



CHEMICAL AND TECHNOLOGICAL SYSTEMS

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IMPROVEMENT OF THE CYCLOHEXANE OXIDATION PROCESS

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Cyclohexane oxidation is object of this research. One of the most problematic points of this process is low conversion of raw material and low selectivities for aim-products at conversions higher than 4 %. One of the reasons for this is absence of modern effective catalytic systems that could increase mentioned indexes.

One of successful directions in search of effective catalysts for this process is creation of binary catalytic systems with use of active oxygen-containing additives and industrial catalyst – cobalt naphthenate. During this research we used oxygen-CN-containing compound – Bis-2-cianethyl ether.

We determined positive impact of researched oxygen-containing additive at main technical-economical indexes of the process of cyclohexane oxidation – selectivity for oxidation products and ratio of aim-products. Selectivity for aim products increases at 3–4 % in comparison with oxidation at industrial catalyst and remains maximal – 73 % at conversion two times higher than industrial – 7.3 %. It is determined that in presence of researched binary catalytic system at conversion higher than 4 % quantity of formed acids increases to 20.3 %. Therefore we propose method of utilization of formed acids by etherification with alcohol.

This provides opportunity of wider use of all products of cyclohexane oxidation. In comparison with similar known methods oxidation in presence of binary catalytic system: cobalt naphthenate – Bis-2-cianethyl ether allows decrease of production cost.

Keywords: cyclohexane oxidation, oxygen-containing additive, binary catalytic system, conversion of raw material.

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SUBSTANTIATION OF THE COMPOSITION OF PROBIOTIC COSMETIC PRODUCTS FOR THE TONING OF OILY SKIN

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The efficiency of using lysates of probiotic cultures of lacto- and bifidobacteria in cosmetics is analyzed, the expediency of using live probiotic cultures in natural cosmetics is shown. The efficacy of using illuminated acid whey and hydroalcoholic extracts of medicinal plants with a high content of bioantioxidants with antiseptic effect (in particular, the extract of dried flowers *Tagetes patula*) is proved to be effective in the composition of cosmetic means for toning the skin.

The optimal mass proportions of acid whey, obtained with the use of probiotic cultures of lacto- and bifidobacteria in the composition of the direct bacterial concentrate *FD DVS ABT-2*, are justified. As well as a water-alcohol extract of dried flowers *Tagetes patula*

(59.98 and 40.02 % respectively) as components of a probiotic cosmetic for toning of oily skin. It has been established that the maximum antioxidant activity (45.6 act. units) and the normalized value of active acidity (4.76 pH units), the probiotic cosmetic for toning of oily skin, has the optimum content of raw ingredients in it. Namely: 59.98 % of the acid whey obtained using probiotic cultures of lacto- and bifidobacteria in the composition of the direct bacterial concentrate *FD DVS ABT-2*, and 40.02 % of the water-alcohol extract of the dry flowers of *Tagetes patula*.

It is determined that the organoleptic and physicochemical quality indicators of probiotic cosmetic means for toning of oily skin, produced with the use of raw ingredients in the optimal ratio, meet the requirements of DSTU 4093-2002. By the content of ethyl alcohol the developed product can be attributed to cosmetic lotions. Microbiological indices of the developed probiotic cosmetic lotion differ from those in DSTU 4093-2002, therefore, for the introduction of it into production, it is necessary to develop appropriate regulatory documents.

It is proved that the developed probiotic cosmetic lotion is natural and safe due to the improved microbiological characteristics. It is established that the strengths of the product are greater than those of the weak, which indicates its competitiveness in the consumer market. Strategic solutions are proposed for the movement of a new cosmetic product and for reducing the impact of weaknesses on its implementation.

Keywords: probiotic cosmetics, skin toning, *Bifidobacterium*, *Lactobacillus*, water-alcohol extract, *Tagetes patula*, acid whey.

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INVESTIGATION OF RHEO-MECHANICAL PROPERTIES OF CEMENT SUSPENSIONS ACTIVATED IN A HYDRODYNAMIC CAVITATOR

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The object of research is cement suspensions activated in a hydrodynamic cavitator. One of the most problematic places of the proposed method of activation is the slowing of the kinetics of the strength of astringents on days 2 and 7 of hardening. It is possible to speed up the set of strength by studying the processes of structure formation occurring in activated suspensions and hardening mixtures, and also to enhance physical effects by improving the design of the cavitator and the mixing chamber.

During the study, activated water and 10 % cement-water suspension are used. After 10 minutes of cavitation treatment at pressures of 0.63–1.4 MPa and a temperature of 28–32 °C, the pH of the medium increases (pH+7.56) and decreases by a factor of 10.38 times the dynamic viscosity of the suspensions. This is due to the fact that the increase in pressure and temperature in the cement-water suspension contributes to the intensification of the dispersion of cement particles in the frequency range 700–800 Hz and the passage of intensive mass-transfer processes in the frequency range 1.9–3.5 kHz, leading to the formation of primary crystallization structures.

Due to this, it is possible to obtain dilatant liquids with a viscosity of 160 to 273.5 cP and control the rate of agitation in the speed range from 50 to 200 min⁻¹. Compared to similar activation methods,

the approach under study provides an increase in brand strength of 1.14 times compared to an unactivated cement system and contributes to a decrease in the amount of Portland cement from 10 to 14 %.

Keywords: hydrodynamic cavitator, dynamic viscosity, cavitation treatment, compressive strength, cement-water suspension.

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ECOLOGY AND ENVIRONMENTAL TECHNOLOGY

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MEASUREMENTS OF ASH EMISSIONS FROM A PLANT FOR BURNING OF RADIOACTIVELY CONTAMINATED WOOD

page 26–29

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The object of research is the efficiency of dust and gas treatment equipment for the removal of contaminated combustion products from the flue gases of the incinerator plant. One of the most problematic areas of the research facility is that when removing contaminated combustion products (ash) from flue gases, the efficiency of the dust and gas treatment equipment should ensure ash concentrations of up to 4 mg/m³ in the incinerator plant emissions.

Investigations were conducted in Chornobyl, Ukraine on an incinerator plant equipped with a gas stream cleaning system, and includes coarse and fine cleaning. Application of two-stage cleaning allows to increase the efficiency of dust and gas cleaning equipment and to reduce emissions of radiation ash.

In order to confirm the design requirement for gas cleaning equipment, in which flue gas filtration should provide ash emissions to 4 mg/m³, experimental measurements are made during the operation of the incinerator plant. Based on the results of measurements of dust and gas cleaning equipment, the maximum ash concentration is 3.76 mg/nm³, which meets the requirements.

This plant plays an important role in reducing emissions and reducing the ecological load of the region and improving the environmental safety of Ukraine.

Keywords: emissions of pollutants, ecological measurements, incinerator of radioactively contaminated wood, dust and gas treatment equipment.

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DEVELOPMENT OF THE METHOD FOR ASSESSING THE ACTION ZONES OF HAZARDS IN AN EMERGENCY AT A CITY FILLING STATION USING GEOINFORMATION TECHNOLOGY

page 29–38

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The object of research is a specific filling station (gas station), which is located in the Odessa (Ukraine) on the Gastello street. Filling station receipts and stores petroleum products (gasoline A-80, A-93, diesel fuel, engine oil) and refueling vehicles. The facility includes a tank of 40 m³ of tank fuel and 1 tank of 15 m³ tanks. The area of influence includes a motorway, a garage cooperative, a cafe-bar, a multi-storey house, a gas distribution station. One of the most problematic places of operation of the filling station is emergency risk – fire and explosion, as a result of leakage and the accumulation of fumes of oil products. Therefore, local destruction of the reservoir is considered with subsequent ignition of the leak, which led to the appearance of a shock wave.

In the course of the research, a method for assessing the zones of action of damaging factors is developed, in which geographical information technologies are used. The method includes the steps of selecting an emergency scenario, processing the primary data, calculating the values and radii of the zones of the component parameters of the emergency situation. Visualization of the destruction zones in Quantum GIS version 2.18.2, with an open information code, distributed under the terms of the GNU General Public License is also included.

Based on calculations of the size of hazardous areas in which full, medium, weak destruction of buildings and related injuries in humans are possible, the results of their visualization based on the architecture of an integrated geographic information system (GIS) are possible. The proposed method has a number of features, in particular, it allows to identify a specific city territory, which is covered by negative factors of accident consequences, in on-line mode. Due to this, certain «care» objects that have fallen into the corresponding risk zones, among which are 2 multi-storey houses, a gas distribution station, a cafe-bar, a garage cooperative, a significant part of the motorway.

In comparison with similar known examples of risk analysis, the method allows to classify the «care» objects by the levels of damage, and organize appropriate measures to minimize risks in the environmental management system of the city. The method provides such advantages as systemic representation of potentially dangerous objects and subjects of their influence, the integration of branched development scenarios, visibility, cross-platform and openness of information data. Using the method of modeling the development of an emergency at filling stations within the city of a million people improves the efficiency of the information presentation, allows to adequately predict the development of the environmental situation in the risk management system. And also positively affects the work of the SES bodies in ensuring the technogenic security of the city.

Keywords: potentially dangerous object, filling station, shock wave, geographical information technology, technogenic risk.

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FOOD PRODUCTION TECHNOLOGY

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RESEARCH OF TOXICITY OF CHITOSAN-BASED FILM-FORMING COMPOSITIONS

page 39–46

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The object of research is chitosan-based film-forming compositions with the addition of decoctions from medicinal plants: Sweet flag, Senegalia catechu, Ledum, *Bergenia crassifolia*; Common yarrow, *Eucalyptus globulus*, *Eleutherococcus senticosus*, *Hypericum perforatum*; *Chamaenerion angustifolium*, Iceland moss, *Calendula officinalis*, *Urtica*; Peppermint, *Potentilla alba*, Common tansy, *Plantago major*; *Artemisia absinthium*, Motherwort, Sage, Common sunflower.

Medicinal herbs have biological activity (toxicity), which accompanies the main therapeutic effect and depends on the dose. Toxicity is not observed in all medicinal herbs, but among them there are strong and even poisonous. Presented in the composition, medicinal herbs based on 2 % chitosan are not studied for toxicity, therefore, to establish the safety of their use as a packaging for fruit and vegetables, this must be done.

The developed compositions are examined for:

1) toxicity using bacteriological methods by sowing on 5 % blood agar;

2) manifestation of hemolysis zones and growth of *B.cereus* culture by diffusion into agar (well method).

During the research, positive results are obtained:

1) all samples are not toxic;

2) hemolysis zones are not identified;

3) there is a suppression of the growth of *B.cereus* culture, which grew on the surface of blood agar (growth retardation zones of culture *B.cereus* 0–34 mm).

Further expansion of the study will allow the use of chitosan-based film-forming compositions that have differentiated properties with respect to solubility, sorption, bactericidal and antioxidant effects as a factor in increasing the biological value of food in the absence of toxicity in fruit and vegetable products.

Keywords: chitosan-based compositions, decoction of medicinal herbs, toxicity of compositions, hemolysis zones, blood agar.

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INFLUENCE OF CONDITIONS OF WATER PRODUCTION FROM AIR ON THE MICROBIOCENOSIS OF CONDENSATE

page 47–56

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The object of research is the microbiocenosis of water, produced from atmospheric air with the help of domestic conditioners of split systems. One of the most problematic places of study of this object is that the microbiocenosis of the aquatic environment is characterized by a considerable variety of microorganisms. Therefore, within the framework of this work, only microbiological indices determined by hygienic norms in force in Ukraine are determined.

In the course of the study, standard methods and techniques are used for microbiological analysis of water samples, chemical analysis of atmospheric air samples, determination of atmospheric conditions, and laboratory equipment certified in Ukraine.

As a result of the work done with the help of household air conditioners located at different distances from the coastal strip, industrial zone and transport highways, samples of atmospheric moisture condensates are obtained. The atmospheric conditions and the content of pollutants in the air in the places where water is produced from it, as well as the condensate flow under the given conditions, are determined. It is shown that the degree of atmospheric air pollution is most affected by the remoteness of air conditioners from industrial enterprises and transport highways. The influence of the height of placement of air conditioners above sea level and their remoteness of the coastal strip are insignificant.

The indicators of epidemical safety of water from air have been experimentally determined, and the percentage relationships between families of bacteria and genera of mold fungi are established. The diversity of species composition of microorganisms present in water from air is shown and the influence of various external factors on the formation of such microbiocenosis is explained. It is proved that the water from the air, obtained with the help of domestic conditioners of split-systems, has a very low quality according to microbiological indices. Use such water for drinking or technical needs is possible only after its disinfection. And it is important to take into account that only correctly identified methods, reagents and technological scheme of water treatment will avoid the formation of harmful substances in the human body in water and contribute to improving the efficiency of the technology.

Keywords: atmospheric air, household air conditioner, water quality, microbiocenosis of water from air.

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CALCULATION OF PHYSICAL PROPERTIES OF FATS ON THEIR TRIACYLGLYCOLEROLE COMPOSITION

page 56–63

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Studies on the development of fat bases with specified physical, chemical and organoleptic properties are given. To obtain fatty products with such properties, it is necessary to take into account the ratio of fats and oils in fat bases, as they affect the structure, stability, organoleptic characteristics and presentation of finished products.

To determine the relationship between the physicochemical parameters and the concentration of the components in the mixture,

Scheffe third-order simplex-lattice plan is used for the three-component mixture. Using a linear model, regression equations are obtained between the melting point, the pour point and the concentration of the components in the mixture.

When the functional relationship between the triacylglycerol (TAG) composition and the physicochemical parameters is revealed, it is necessary to obtain the TAG composition of pure fats and mixtures. With the help of mathematical solutions, linear equations for TAG composition and physical and chemical parameters are obtained. With the help of the obtained mathematical model, the ratio of components in the new mixture is calculated for: palm olein (PO) $x_1=0.469$, palm stearin (PS*) $x_2=0.255$, hydrogenated fat M3 (HF) $x_3=0.276$. The melting temperature which is equal to 40.3 °C and pouring – 28.7 °C are determined. This makes it possible to calculate fat bases of margarines with given properties.

Keywords: triacylglycerol composition, melting point, pour point, vegetable oil.

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INVESTIGATION OF HYDRATION AND FORMATION OF STRUCTURAL-MECHANICAL PROPERTIES OF VEGETABLE PASTE WITH IODINE-CONTAINING RAW MATERIAL

page 63–70

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The object of research is the technology of vegetable pastes with iodine-containing raw materials. One of the most problematic places of the research object is the cost of iodine-containing raw materials, namely, hydrobiont powders. Comparison of the price of powders made from hydrobionts with the price of traditional raw materials shows that they are not competitive enough, because they exceed the traditional one. In the course of the research, the physicochemical parameters of the pastes are used, which depend on the raw materials, added additives and process parameters, as well as rheological properties, which are characterized by effective limiting shear stress and adhesion. As a research result, the use of laminaria powder with the hydromodule from 1:4 to 1:5 and hydrobiont powder with the hydromodule from 1:5 to 1:6 is justified, which leads to an increase in the technological properties of vegetable pastes by 1.7...2.8 % and 2.7...3.9 % respectively. It is revealed that the structural and mechanical parameters of vegetable pastes increase with a concentration of hydrated laminaria powder 3 g and hydrated hydrobiont powder 48 g by 2.8 %, and the organoleptic index rises to the highest value of 4.78 points. This indicates an increase in the stickiness of the paste, improving the stability of the paste during the formation and transport. Due to this, it is determined the expediency of joint use of vegetable and protein ingredients, as well as inactivated yeast in vegetable pastes that will ensure high biological value of the product and a high level of iodine assimilation. The conducted researches allows to develop the formulation composition and technological process of obtaining rolls with vegetable paste made from iodine-containing raw materials, which is fixed in the approved technical conditions: TU U 10.8-05476322-002:2013 «Culinary products. Rolls with vegetable fillings» and technological instruction with TU U 15.8-32214657-003:2010 «Culinary products. Rolls with vegetable fillings». Thus, a broad interpretation of the problem of iodine deficiency and the research results can be used not only by specialists in the field of nutrition and the food industry, but also by endocrinologists and physicians of other specialties. This allows to recommend the developed culinary products for use for the prevention of iodine deficiency disorders.

Keywords: structural and mechanical characteristics, vegetable pastes, hydrobiont and laminaria powders, iodine-containing raw materials.

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