

DETERMINING THE EFFECTIVE USE OF MAGNETITE IN LIPID-MAGNETITE SUSPENSIONS (p. 4-8)

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Biomagnetic liquids (suspensions) are a colloidal system, consisting of a disperse phase, usually magnetite (Fe_3O_4), surface-active agent (SAA), and disperse medium. Ultra-fine particles of magnetite with biologically-active compounds, immobilized on the surface (e.g., SAA) are of theoretical and practical interest for use in various biotechnologies.

Herewith, nanoparticles are investigated as both independent units, and complex organic-inorganic systems "mineral core - functional shell". These studies are necessary because the structure and morphology of the nanoparticles depend on the functionality of their surface.

Biomagnetic liquid (suspension), based on the following components: oil - corn, soybean and sunflower; SAA - monoacylglycerol; magnetite is obtained in our paper. The stability of the suspension is studied by the centrifuge method. The optimum ratio of the lipid-magnetite suspension components - disperse medium (vegetable oil): disperse phase (magnetite): SAA (monoacylglycerol) = 49, 625 g (98, 255 wt. %): 0.35 g (0.7 wt. %): 0.025 g (0.045 wt. %) is determined.

Using the infrared spectroscopy method, issues of chemical compatibility of magnetite with the suspension components are investigated.

It has been found that there is a chemical interaction (chemisorption) between magnetite and SAA in the suspension. When adding monoacylglycerol to magnetite in the IR-spectrum of SAA there is a new absorption band in the region of the stretching vibrations of associated OH-group at 3375 cm^{-1} , which can only be attributed to the interaction ("association") of OH-groups of monoacylglycerol with magnetite (most likely by donor-acceptor mechanism). In addition, during the modification of magnetite by monoacylglycerol, the absorption band of OH-group shifts to the short-wave region 3003 cm^{-1} (3009 cm^{-1} in monoacylglycerol), and the bands of symmetric and asymmetric stretching vibrations of COO-group are clearer and shift to long-wave region by approximately 30 cm^{-1} : $\nu_s = 1760\text{ cm}^{-1}$, $\nu_{as} = 1670\text{ cm}^{-1}$ ($\nu_s = 1730\text{ cm}^{-1}$, $\nu_{as} = 1640\text{ cm}^{-1}$ in monoacylglycerol), which may indicate the interaction between the COO-group and magnetite.

The importance of the obtained data is that they can be used in obtaining biomagnetic vegetable oil-based liquids. The developed suspensions contain magnetite. And considering the biocompatibility of magnetite with living organisms and its positive effects on the human body, suspensions can be used as food (dietary) additives in food products in order to enrich with digestible iron and create antianemic categories of food products (for treatment and prevention).

Keywords: suspension, magnetite, monoacylglycerol, surface-active agent, stability, centrifugation, infrared spectroscopy.

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SELECTIVE OXIDIZATION OF 2- AND 3-AMINOTOLUENE BY OZONE IN THE GLACIAL ACETIC ACID TO THE CORRESPONDING AMINO BENZOIC ACIDS (p. 9-12)

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The kinetic regularities and mechanisms of oxidation reactions of 2- and 3-aminotoluene and its acylation derivatives by the gases that contain ozone and glacial acetic acid have been studied.

It has been established that ozone attacks mainly the lone pair of electrons of the nitrogen atom with formation, mainly, of polymers of azo compounds. The products oxidation on methyl group are not formed in these conditions.

The direction of the ozone's attack can be altered and directed on the methyl group, as well as by an aromatic ring, by acylation of the amino group. The total yield of the products of oxidation of the methyl group of 2- and 3-acetamidotoluene is 5,1 and 12,4 % respectively.

The process of liquid-phase catalytic oxidation of 2- and 3-acetamidotoluene by the ozone in the presence of transition metal salts and their mixtures with potassium bromide to the corresponding acetamidobenzoic acids has been investigated as well. At the presence of acetate Co (II) the output of 2- and 3-acetamidobenzoic acid 25,0 and 31,2% respectively.

We found out that the use of our catalytic system (ozone - acetamidotoluene - Co (III) - glacial acetic acid - potassium bromide) significantly increases the reaction rate and the selectivity of substrate oxidation of methyl groups. The main product of oxidation of 2- and 3-acetamidotoluene becomes 2- and 3-acetamidobenzoic acid (55,0 and 71,2 % respectively). Replacing ozone-air mixture with the ozone-oxygen mixture leads to higher yield of 2-acetamidobenzoic acid 70,0 % and 3-acetamidobenzoic acid 86,0 %.

Keywords: 2-aminotoluene, 3-aminotoluene, 2-acetamidotoluene, 3-acetamidotoluene, ozone, oxidization, 2-acetamidobenzoic acid, 3-acetamidobenzoic acid.

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ACQUIRING PRODUCTION RESERVE BY OPTIMIZING CONTROL OVER METHANOL SYNTHESIS COLUMN (p. 19-23)

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THE INTERACTION OF MALEIC ANHYDRIDE AND DERIVATIVES OF LONG-CHAIN OLEFINS (p. 13-18)

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The possibility of interaction between maleic anhydride and derivatives of long-chain olefins, where the double bond is in the depth of the hydrocarbon chain was considered in the paper. Available and cheap natural raw material - oleic acid is taken as such olefin. It was assumed that the nucleophilic addition of oleic acid to maleic anhydride by the double bond with retaining the molecular structures may proceed by the Alder mechanism under appropriate conditions: reaction temperature of more than 150 °C or in the presence of Lewis acid-type catalysts. Series of syntheses in melts and organic solvents: trihloretylene, perhloretylene and o-xylene were conducted. Reaction temperature modes were from 130 °C (boiling temperature of solvents) to 210 °C. As a result, three types of products were obtained: white crystal sediment, colorless plates and viscous filtrate from light brown to dark brown. The products were separated by different solvents, identified by the melting point and the acid number. The target reaction products were colorless plate crystals with the acid number of 369.6 mg KOH/g and the melting point of 140-142 °C. Additional analyses (IR and NMR spectroscopy) have shown that the plates are the product of addition of oleic acid residue to maleic anhydride by the double bond. The resulting substance possesses surfactant properties. Thus, during studies, it was proved that the addition of olefins with the double bond in the center of a hydrocarbon radical with structure retaining to maleic anhydride is impossible in conditions, specified in the literature.

Keywords: maleic anhydride, oleic acid, long-chain olefins, surfactant, nucleophilic addition.

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ENZYMIC TREATMENT OF LEATHER INTERMEDIATE PRODUCT IN THE PROCESS OF SOFTENING (p. 23-27)

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Using enzyme preparations in animal hide treatment technologies is caused by their strong and specific catalytic action in various chemical transformations. The influence of the concentration of proteolytic enzymes - pancreatin and Chemizym BH and treatment duration on the process of softening the hide of wet-salted bull by canning method after unhairing - ashing, washing, splitting and deashing was studied. The effectiveness of the enzymes was estimated by determining the amount of the melted gelatin from deashed and softened hide and physicochemical properties of intermediate products. At the enzyme preparation concentration of 2.2 g/L, temperature of 35-37°C and long-term hide softening, amount of melted gelatin from the dermis reaches 45.0%, and for papillary layer this indicator is close to 100 %.

The results obtained were used in manufacturing the intermediate product "Crust". The studies of physical-mechanical properties of the intermediate product "Crust" have allowed to determine softening duration that provides an optimal range of performance properties.

The results obtained can be used for softening process optimization in the manufacturing technology of the intermediate product "Crust" in order to ensure the required material quality at the expenditure rate of enzyme Chemizym BH of 0.3 % and water of 100 % of the ashed hide mass. Twelve-hour unhairing - rawhide ashing and one-hour hide softening at the optimum action of enzyme Chemizym BH can be considered effective in the manufacturing technology of boxcalf materials for footwear, clothes and fancy goods.

Keywords: enzyme preparations, proteolytic activity, intermediate product, hide, ashing, softening, physicochemical properties.

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CATALYTIC CYCLOHEXANE OXIDATION IN THE PRESENCE OF ALCOHOLS OF DIFFERENT NATURE (p. 27-31)

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One of the ways of improving homogeneous catalytic oxidation of cyclohexane is the use of additives to industrial catalysts based

on metals of variable valency. The analysis of literature sources has shown that alcohols that are formed in the process of oxidation and are able to form intermediate complexes with a catalyst have a significant impact. The effect of C2-C5 alcohol additives on the process of homogeneous catalytic oxidation of cyclohexane was studied in the paper. In the paper, the oxidation indices using binary catalytic systems of cobalt naphthenate – alcohol are given. The qualitative and quantitative effect of additives of monohydric and polyhydric alcohols on the process was defined, and their effects were compared. The dependences of the reaction rate on the nature of additives and the ratio between the components were determined. The optimal binary catalytic systems for the liquid-phase homogeneous catalytic oxidation of cyclohexane were selected, the use of which will allow improving the technical and economic production indices.

Keywords: cyclohexane, cyclohexane, cyclohexanone, oxidation, catalysis, catalytic systems.

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MOLECULAR PUMP FUNCTIONING DUE TO FLUCTUATIONS OF INTRAMEMBRANE POTENTIAL (p. 31-36)

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The paper considers a model of the molecular pump, which creates a directed motion of nanoparticles through the cell membrane, at the edges of which the preset concentrations are maintained due to fluctuations of intramembrane potential. For this model, the numerical solution of equations for the particle flow at the stochastic switching of two sawtooth potentials with given switching frequencies is obtained. This solution has allowed to determine the dependence of the particle flow and concentration ratio at the membrane edges at zero flow on such system parameters as temperature, spatial amplitude and the fluctuation frequency of the potential profile. Also, low-frequency

asymptotics is obtained, which has allowed to compare the mechanisms of molecular pump and motor, operating in the same mode of the potential energy fluctuations, namely in the high-temperature region, the particle flow through the membrane greatly exceeds the particle flow of motor with parameters, corresponding to the considered pump. Furthermore, it is found that the pump can function in the mode of potential energy sign fluctuations whereas such operation is prohibited for the corresponding motor. These patterns are caused by the difference in the boundary conditions of the pump and motor: setting concentrations on the membrane edges for the pump and periodic boundary conditions for the motor.

Keywords: nanomachines, nanomechanisms, Brownian motors, molecular pumps, near-surface diffusion, nonequilibrium fluctuations.

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DETERMINATION OF FOAMING PROPERTIES IN SURFACTANT SOLUTIONS (p. 36-41)

Olga Paraska, Svitlana Karvan, Tetyana Rak

The process of binary surfactant mixture foaming was investigated on the basis of a comprehensive determination of its physicochemical and processing characteristics. Based on the research results, the quantitative characteristics of the foaming of binary surfactant mixtures were determined. The optimum ratio of mixture components and working concentrations of solutions for the efficient application in various product treatment processes was determined.

The optimum ratio of the omero-16/LAS-80 surfactant mixture components, which is 33/67 %, for the efficient use in the processes of cleaning and finishing of products, was determined. It was found that for the efficient use in the automatic washing of products, it is not recommended to exceed the working concentrations of the proposed surfactants in the range from 1 to 2 g/l, since the foam increase during materials washing will complicate the removing of the washing residues during the next rinsing. The

performance properties (stiffness, indelibility) of polyester and cotton materials after the treatment with the surfactant mixtures were evaluated. The studies have shown that after treating the fabrics with the mixture 80 omero-16/LAS, the material surface becomes softer, which recommends applying the surfactant mixture in the creation of softeners and conditioners for textile products.

Keywords: foaming, surfactants, binary mixtures, dispersion systems, finishing.

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STUDYING NITROGEN INFLUENCE ON EFFICIENCY OF VIBROCAVITATION TREATMENT OF DAIRY FACTORY WASTEWATER (p. 42-47)

Liliya Shevchuk, Ivan Aftanaziv, Orysa Strohan, Lesya Predzymirskia

Creating highly efficient methods of wastewater decontamination and destruction of present organic compounds is one of the promising trends for solving problems in technology of water treatment.

The technology for wastewater treatment of organic and biological contaminants, based on the cavitation water treatment is proposed in the paper. Theoretical knowledge and experimental researches in the field of cavitation has given ground to a method of vibro-resonance cavitation processing of liquids, which specific feature is organic combination of high-intensity of the formed cavitation field with significant treatment capacity. For its implementation, a low vibration electromagnetic resonance cavitator, which is of a simple structural design, energy saving and convenient in operation and maintenance was developed.

The studies of vibrocavitation treatment efficiency, carried out on the dairy factory wastewater in the presence of nitrogen, indicate synergism of vibrocavitation action in the presence of gas that is confirmed by the calculated values of effective rate constants of microbial decontamination and destruction of organic compounds. The obtained results show high efficiency of wastewater treatment, conditioned by shock-dynamic, cavitation effects of sterilization and side phenomena of physical and electromagnetic nature, enhancing its effectiveness. Such integrated approach provides greater efficiency of the process on the whole process and opens the prospect of practical application in technologies of wastewater treatment at food enterprises.

Keywords: cavitation, vibration electromagnetic cavitator, wastewater, chemical oxygen demand, microorganisms, decontamination.

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INFLUENCE OF FILLERS DENSE PACKING TO THE PERFORMANCE PROPERTIES OF WATER-DISPERSION COATINGS (p. 47-50)

Taras Karavayev

The considerable attention of scientists and practitioners is devoted to improving of coatings performance properties. Providing the most fillers dense packing in the polymer matrix of paint coating is one way of development in this area. Purpose of the article is creating a fillers dense packing of performance properties of water-dispersion coatings.

Object of study – the water-dispersion styrene-acrylic coatings filled by Ukrainian carbonates. Research of film tensile strength was carried out according to GOST 18299, resistance of coating to wet abrasion – according to ISO 11998.

The mathematical model let to determine that the maximum packing of particles in the coating will be achieved when the ratio of carbonate filler for plastics (CFP, the average particle size 1.8 microns) to chalk grade MMC-1 (1.0 microns) as 85.4 wt.% to 14.6 wt. % respectively. The maximum films tensile strength (5.52 MPa) and coatings resistance to wet abrasion (4.8 micron thickness loss) got from water-dispersion paints achieved when filled by carbonates CFP and MMC-1 at ratio 85.0 wt.% and 15.0 wt.% respectively. This is higher than the corresponding values in the case of each of the fillers alone and at other ratios that confirmed of getting the most dense packing of the particles in the coating.

The influence of fillers packing density to coating performance properties from the water-dispersion paints has been determined. Getting the most dense packing of particles at specified ratio of carbonate filler allows to improve the performance properties of water-dispersion coating through a uniform wetting of the filler particles by polymer, strengthening the adhesive bond between binder and filler. This is to promote the continuous phase, resistance to cracking and destruction of coatings.

Keywords: water-dispersion paints, coatings, fillers, carbonates, particles dense packing, mathematical model.

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INFLUENCE OF MODIFIER ON HARDENING CEMENT STONE AND REFRACTORY CONCRETE PROPERTIES (p. 51-57)

Victoria Peschanska, Anna Voytyuk, Yaroslav Pitak

A tendency to increasing the volumes of production and application of low cement refractory concrete has determined the development of theoretical and practical aspects of modifying concrete with surfactants. Varying the rate of hydration of calcium aluminate cement, surfactants (deflocculants) has influenced the rheotechnological characteristics of concrete masses and their consolidation, formation of the solid low porosity concrete structure, both when hardening at normal temperatures and in conditions of thermal heating.

The influence of the low cement refractory cement deflocculant – sodium tripolyphosphate and a complex modifier, containing sodium tripolyphosphate, and an organic superplasticizer, on changing the nature of hydration processes of cement and the ratio between the crystalline and amorphous phases, the strength properties of cement stone at early stages of hardening, was studied in the paper. The differences in spatial orientation and density of the nanostructures on the surface of cement crystallohydrates, modified with sodium tripolyphosphate and the complex modifier were revealed. It was found that the complex modifier, presented by surfactants of different nature, has a significant influence on the formation of a finely porous and mechanically strong structure of composite material, physical and technical properties of the heat-treated concrete.

Keywords: low cement refractory concrete, calcium aluminate cement, hydration, modifier, amorphous phase, crystallohydrates, microstructure.

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PENETRATING WATERPROOFING COATINGS BASED ON SLAG -CONTAINING CEMENTS, MODIFIED BY NATURAL ZEOLITES (p. 57-62)

Kateryna Pushkarova, Maryna Sukhanevych, Kateryna Bondar

The paper deals with obtaining penetrating waterproofing coatings for concrete surfaces based on the slag-cement systems,

modified by natural zeolite additives. The composition was investigated and physico-mechanical properties of slag-containing cements with natural zeolite, which were subsequently modified by the salt-electrolyte complex to create penetrating coating, were optimized. Studying the properties of the developed coating has confirmed its competitiveness in the market of similar concrete waterproofing products and shown the property retention in time (after 1-2 years of operation). Hydration products of the developed material were investigated using physicochemical research methods. It was shown that the component structure of the cement matrix creates the conditions for the synthesis of new hydration formations of C-S-H type, capable of concrete pore space calmatation. It was revealed that introducing the modifying complex additive of salts-electrolytes provides a directed formation of crystal-hydrate phases, capable of binding free portlandite in the concrete structure and filling voids and pores of the concrete.

Concurrent administration of the natural zeolite additive promotes binding of free alkali and ensures forming of a durable waterproofing coating, which does not lose its insulating properties over time.

Developed coatings become part of the concrete structure, sealing its composition and creating new stable formations, coatings are not peeled off over time and do not loosen the existing concrete as it was observed in the compared analogues. Thus, the developed method for restoring massive concrete structures allows to avoid costly removal and new concreting.

Keywords: penetrating waterproofing coating, slag-containing cement, natural zeolite, electrolyte salts.

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