" and the bread "Darnitsky". The impact of food additive "Magnetofood" on the duration of dough fermentation was examined. It was proven that adding the food additive "Magnetofood" reduces the time of dough fermentation by 10.0–16.7 % (for the dough prepared using wheat flour of grade 1 and pressed yeast), and by 7.1–14.3 % (for the dough prepared using wheat flour of grade 2 and pressed yeast with low amylolytic activity).

We established positive effect of the food additive "Magnetofood" on physical-chemical and technological indicators of rye-wheat semi-finished product and finished product. Introducing the additive to rye-wheat dough reduces moisture content and acidity by 1.0 % and 2.7–4.0 %, respectively (for the dough prepared using wheat flour of grade 1 and pressed yeast); by 5.8 % and by 7.1–8.2 %, respectively (for the dough prepared using wheat flour of grade 2 and pressed yeast with low amylolytic activity). It was determined that the higher yield of dough (by 2.1–3.7 %), and of the finished bread "Kharkivski rodnichok" and "Darnitskiy" (by 3.3–3.6 %), was obtained in samples with the addition of polyfunctional food additive "Magnetofood".

It was found that the food additive "Magnetofood" not only slows down the process of hydrolysis of hydrocarbon and protein components of dough (the accumulation of free organic acids), but also sorbs on Fe_3O_4 particles a certain amount of organic acids, which improves the quality of dough and finished product.

It was established that adding "Magnetofood" in the production of rye-wheat bread improves its organoleptic indicators: taste, color, porosity and crumb state. Based on the data obtained, we designed a technology for the rye-wheat bread "Kharkivski rodnichok" with the addition of polyfunctional food additive "Magnetofood".

Keywords: polyfunctional food additive, rye-wheat dough and bread, quality indicators.

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STUDY OF THE CHEMICAL COMPOSITION OF CRANBERRY AND THE USE OF BERRIES IN FOOD TECHNOLOGY (p. 59-65)

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We investigated the ingredient composition of fractions of phenolic compounds of cranberries gathered in Ukraine and its change depending on methods of fermentolysis in the production of juice. The studies showed that the use of complex action enzymes for pretreatment of raw material makes it possible to enrich finished product with physiologically active ingredients of raw material by adjusting the activity during fermentolysis of endo- and exo-enzymes. We established that we can expect the best results in the case of instantaneous warming of squash after enzymatic treatment.

We determined that significant content of phenolic substances remains in the waste of juice production – in squash. The complex processing of cranberries with the use of cranberry juice in the technology of fruit sauces, as well as high-quality juice production, is offered in the technology of nonalcohol beverages and meat pastes. The use of cranberry juice in fruit sauces provides product with a pleasant color, prevents darkening of bananas during processing. The use of water-alcohol extracts produced from squash makes possible to avoid the use of artificial coloring agents in the production of nonalcohol beverages. The use of powder made of dried cranberry squash in the receipt of paste products increases moisture binding capacity of meat and the output of a finished product.

The study shows that the use of cranberries for the production of food products will make it possible to enrich chemical composition, to compensate for the deviation in functional and technological properties of raw material and to introduce resource-saving technologies.

Keywords: enzyme preparations, phenolic compounds, volatile aromatic substances, cranberry, juice, sauce, beverages, pastes.

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EFFECT OF THE PARAMETERS OF RHUBARB AND GOOSEBERRY TREATMENT ON THE FORMATION OF COLOR (p. 66-71)

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We report a study of the effect of thermal treatment (blanching, steam treatment, boiling for 10–60 seconds, boiling for 30–60 seconds) on the degree of chlorophyll destruction in rhubarb and gooseberry. The content of chlorophylls in rhubarb and gooseberry depending on the degree of their shredding was determined. We established the effect of stabilizing additives ($MgSO_4$, $MgCl_2$, $CaCl_2$, KCl) on the transformation of chlorophylls and a change in the color of rhubarb and gooseberry.

When manufacturing products from plant raw materials whose pigment complex contains mostly chlorophylls, the color, which is destroyed under the action of various factors, turns from green to yellow-brown, which negatively affects consumer choice. As the color estimation of products made from plant raw materials employs sensory analysis, which displays low accuracy and subjectivity, this creates certain difficulties both for investigating and solving a problem to improve product quality.

It was established that technological treatment influences objective color-parametric characteristics of fruits and vegetables, specifically, a deviation in values of the dominant wavelength, purity of color, and brightness, from their value for the untreated samples. It is shown that in order to estimate the effect of treating rhubarb and gooseberry on color, it is expedient to use the dominant wavelength as the basic color-parametric characteristic. Using the color-parametric characteristics, it is possible to track changes in color under various conditions in the process of technological treatment. In this case, color-parametric characteristics can be applied as critical points to control product quality.

Treatment with $MgCl_2$ and KCl salts ensures improved consumer properties of products made from rhubarb and gooseberry through maximum preservation of physiologically active substances and the original color of raw materials. This renders significant level of competitiveness to new products.

Keywords: plant raw materials, technological treatment, color-parametric characteristics, stabilization of pigments.

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EFFECT OF NITROGEN AND MINERAL COMPOSITION OF THE HIGH-CONCENTRATED WORT MADE FROM STARCH-CONTAINING RAW MATERIALS ON THE CULTIVATION OF YEAST (p. 72-77)

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We theoretically substantiated and experimentally confirmed the feasibility of enriching highly-concentrated wort made from starch-containing raw materials with nitrogen and mineral nutrition for yeast cells. The influence of nitrogen nutrition, as amine and ammoniac nitrogen, as well as mineral nutrition as nanoparticles and ions of metals was investigated.

It was established experimentally that in the course of cultivating the yeast on wort with a concentration of 20, 28 % DS, a necessary precondition is the adjustment of nitrogen nutrition through additional introduction of glycine to serve as amine nitrogen, the concentration of 0.7 g/dm^3 of wort, and ammoniac nitrogen (to serve as carbamide) in the amount of 800 g/m^3, which would make it possible to increase the concentration of yeast cells to 280–430 mln/cm^3 in the process of culturing the yeast depending on the concentration of wort and the type of nitrogen nutrition, respectively.

Based on results of the present research on the influence of mineral nutrition in the nano- and ionic form on the yeast-generation process, it was determined that the largest positive effect on the synthesis of yeast cells was exerted by Zn and Mg and the mixtures of these metals, both in nano- and in ionic form, whose concentration was 1.2 mg/cm^3 and 50 g/m^3, respectively; in this case, the number of yeast cells ranged from 360 to 480 mln/cm^3 depending on the concentration of wort and the type of mineral nutrition. We have proven the feasibility of cyclic use of mineral nutrition, both in ionic and in nano forms, when cultivating yeast, in order to obtain cells with high physiological-biochemical activity.

The use of mineral and nitrogen nutrition allowed us not only to obtain a high concentration of yeast cells, but also reduce the duration of yeast-generation to 15–20 hours and ensure their high regenerative and physiological activity during fermentation of wort with high concentrations of dry substances.

Keywords: yeast cell, highly-concentrated wort, dry substances, yeast-generation, nanoparticles of metals, mineral and nitrogen nutrition.

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