ABSTRACT AND REFERENCES

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DEVELOPMENT OF A DECONTAMINATION SYSTEM FOR DECOMPOSING N-(PHOSPHONOMETHYL) GLYCINE (p. 6-13)

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The study has specified the influence of activators on the decomposition of N-(phosphonomethyl)glycine under the effect of hydrogen peroxide and potassium hydroxide. As decontamination systems, potassium hydroxide, hydrogen peroxide, boric acid, cetylpyridinium chloride and monoethanolamine borate were considered. It has been shown that boric acid is an effective activator of hydrogen peroxide as α-nucleophile in the micellar decontamination system of N-(phosphonomethyl)glycine.

It has been found that N-(phosphonomethyl)glycine does not enter the splitting reaction at high pH without the involvement of activating agents. At pH 13, the expected half-period of decomposition of the substrate by the nucleophilic mechanism is about 3 hours.

The study has shown that hydrogen peroxide, cetylpyridinium chloride, and boric acid provide favorable conditions for nucleophilic attack on the organophosphorus compound at decontamination of N-(phosphonomethyl)glycine in the alkali system due to the formation of micelles and the activation of the mechanism of forming peroxide ions. In this system, the rate constant of the second order is twice higher than in the unactivated system.

It has been established that monoethanolamine borate does not have any significant activating effect on micellar nucleophilic catalysis in the degradation of N-(phosphonomethyl)glycine.

The optimal conditions of decontaminating N-(phosphonomethyl) glycine in the micellar decontamination system have been determined to be as follows: 0.25 mol/L of the concentration of cythylpyridinium chloride and 0.15 mol/L of the concentration of boric acid. It has been proven that an important condition is the pH of the system, which should be in the range from 10.5 to 11.5.

It is concluded that the study of decomposing N-(phosphonomethyl) glycine in soft micellar catalysis has a theoretical and significant application value due to the minimization of risks associated with the production, use and disposal of organophosphorus compounds.

Keywords: decontamination system, hydrogen peroxide, N-(phosphonomethyl)glycine, peroxoborate, deactivation, organophosphorus compounds.

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STUDYING THE INFLUENCE OF UV ADSORBERS ON OPTICAL CHARACTERISTICS OF LIGHT-PROTECTIVE POLYMER FILMS FOR TEXTILE MATERIALS (p. 14-21)

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The use of UV adsorbers included in composition of a polymer film is a promising way of color protecting against effects of light since application of the polymer to the textile material surface is a universal way of providing the textile materials with necessary special properties.

Optical characteristics are the most important indicators of suitability of polymer films for their use in final processing of colored textile materials. The objective of this study consisted in a spectrophotometric determination of optical characteristics of polymer films based on a styrene-acrylic polymer with addition of a cross-linking agent and UV adsorbers for the use in final processing of textile materials for the purpose of their color protection.

The polymer matrix is an aqueous dispersion of a thermally linking styrene-acrylic copolymer. Partly esterified melamine resin was used as a cross-linking agent and 2,4-dihydroxybenzophenone, 3,6-dihydroxyacetophenone, salicylic acid phenyl ether, p-methoxy cinnamic acid were used as UV adsorbers.

Optical characteristics of polymer films were determined using SF-56 spectrophotometer by constructing spectral curves of absorption and transmission in the range of 200–800 nm.

Based on analysis of spectral curves of absorption in polymer films, UV adsorbers which provide formation of colorless polymer films have been established. Spectral curves of light transmission of the studied polymer films in the visible portion of spectrum have allowed us to determine effect of UV adsorbers on film transparency and light transmission in relation to UV rays in the UV portion of the spectrum. Substances that contribute to reduction of UV radiation transmission through polymeric films and provide light protection properties were established.

Based on the multivariate analysis of the results obtained in the study of optical characteristics of polymer films, a composition based on styrene-acrylic polymer, cross-linking agent and UV adsorber was recommended. The found composition is suitable for its use in final processing of colored textile materials in order to form a colorless, transparent coating with light-protective properties.

Keywords: styrene-acrylic polymer, cross-linking agent, UV adsorber, polymer film, absorption, transmission, light protection.

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DETERMINING THE COMPOSITION OF BURNED GAS USING THE METHOD OF CONSTRAINTS AS A PROBLEM OF MODEL INTERPRETATION (p. 22-30)

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This paper proposes a method for solving the problem on determining the unknown composition of a gaseous hydrocarbon fuel during its combustion in real time. The problem had been defined as the inverse, ill-posed problem. A technique for measuring technological parameters makes it possible to specify it as a complex interpretation problem.

To solve it, a "library" method has been selected (selection), which is the most universal one. To implement it, a method has been constructed to compile a library in the form of a working three-dimensional array. The source data for each solution to a direct problem in the generated array are represented in the form of a single number. To this end, a position principle for recording decimal numbers has been applied.

Compiling a working array employed a method for comparing the excess factor of an oxidizer and the ratio of volumetric consumption of an oxidizer and fuel. This has made it possible to apply the results from solving a direct problem on determining the temperature of combustion products in order to solve the inverse problem on determining this composition based on the measured temperature.

A method has been devised for finding a solution among the elements of the working array based on the results from technological measurements of temperature of the combustion products of the burnt fuel and the ratio of the volumetric consumption of an oxidizer and fuel.

The work shows the absence of errors introduced to the solution by an algorithm of the proposed method. When modeling precise technological measurements, errors are due only to the sampling of source data while solving a direct problem. The influence of measuring the technological parameters on accuracy in determining the composition of fuel has been defined. It does not exceed the magnitude that is permissible for engineering calculations.

The proposed calculation method could make it possible to use under a managed mode, in energy and in the chemical industry, a large amount of hydrocarbon fuel gases that are currently considered waste. Their energy equivalent is comparable with the energy needs by the African continent.

Keywords: composition of fuel, inverse problem, complex interpretation problem, constraints method.

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A COMPREHENSIVE ANALYSIS OF CONSUMER PROPERTIES OF NUTRIA VELOUR HYDROPHOBICIZED WITH ALKENMALEIN-ACRYLSYNTANE COMPOSITION (p. 31-36)

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A set of consumer properties of hydrophobicized nutria fur velour obtained with the use of alkenmalein-acrylsyntane composition has been studied. Components of this composition included alkenmalein polymer, polyacrylic polymer and synthetic tanner. The process of filling and hydrophobicizing nutria fur velour was carried out at pH of the working solution of 6.8–7.0, temperature of 40–43 °C during three hours and completed at a pH of 3.8–4.0.

Hydrofobicized nutria fur velour was obtained from raw materials with low hair quality, heterogeneous structure in different topographical areas and low density but with satisfactory physical and mechanical properties of the skin tissue.

Influence of the component ratio of the filling and hydrophobicizing composition on the physicochemical properties of fur velour was established. Specifically, the following characteristics have been studied: total thermal resistance, dynamic water wetting, water drop absorption, wetting angle, wetting, vapor permeability, air permeability, etc.

Optimal component ratio of the alkenmalein-acrylsyntane composition has also been established which ensures formation of a modified nutria fur velour with a set of improved consumer properties compared with the sheepskin velour. In particular, reduction of the total thermal resistance and vapor permeability of the hydrophobicized nutria fur velour observed during hydroprocessing was less: 9.7 and 1.7 times, respectively, than that of the sheepskin velour. At the same time, aesthetic indicators of the nutria velour (coloristic design and quality of leather dressing were also higher (by 39–41 %) than those of the sheepskin velour.

The obtained results from hydrophobicizing fur velour with a set of required consumer properties indicate the possibility of expanding the range of products made from fur raw materials with poor-quality hair but satisfactory physical and mechanical indicators of skin tissue. Fur products manufactured from hydrofobicized nutria velour will be suitable for wearing under conditions of high humidity.

Keywords: nutria fur velour, filling and hydrophobicizing, alkenmalein-acrylsyntan composition, consumer properties.

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PRINCIPLES OF THE PROGRESS OF REACTIONS INVOLVING DEEP OXIDATION OF ISOPROPYL ALCOHOL UNDER CONDITIONS OF AEROSOL NANOCATALYSIS TECHNOLOGY (p. 37-43)

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We studied the process of deep oxidation of isopropyl alcohol under conditions of aerosol nanocatalysis technology. The process was carried out in a reactor with a vibro-fluidized bed of a catalytic system, which consists of powder of a catalytically active Fe_2O_3 substance and dispersing material. We performed a study for the further development of an environmentally friendly catalytic heat generator, which would operate in accordance with principles of nanotechnology. It was noted that the main controlling factors in the applied method of aerosol nanocatalysis are temperature and mechanical-and-chemical activation of a catalyst. Mechanical-and-chemical activation makes it possible to adjust a mode of vibro-fluidization to obtain the required reaction products. We modernized the laboratory unit to study the processes by the method of aerosol nanocatalysis in a vibro-fluidized bed of a catalytic system for tasks of deep catalytic oxidation of isopropanol.

We carried out experimental studies into the effect of temperature on carbon monoxide content in oxidation gases, a degree of isopropanol transformation, and selectivity of the deep oxidation process. It has been shown that it is possible to achieve almost 100 % oxidation of isopropanol to CO_2 in aerosol of nanoparticles of iron oxide at temperatures below 630 °C. The mentioned fact makes it possible to use low-alloyed steels and to reduce equipment costs in future technology. The results of the study give a possibility to determine a direction of the further research to optimize parameters of the process of control of oxidation of isopropyl alcohol for its deep oxidation and to obtain free energy for further use. We performed comparison of some technical-and-economic parameters of the process being developed with the processes based on heterogeneous catalysis.

Keywords: aerosol nanocatalysis, mechanical-and-chemical activation, oxidation, isopropyl alcohol, frequency, catalytic heat generator.

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ANIONIC CARBONATE ACTIVATION OF LAYERED (α+β) NICKEL HYDROXIDE (p. 44-52)

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Nickel hydroxide is widely used as the active material in supercapacitors. Samples of $Ni(OH)_2$ with the (α+β) layered structure, synthesized in the slit-diaphragm electrolyzer, are the most active. The possibility of carbonate activation of layered (α+β) $Ni(OH)_2$ was studied by the synthesis of samples in the slit-diaphragm electrolyzer using a mixture of sodium hydroxide and sodium carbonate as the electrolyte. The molar part of sodium carbonate in the $NaOH+Na_2CO_3$ mixture was controlled by acid titration in the presence of two indicators. The synthesis of nickel hydroxide samples was conducted at the molar part of carbonate from 0.16 (NaOH without the additional introduction of carbonate) to 0.83. The crystal structure of the samples was studied by means of X-ray diffraction analysis, electrochemical characteristic – by means of cyclic voltammetry and galvanostatic charge-discharge cycling in the accumulator regime. By means of XRD analysis, it was found that upon increasing the molar part of carbonate in the anolyte to 0.49, the crystallinity of the monophase layered (α+β) structure increases. It was found that a further increase of the carbonate part results in a more amorphous structure due to a partial breakdown of the hydroxide lattice with the formation of basic salts and formation of the bi-phase system. This conclusion is supported by cyclic voltammetry and discharge curves. The study of the electrochemical characteristics revealed, that for the molar part of carbonate below 0.39, carbonate activation of hydroxide occurs resulting in an improved specific capacity. Increasing the carbonate part to 0.49 results in a lower specific capacity, and even further increase results in the breakdown of hydroxide into basic salts and a significant drop in electrochemical activity. Thus, it was found, that to achieve the maximum activating effect, the optimal molar part of sodium carbonate (in a mixture with sodium hydroxide) should be about 40 %. The specific capacity of nickel hydroxide under this optimal condition is 234 mA·h/g, and this sample is found to be susceptible to activation with cobalt compounds, which further improved capacity to 254 mA·h/g.

Keywords: carbonate, activation, nickel hydroxide, layered(α+β) structure, alkaline accumulator, slit-diaphragm electrolyzer.

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INFLUENCE OF MODIFICATION OF THE SOLID COMPONENT ON THE PROPERTIES OF NON-AUTOCLAVED AERATED CONCRETE (p. 53-59)

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This paper reports results of research into the modification of a solid component in the non-autoclaved aerated concrete with a lime-carbonate additive that contains calcium carbonate (calcite), calcium hydroxide (portlandite) and the additive with a plasticizing and accelerating effect in order to improve its strength. Based on an analysis of the scientific literature, it has been suggested that the properties of cellular concretes are defined by the character of a solid component. The object of research that we selected was the non-autoclaved aerated concrete with a density of 500 kg/m^3. The list of raw materials and their characteristics is provided. The aerated concrete was molded at a fixed water demand corresponding to the spread of a mixture of 220 mm by a Suttard viscometer. In the course of experimental study we applied both standard and original test methods (mathematical-statistical methods, x-ray phase analysis, determining the equipotential field of the surface of samples of aerated concrete).

We have obtained the non-autoclaved aerated concrete with a modified solid component, which has a maximum compressive strength of 3.53 MPa corresponding to concrete of class C2 in line with current standard. The high strength is explained, based on data

from an X-ray phase analysis, by the presence of crystalline phases, which are represented by stable new structures in the form of calcium carbonate and its modifications: vaterite – μ-form of $CaCO_3$, aragonite – metastable form of $CaCO_3$ and tobermorite gel.

Based on the data obtained, we have constructed experimental-statistical models of the examined properties. A specific relationship has been established between the strength of non-autoclaved aerated concrete and the equipotential field strength. The research results have been implemented industrially for manufacturing articles from non-autoclaved aerated concrete, which are not inferior, in terms of strength, to its autoclaved analogs.

Keywords: cellular concrete, aerated concrete, solid component, calcite, polymorphic modifications, portlandite.

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