PHYSICOCHEMICAL PROPERTIES OF SYNTHESIZING ORGANOCLAY FOR CHROMIUM ADSORPTION (p. 4–7)

Anton Golembiovskyi

The influence of physicochemical factors when modifying the clay mineral montmorillonite (MMT) with a cationic surface–active agent (SAA), called hexadecyltrimethylammonium bromide (HDTMA) on adsorption properties of resultant sorbents for extracting chromium (VI) ions from aqueous media, is given for the first time in the paper. The X–ray analysis, macroelectrophoresis and sorption methods for designating the selected samples were used in the research. It was found that the wide range time shifting of a contact between a HDTMA solution and MMT slurry as well as changing of pH–level within the range of 4–10 do not significantly affect adsorption properties of output products. It was proved that increasing the ratio of SAA in regards to the exchange capacity of clay mineral up to 2, and carrying out the synthesis in an aqueous medium at low temperatures significantly increase the adsorption capacity of output products relating to chromium (VI) ions. The research results can be applied to obtaining sorbents for extracting chromium (VI) ions from aqueous media.

Keywords: organoclay, synthesis, montmorillonite, modification, hexadecyltrimethylammonium bromide, ethanol, chromium, adsorption, macroelectrophoresis.

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RATIONAL CONDITIONS FOR FRACTIONAL CRYSTALLIZATION OF SUNFLOWER OIL OF PALMITIC TYPE FROM SOLUTION (p. 8–12)

Ekaterina Kunitsa, Elena Litvinenko, Fedor Gladkiy

The paper deals with the definition of rational conditions for fractionation of sunflower oil of palmitic type from solution. Justification of solvent selection for the fractional crystallization process is given. The work is aimed at the definition of rational fractionation conditions and obtaining dependences of target fraction output and its melting point on the key process parameters, such as process temperature and oil concentration when applying new solvent. The data on the dependences of target fraction output and its melting point on the key process parameters, namely, temperature and oil concentration in solvent was obtained. As a result of the studies it was found that using the new solvent, namely butyl alcohol is effective for the fractional crystallization process. Total process duration, depending on the oil amount in the solution is 12–24 hours. When using butyl alcohol, there is crystallization acceleration by 4.3 times: from 68 hours without solvent up to 16 hours for 40–60 % oil solutions in solvent. Fractionation from butyl alcohol leads to oil crystallization acceleration, lower capture of the liquid fraction, and provides achieving higher melting points of high–melting fraction as compared to fractionation from melt.

Keywords: sunflower oil of palmitic type, fractional crystallization, butyl alcohol, solution

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KINETICS LAWS OF ADIPIC AND SUCCINIC ACIDS ESTERIFICATION WITH ALIPHATIC ALCOHOLS C_2–C_5 (p. 13–17)

Stepan Melnyk

Kinetic laws of adipic and succinic acids esterification with aliphatic alcohols C_2–C_5 in the closed system in the temperature range 333–363K were studied. The method for determining the composition of the reaction mixture, consisting of dicarboxylic acid, alcohol, mono– and diester, using titrimetric and chromatographic analyses was proposed. For different temperatures, the rate constants of consecutive transformation reaction of acid to monoester and monoester to diester were calculated, according to which the values of pre–exponential factor, energy, entropy and enthalpy of esterification reaction activation were determined. The compensation effect for reactions of obtaining mono–and diesters, indicating the identical mechanism of intermediates transformation was revealed. Isokinetic temperatures for systems AA (adipic acid) – C_2–C_5 alcohol and SA (succinic acid) – C_2–C_5 alcohol for catalysis conditions with sulfate and p–toluenesulfonic acid were defined. Approximation of the temperature range 343–423K, typical for esterification in non–stationary conditions, made using the determined values of pre–exponential factors and activation energies allowed to evaluate and compare the alcohols reactivity in the interaction with the corresponding DCA (dicarboxylic acid) and monoester. It was determined that the effect of dicarboxylic acid nature on the esterification rate is lower than that of the catalyst (Bronsted acid) and alcohol nature.

Keywords: esterification, rate constant, activation energy, adipic, succinic, acid, C_2–C_5 alcohols.

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DIFFUSION OF POLAR AND NON–POLAR MOLECULES IN POLYMER MEMBRANES (p. 17–22)

Inessa Burtna, Otar Gachechiladze, Ludmila Rhuzinska, Mikhail Murashko

Diffusion of small molecules of different polarities in polymeric membranes is the most interesting in terms of studying thermodynamic and kinetic parameters of the separation process of liquid multicomponent organic mixtures. In the paper, the principle emphasis is made on diffusion mechanisms of polar and non–polar molecules in flexible, non–polar organic–silicon polymers. For estimating the diffusion rate and determining diffusion mechanisms, the experiments on adsorption and desorption of a number of samples at constant temperature and pressure have been conducted. Dynamics of the curves shows possible kinetic processes, occurring in polymer at its dissolution into non–polar solvents differing in a molecular size. The similar studies have been carried out using polar solvents with different dipole molecular moments. It has shown that the limited dissolution rate for polar solvents compared to non–polar ones is low. It has been found that the principal mechanism of diffusion in the polymer under its dissolving in polar solvents is the Fickian diffusion. Herewith, at the beginning of a sorption process the diffusion runs very fast, and then the process slows down significantly and a macromolecular matrix manages to complete relaxation, not allowing the solvent molecules to deform the lattice further. In the process of dissolving the polymer in solvents with non–polar molecules the main mechanism of diffusion is not the Fickian diffusion. Moreover, a more low–molecular solvent causes a high degree of swelling that is associated with a higher mobility of molecules and the possibility of their rapid penetration into the polymer depth at the beginning of dissolving. A long time "tail" while desorbing the polymer, dissolved in non–polar solvents shows that there is a second diffusion type. There are obvious micropores in the polymer, through which small non–polar molecules can be trapped and can form clusters with polymer alloys. When desorbing the temperature of carrying out the process is not sufficient for activating such centers.

Keywords: Fickian diffusion, swelling, dissolution, polar and non–polar solvents, polymer membrane.

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ASPECTS OF POLYMER SURFACES WETTING
(p. 23–26)

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Predicting quantitative characteristics of polymer surfaces wetting is one of the urgent tasks, which is to be solved at designing the systems of adhesives, coatings, printing materials, etc. The hydrophilic–lipophilic balance concept, which, however, allows only a qualitative effectiveness assessment of wetting agents is often used to solve this problem. The modified Owens–Wendt method, the theoretical basis of which allows to determine the relationship between the components of the surface tension of liquid and wetting efficiency of polymer surface with the known energy distribution is used in this paper. A practical approach, allowing to define the parameters of the surface tension of surfactants solutions, using the reference data on the components of the surface tension of liquids is proposed. It was shown that the method allows to achieve the high measurement accuracy of the specified solutions parameters and quantitatively predict the angles values of polymer surfaces wetting by liquid with the accuracy ± 4°. It was determined that solutions of anionic and nonionic surfactants are characterized by extremely low values of the polar component of the surface tension. At the same time, the values of solvent dispersion component increase at introducing these modifiers. The results are of practical importance, and can be used to develop wetting agents for the systems of polymeric adhesives, printing materials and coatings for plastics. Developing the obtained theoretical patterns will allow to take into account the influence of bi– and three–component solvent systems in the model that provides a quantitative description of such processes as dispersing highly–hydrophobic pigments and creating strong adhesion contacts in polymeric systems.

Keywords: Owens–Wendt method, surface energy, surfactants, polymers, wetting, wetting angle

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DEMULSIFYING ABILITY OF BLOCKPOLYMERS BASED ON ETHYLENE AND PROPYLENE OXIDES
(p. 27–32)

Sergey Bojchenko, Alexander Lazorko, Yuri Golych, Petro Topilnyckyy, Viktoria Romanchuk

In practice, settling, heating, alternating electric field application and reagent–demulsifier supply are combined to increase oil emulsion destruction efficiency. Application of demulsifiers is considered the most effective method to influence the adsorption layers of oil emulsions, and its use is necessary in combination with the above–named and all other technological methods, which are not widely used. Nonionic demulsifiers are the most effective. Block-polymers, based on ethylene and propylene oxides with different molecular masses: M=3200, M=3500, M=6000 and different ratios of ethylene oxide and propylene oxide (EO/PO) were taken for research. Demulsifiers were prepared by adding 40 % of water and 10 % of isopropyl alcohol to the base. All experiments were carried out at a temperature of 60 ºC. After been mixed, the emulsion was settled during 1, 2 and 3 hours. The amounts of demulsifier, added to the emulsion are 10, 50, 70 and 100 g/t. The water, released during the emulsion settling was separated, and its volume was measured.

Blockpolymers with the molecular mass of 3200 and 3500 showed the greatest demulsifying property. The increase of ethylene oxide in the macromolecule had a positive effect on the blockpolymers demulsifying ability. Each of these blockpolymers showed its highest demulsifying ability at the ratios EO/PO – 90/10 and 85/15 respectively.

Dehydration degree practically in all substances was insufficient at the consumption of 10–50 g/t. When comparing demulsifying ability of blockpolymers with the consumption of 70 g/t it was found that blockpolymers with M=6000 shows the lowest demulsifying ability. All other blockpolymers with M=3200 and M=3500 showed 90 % efficiency. Further increase in the blockpolymers consumption up to 100 g/t increases the blockpolymers dehydration degree by 5 %, reaching the value of 97–98 % for blockpolymers with M=3200 and M=3500.

Keywords: emulsion, demulsifier, ethylene oxide, propylene oxide, dehydration, desalting, dehydration degree.

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PRODUCING ENAMELS BASED ON SECONDARY POLYSTYRENE (p. 33–36)

Nataliia Sholukh

The formulations for lacquer and enamel compositions based on «secondary» polystyrene were developed, and physicomechanical properties of coatings based on these compositions were studied. It was shown that as a solvent, it is better to use a mixture of toluene and ethyl acetate in the ratio of 1:1 that allows obtaining lacquer compositions with high speed of drying out and time, sufficient for forming a heavy–duty coating. It was determined that the physicomechanical characteristics of all samples of paint compositions are higher comparing to the known similar enamels (TU 67–371–81 Enamels polystyrene), namely coating hardness and water resistance characteristics. Using «secondary» polystyrene in the developed compositions will significantly reduce lacquer and enamel costs. Using polystyrene wastes for the production of lacquers and enamels will solve two urgent problems: the saving of crude products and materials, involved in the production of polymeric materials and the environmental protection of industrial regions.

Keywords: polystyrene wastes, high–impact polystyrene, lacquer, enamel, excipients, paint compositions.

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THE STUDY OF A LOW–CYCLIC LOADING EFFECT ON DEFORMATION CHARACTERISTICS OF THE SANDWICH PLATES (p. 37–40)

Ivan Glagola

Modern promising development areas of building materials and designs of them, corresponding to the new increased requirements to sandwich plates, which ensure significant steel savings are considered in the paper. The results of experimental studies of the low–cyclic loading influence on deformation characteristics of sandwich plates are given in the paper. Based on the original method for determining deformation at low–cyclic loadings, the author has determined the basic deformation characteristics of sandwich plates. The comparison of low–cyclic loading influence on different models of plates, comparison of deformation characteristics of sandwich plates with concrete plates, selected as samples were conducted in the paper.

Experimental tests allowed to determine the maximum and residual deformations of the stretched layer of steel fiber concrete, deformation characteristics of sandwich plates of steel fiber concrete, hybrid steel fiber reinforced concrete, two–layer steel fiber reinforced concrete under the low–cyclic loading. As a result of the studies, the deformation diagram of the stretched layer under the low–cyclic loading of plates of the series of hybrid steel fiber reinforced concrete and two–layer steel fiber reinforced concrete was constructed. The obtained research results revealed that the samples of the series of hybrid steel fiber reinforced concrete and two–layer steel fiber reinforced concrete are much more receptive to cyclic loading than the samples of concrete.

Keywords: sandwich plates, fiber, cyclic loading, deformations, concrete, reinforced concrete, steel fiber reinforced concrete, method.

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INFLUENCE OF RELEASE AGENTS ON PHYSICAL AND MECHANICAL PROPERTIES OF COLD THERMOPLASTIC CONCRETE (p. 41–44)

Maxim Svynarov, Viktor Zolotaryov

The methods and techniques of ensuring processability of cold asphalt concrete mixtures were considered, taking into account specific features and technologies of producing a polymeric petroleum binder, also used in producing a colored cold mix. For reducing, the treatment of the mixture with an aqueous solution of a non–ionic surface–active agent, which is compound in the mixture directly during its production, was proposed. The dependences of slumping abilities of mixtures, treated by different amounts of an additive agent on the binder viscosity, were given. The optimum agent content was determined. It reduces slumping abilities of thermoplastic concrete mixtures, and increases the strength of asphalt–concretes, based on these mixtures. The obtained results on water saturation and density show that the agent does not only reduce slumping abilities of mixtures, but also promotes their sealing. It was shown that adding a release agent into mixtures, obtained on certain binder grades, can improve physical and mechanical properties of thermoplastic concretes by increasing viscosity of applied fluid binders.

Keywords: autohesion, slumping abilities, release agent, fluid binders, thermoplastic concrete mixture, cold thermoplastic concrete.

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PROBLEMS OF THE NORMATIVE SUPPORT FOR THE PRODUCTION OF HYBRID SILICA FILLERS OF DENTAL COMPOSITE MATERIALS (p. 45–48)

Anton Lozovskoy, Daria Oleynik, Olga Skorodumova, Tatiana Gontar, Yana Goncharenko

The research on the problems of normative support for quality control of silica filler with a reduced tendency to aggregation, obtained from hybrid gels of the system MTEOS–TEOS–water–alcohol under conditions of variable pH was given.

As a result of the conducted studies, the technology for hybrid filler with a homogeneous structure and uniform particles surface hydrophobization was developed. It was established that the increase in the ratio MTEOS/TEOS in the gel increases the particles adsorption activity of the silica powder and its hydrophobicity degree due to the methyl groups presence on the particles surface. It was found that the alkali concentration at TEOS and MTEOS hydrolysis products joint coagulation has a decisive influence on the homogeneity degree of powder and its physicochemical characteristics. The method of quality control of the hybrid silica filler of dental composite materials was developed.

Keywords: silica filler, dental composite materials, hybrid gels, aggregation, hydrophobicity.

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EFFECT OF PHASE COMPOSITION ON RESORPTION OF CALCIUM SILICATE–PHOSPHATE GLASS–CERAMIC COATINGS FOR TITANIUM (p. 49–53)

Galina Shadrina, Oksana Savvova, Darina Shemet

The problem of long–term knitting of bioactive glass–ceramic calcium silicate–phosphate coatings for titanium with a bone that constitutes about 6 months today, using foreign implants of this kind is considered in the paper. The solution to this problem by providing an appropriate resorption level of glass–ceramic coatings due to reproducing a certain ratio of phase–forming components is proposed.

The purpose of this work was to study the effect of phase composition on resorption of glass–ceramic coatings for titanium. Bioactive calcium silicate–phosphate glass–ceramic coatings for titanium were synthesized; their crystallizability and solubility in the distilled water and physiological liquids were investigated in the paper. The resorption dependence on the calcium silicate–phosphate glass–ceramic coating structure and parabolic nature of the deposition kinetics of medium components on surfaces in the model liquid of the organism in vitro for a certain period were established. It is expedient to use the obtained results in the composition design of resorption bioactive glass–ceramic coatings for titanium in creating femoral endoprostheses with knitting terms from 3 months.

Keywords: glass–ceramic coatings for titanium, resorption, crystallizability, physiological liquid.

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SIMULATION OF RESISTANCE OF MODIFIED WOOD TO WASHOUT OF PROTECTIVE AGENTS (p. 53–56)

Yuriy Tsapko

Using the developed computational and analytical method, the intensity of modifiers mass transfer from the treated wood was determined, and the effect of the wood preservative covering and water repellent on the flame retardant removal slowdown process was defined. The developed mathematical model and its numerical implementation method allow to determine the parameters of modifiers washout in wood and its covering into the environment, depending on the samples geometry, physical–chemical properties of substances, impregnating wood and their initial distribution in the covering material, wood and environment. In particular, it was established that, after the 100–th time step, reduction of the flame retardant concentration in the wood, covered with preservative was approximately 30 %, while using water repellent – only 4 %. The calculated thickness of the polymeric preservative covering for the mixture DSA–2, which causes destruction is $12{,}6 \cdot 10^{-6}$ m, while using water repellent – $29{,}5 \cdot 10^{-6}$ m. This allows to consider that using the water repellents considerably prevents the flame retardants escape from the modified wood and make a rational choice of agents to increase the service life of the treated wood.

Keywords: impregnation, flame retardants, preservatives, wood, diffusion, water repellents, washout, wood service durability

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INFLUENCE OF GEOCEMENT–BASED COATINGS ON ACTIVATION ENERGY OF THERMAL OXIDATIVE WOOD DEGRADATION (p. 57–60)

Anastasiya Kravchenko, Pavlo Kryvenko, Sergii Guzii, Yuriy Tsapko

The influence of geocement–based coatings on activation energy of thermal–oxidative wood degradation was studied. The obtained thermogravimetric data enable determining the rate of thermal decomposition of materials at a given temperature and oxygen concentration in an ambient medium and therefore show a qualitative evaluation of thermal effects and determine activation energy of thermal–oxidative degradation. The results of studying the thermal wood degradation and coatings were given. It was determined that the disintegration temperature for wood was 503 K and mass losses of samples, which give the basis for estimating activation energy, increasing by 3 times for geocement–based coatings. The study on determining flammability group of wood, modified by coatings, was carried out and the efficiency of lowering the temperature of flue gases by 1.5 times and losing mass during tests by almost 8 times was set.

Keywords: fire resistance, geocement, wood, activation energy, modification efficiency, coatings, distribution, thermal–oxidative degradation.

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