ABSTRACT AND REFERENCES

ECOLOGY. TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

DEVELOPMENT OF A MATHEMATICAL MODEL OF THE PROCESS OF BIOLOGICAL TREATMENT OF GASOUS EFFLUENTS FROM FORMALDEHYDE (p. 4-10)

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Experimental studies found the kinetic characteristics of oxidation of formaldehyde in gaseous effluents by microbial association. The quantitative values of the kinetic characteristics of formaldehyde destruction indicate the technological possibility of using a biological method of treatment of gaseous effluents from formaldehyde. It is found that the specific rate of oxidation of formaldehyde (CH_2O) depends on its concentration and a maximum biomass – 45 and 275 mg/g for aerobic and anaerobic processes, respectively. This fact testifies to higher efficiency of formaldehyde detoxification under anaerobic denitrification than under aerobic oxidation.

On the basis of experimental studies, a mathematical description of the processes occurring in the filled reactor vessel due to changes in the concentration of inflowing pollutants is developed. Using the found analytical relationships, an algorithm to calculate the changes in the average formaldehyde concentration in the vessel under continuous pollution is elaborated. The results allow making science-based design calculations of the process of biochemical treatment of formaldehyde.

Keywords: mathematical model, biological treatment of effluents, formaldehyde, concentration, harmful substance, bioreactor.

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THE STUDY OF FORMATION AND ACID PRECIPITATION DYNAMICS AS A RESULT OF BIG NATURAL AND MAN-MADE FIRES (p. 11-17)

Maksim Kustov

In the event of big natural and man-made fires, many hazardous chemicals are released into the environment. These compounds react with the atmospheric components to form

sulfuric and nitric acids. Among the atmospheric components, highly active radicals – hydroxyl, hydroperoxide and nitrate ions have the greatest influence on the acid formation processes. The reaction of acids with atmospheric water leads to acid precipitation. The paper discusses the physical and chemical features of the transformation of gaseous combustion products into acidic products. Using the kinetic multilayer model of gas particles, the absorption dynamics of gas-phase nitric and sulfuric acids by water microdroplets in the atmosphere is considered. Further evolution of acid solution microdroplets occurs due to coagulation. The coagulation rate significantly depends on the relative sizes of droplets. The criterion is the Knudsen number, which determines the flow of Brownian or gravity coagulation. The motion of small droplets is determined by the interaction with heat molecules and the absence of sedimentation. As for relatively large droplets, interaction with heat molecules can be neglected. They settle in the air stream due to weight and absorb small droplets when colliding. The intensity of the coagulation growth of droplets in the course of precipitation is determined using the mathematical simulation.

Keywords: hazardous chemicals, condensation, condensation nuclei, coagulation, precipitation, environment purification.

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CALCULATION OF THAT ENVIRONMENTAL AND GEOLOGICAL LANDSLIDE RISK ESTIMATE (p. 18-25)

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A new method of quantitative predictive risk assessment of exogenous geological processes (EGP), which is based on the studies of spaciotemporal prediction of their development is proposed. The algorithm is presented, which includes the main stages of calculation: determining the set of EGP for risk calculation; analyzing spaciotemporal development of EGP considering initiating factors; creating predictive spaciotemporal development models of EGP; selecting the spatial and analytical-descriptive hazard and risk assessment system; constructing predictive risk assessment maps according to the type of EGP; summarizing the estimates of spatial and protective systems, and building the integrated risk map for all types of EGP.

The calculation of the given landslide risk is based on the calculation of average spaciotemporal landslide probability, partial and total landslide area for the analyzed period, the maximum area of damage, population density, the coefficient that takes into account the presence of protective systems in the area. Landslide risks for the year of maximum landslide activity are calculated. The cartogram of landslide risk estimates for administrative-territorial units (rural and city councils) on the example of the Ivano-Frankivsk region is built.

Keywords: exogenous geological pr o cesses, landslide risks, factor, environmental and geological assessment, cartogram.

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EMERGENCY SITUATIONS WITH EXPLOSIONS OF AMMUNITION: PATTERNS OF OCCURRENCE AND PROGRESS (p. 26-35)

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Results of studies of the main causes and patterns of occurrence and progress of man-made emergency situations (MMES) with explosions of ammunition are summarized. The analysis of records on 73 MMES with explosions of ammunition is performed. The major causes and patterns of occurrence of MMES are identified. It is shown that the vast majority of emergencies is caused by a human factor, namely safety violation. May, June and October are the most riskful months. MMES should be seen as a complex system with specific, new properties such as significant duration, spatial factor and scale factor, which are not inherent in its elements - cartridges. For example, the mercury content in the cartridge primer showed that the scale factor can turn the shot of minor environmental effect into the catastrophic impact of MMES with explosions of ammunition on the environment.

Keywords: emergency situations, explosions of ammunition, fires, environmental safety, civil protection.

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THE RESEARCH AND ANALYSIS OF THE CHOCOLATE NUT BUTTER WITH POLYFUNCTIONAL PROPERTIES (p. 36-41)

Natalia Kondratyuk, Igor Garkusha

The usefulness of the protein and fat composition consisting of whey and blended mixture of vegetable oils in the production technology of chocolate nut butter with a sweet extract from stevia leaves is theoretically proved and verified under production conditions. The composition of the fatty base of the product comprising a mixture of refined sunflower oil and palm oil is developed. The paper examines the polyfunctionality of the chocolate nut butter on the human body,

which is due to a high content of whey protein, polyunsaturated fatty acids of vegetable oils and complete replacement of sugar with the sweet extract from stevia leaves. The study of organoleptic characteristics and the chromatographic quantitative assessment of fatty acid and amino acid composition of the final product revealed that the resulting composition has a high nutritional and biological value. Adding the blended fat composition favorably affects the structure and fatty acid composition of the butter, allowing to obtain a product of a given structure and properties.

Keywords: chocolate nut butter, sweet extract from stevia leaves, protein and fat composition.

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THE STUDY OF MASS LOSS INTENSITY OF PLUM FRUITS DURING STORAGE (p. 42-48)

Marina Serdyuk, Dmitrij Stepanenko, Sergei Kurchev

The study deals with scientific substantiation of the influence of the main chemical composition constituents and stressful weather factors of the growing season on the natural mass loss intensity of plum fruits during storage and development of a mathematical model for predicting this process. The fruits of plum varieties Voloshka, Stanley and Uhorka Italiis'ka were objects of the study. The fruits were stored at 0... –1 °C, relative humidity of 90±1 %. The study revealed that weather in the years under research was highly changeable and had many stressful factors. The highest dry matter content, including sugars and organic acids, was present in the fruits of plum variety Voloshka, higher ascorbic acid content – in the fruits of plum variety Uhorka Italiis'ka and phenolic substances – in the fruits of plum variety Stanley. The latter had the highest antioxidant status. The average mass loss during storage of plum fruits was about 7.7 % or 0.23 % a day. The calculated rate constants showed that the fruits of plum variety Uhorka Italiis'ka had the maximum mass loss rate. Among the constituents of the chemical composition of plum fruits, dry matter content has a dominant influence on the daily mass loss. The regression model for mass loss prediction depending on the dry matter content has the form: $y=0{,}018x^2-0{,}759x+7{,}715$. Among the weather factors, the most significant is the sum of active temperatures in the last month of the fruit formation. The equation $y=1{,}874262-0{,}00211x$ should be used as a regression model for predicting the mass loss caused by abiotic factors.

Keywords: plum, fruits, mass loss, storage, weather, sugars, dry matter.

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OPTIMIZATION OF FORMULATION COMPOSITION OF HEALTH WHEY–BASED BEVERAGE (p. 49-57)

Nataliia Tkachenko, Pavlo Nekrasov, Svitlana Vikul

The development of industrial production of cheese and casein in the world gives rise to the whey use problem. The need to solve this problem is caused by technological and environmental aspects. Whey is almost not processed in Ukraine. Therefore, the development of health whey-vegetable beverages with optimal component composition is an urgent task.

The paper presents the classification and characteristics of whey types, justifies the choice of vegetable raw materials – Tagetes patula, as a source of biologically active substances, substantiates the usefulness of berry fillers in beverages.

Rational parameters of the extraction process of biologically active substances from Tagetes patula flowers by drinking water: temperature (95±5) °C, duration 60 min, water duty 10 are established. The optimal ratio of whey, tincture of Tagetes patula flowers and berry filler “Wild berry” – 73.8; 18.5 and 6.2 %, respectively, as the components of the whey-vegetable basis for the production of health beverages is found. The chemical composition and quality indicators of the developed whey-vegetable basis with the optimal component composition are determined. The recommendations on developing the technologies of three groups of non-fermented and fermented health whey-vegetable beverages with high probiotic, antioxidant and hepatoprotective properties are given.

Keywords: whey, Tagetes, berry filler, extraction, biological activity, optimization, response surface.

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STUDY OF LACTOSE-FERMENTING YEASTS KLUYVEROMYCES LACTIS FOR WHEY AND APPLE PECTIN MIXTURE FERMENTATION (p. 58-64)

Olena Grek, Natalia Chepel, Olena Krasulya

This study was carried out by using whey and apple pectin in the fiber mixture as a fermentative medium in order to evaluate the biochemical activity of lactose-fermenting of some Kluyveromyces lactis strains during fermentation. The fermentation medium contained whey and apple pectin in the fiber in the ratio 9:1. Ten lactose-fermenting Kluyveromyces lactis strains coded 42 K, 95, 300, 304,317, 318, 325, 469, 868–K and 2452 were investigated.

During cultivation in aerobic conditions the biomass yield was the highest by yeast cultivation in whey and apple pectin in the fiber mixture with Kluyveromyces lactis 868–K strain (71.3×106 CFU/ml). Maximum biomass accumulation of Kluyveromyces lactis 868–K strain was achieved on the 30 h of cultivation at a temperature of 30±2° C. But the addition of apple pectin in the fiber into whey caused lactose-fermenting yeast growth inhibition (in exponential multiplication phase 1.59 % less biomass accumulation compared with the sample without apple pectin in the fiber).

During the alcoholic fermentation, the dynamics of CO_2 accumulation is positively correlated with the dynamics of biomass accumulation. Maximum CO_2 content and ethanol content were observed after 30 h of fermentation at an optimal temperature of 32 °C. The best contents of higher alcohols, aldehydes and esters were obtained in whey and APF fermented beverage by using Kluyveromyces lactis 868–K strain which consists of low contents of n-propane (1.84 mg/l), isobutane (29.30 mg/l), acetaldehyde (27 mg/l), and high contents of 2-methyl-1-butanol (73.52 mg/l), 3-methyl-1-butanol (211.11 mg/l), methylacetate (10.61 mg/l) and ethylacetate (85.11 mg/l).

Keywords: apple pectin, whey, lactose-fermenting yeasts, fermented beverages, odor–active compounds.

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