

OPTIMUM CONDITIONS DETERMINATION OF METHYL METHACRYLATE OBTAINING OVER TUNGSTEN-CONTAINING CATALYST (p. 4-7)

Yuliia Dmytruk, Volodymyr Ivasiv,
Roman Nebesnyi, Svitlana Maykova

The main common methods of methyl methacrylate producing are acetoncyanohydrin method and oxidation of isobutylene and tert-butanol. Because of the significant drawbacks of these methods, it is important to develop new, alternative ways of methyl methacrylate obtaining, one of which could be aldol condensation of methyl propionate with formaldehyde in the gas phase. The actual task for today is to find out effective catalysts for this process.

For this aim, methyl propionate condensation with formaldehyde was studied in the presence of $B_2O_3-P_2O_5-WO_3/SiO_2$ catalyst, which previously has showed high activity in the condensation of propionic acid with formaldehyde to methacrylic acid. The paper also investigates the influence of methanol on the side reaction of methyl propionate hydrolysis; it was found that adding methanol causes a slight increase in MMA selectivity, but the yield of unsaturated products decreases, and therefore adding methanol to the reaction mixture for the MP condensation with FA over $B_2O_3-P_2O_5-WO_3/SiO_2$ catalyst is impractical. The optimum conditions for MP condensation with FA, namely temperature 653 K and contact time 12 s were found. Under these conditions, in the presence of $B_2O_3-P_2O_5-WO_3/SiO_2$ catalyst with an atomic ratio of components B:P:W 3:1:0.6 respectively total yield of MMA and MAA was 31.91 % while their total selectivity was 32.3 %.

Keywords: methyl methacrylate, methacrylic acid, methyl propionate, formaldehyde, catalyst, heterogeneous catalysis, aldol condensation.

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MICROSILICA INFLUENCE ON THE PHASE CONSTITUTION AND PROPERTIES OF SPINEL-FORMING COMPOSITION (p. 8-12)

Victoria Peschanska, Anna Voytyuk, Yaroslav Pitak

Experience in using low cement alumina-magnesia castables, containing spinel-forming reagents, in monolithic ladle linings identified their significant advantages in terms of thermomechanical properties, corrosion resistance and slag resistance. A particular feature of these castables is the synthesis of «in situ» magnesium aluminate spinel at high operating temperatures, which provides increased operational lifetime of the lining.

The microsilica influence on the phase constitution of the composite mixture, containing calcium aluminate cement and spinel-forming reagents – calcined alumina and sintered periclase after firing at 1700 °C was investigated in the paper. It was found that as a result of the interaction of cement calcium aluminates with microsilica, fusible compounds – anorthite and helenite that, at increased microsilica content, impair physical and technical properties of the composite are formed. It was determined that the ratio of spinel-forming reagents and content of the silica-containing material in a matrix component of alumina-magnesia castables is a more important factor of the synthesis of high-melting-point crystalline phases than the microsilica content. Directed regulation of the phase constitution of the matrix component of alumina-magnesia castables by adjusting the grain-size composition of spinel-forming reagents and their optimal ratio will ensure achieving a set of the given physical and technical characteristics of concrete and increasing the operational lifetime of monolithic ladle linings.

Keywords: alumina-magnesia castable, microsilica, spinel-forming reagents, phase constitution, fusible compounds.

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A STUDY OF THE EFFECT OF IRON (III) COMPOUNDS ON OXIDATION OF IRON (II) IONS BY ATMOSPHERIC OXYGEN (p. 13-17)

Victor Yavorskiy, Yaroslav Kalymon, Olga Rubay

Deferrisation of groundwater has been performed by many methods whose choice depends on the form in which iron (Fe) compounds exist in water and on its chemical composition. A number of published studies have proved that the iron (III) compounds sediment used in the filtering substrate has a catalytic effect on the oxidation process. The same property of iron (III) compounds sediment is observed in the sediment layer resulting from contact purification of water. However, in the case of filtering, due to the large-size granules of the filter substrate, the specific surface area of the autocatalytic layer is small, which significantly reduces the system performance. In the schemes of contact filtering with held-up sediment, the area of the phases' contact increases, but there is a need for strict observance of the speed of the water flow and an extended contact time (45 min.). Therefore, our tasks were to increase the active contact area of the catalyst pellicle of the iron (III) sediment and to reduce the time of the contact between water and the held-up sediment.

Deferrisation was carried out in a horizontal absorber bucket of dispersants, in which intensive dispersion significantly increases the area of the phases' contact in the system. Thus, if the pH of water was 6.4 to 7.8 and the temperature was 291 K, the achieved deferrisation was highly efficient, with low concentration of iron (III) compounds in the volume of the researched water in the process of dispersion—0.02 and 0.05 mol Fe³⁺/m³. The time of the contact

between the purified water and the compounds of the sediment was 15 to 80 sec, depending on the pH of the water and the dose of the applied iron (III) compounds.

The obtained results can serve as a basis for the development of a resource and energy saving technology of groundwater deferrising with recirculation of the newly formed sediment.

Keywords: autocatalytic process, deferrisation, iron (III) compounds, sediment, oxidation by atmospheric oxygen.

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THE STUDY OF PHYSICO-CHEMICAL PROPERTIES OF THE SEDIMENTARY CHALK SURFACE OF DOMESTIC DEPOSITS (p. 17-22)

Dmytro Arshynnikov, Valentyn Sviderskiy

The physicochemical properties of the surface of sedimentary chalk deposits in Ukraine were studied, quantification of wettability in static cycles (water) with sinters (water and xylene) compared to chemically precipitated chalk and some imported varieties of calcite was presented. The importance of the role of mineralogical composition and content of adsorbed water in the process of implementation of polar and nonpolar wetting liquids is shown.

The effect of specific surface area, particle morphology, pore structure, surface energy state and variety of sedimentary varieties on the wetting process and adsorption activity with respect to water and oil was evaluated. Analysis of the importance of the role of chemically

deposited chalk in the above-mentioned processes was also conducted. The influence of hydrophobization of calcium carbonates on sedimentary chalk, for example, the possibility of a fundamental change in the physicochemical properties of the surface was analyzed. Future possibilities for use of natural sedimentary chalk in the finished building materials suitable for various functional applications were identified.

Keywords: calcium carbonate, sedimentary chalks, reactive surface, wettability liquids, power status, porosity, adsorption capacity.

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USE OF THE ADMIXTURE CONSISTING OF PRODUCTS OF PROCESSED POLYMER FRACTION OF MUNICIPAL SOLID WASTE AS A CEMENT HARDENING ACCELERATOR (p. 23-29)

Anna Fleysher, Volodymyr Tokarchuk, Valentin Sviderskiy

Increasing quality and durability requirements of concrete and reinforced concrete products lead to the growth of quality requirements not only of the main raw materials but also additional, for example, admixtures. Therefore, many effective admixtures, which have a negative impact on the quality of concrete are taken out of use. These include calcium chloride, which causes corrosion of concrete reinforcement. Hence, developing and introducing new admixtures that would combine high main effect and the lack of negative impact on the concrete quality is reasonable.

The influence of the experimental admixture DOR № 1 on physical and mechanical properties of the cement and the formation rate of bound water in the hardening of the latter was investigated. The admixture DOR № 1 is the product of the processed polymer fraction of municipal solid waste and consists of amides and ammonium salts of the terephthalic acid.

It was found that the admixture DOR № 1 accelerates cement setting and hardening under normal and low temperatures, but has a selective efficiency, which depends on the admixture concentration, cement type and temperature conditions.

Cement hardening acceleration occurs due to increased solubility of clinker minerals, which in turn increases the formation rate of the gel-like phase, calcium ions and accelerates crystallization of calcium hydrosilicates, which increases cement strength.

The results confirm the possibility of using the admixture DOR № 1 as a cement setting and hardening accelerator. The admixture can be used for concreting under different temperatures.

Keywords: admixture, cement setting and hardening accelerator, polymer fraction of municipal solid waste, compressive strength, hydration rate, amount of bound water.

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DESIGN OF GASOLINE VAPOR EJECTION CONDENSATOR FROM VAPOR AND GAS MIXTURES (p. 29-37)

Michail Kologrivov, Vitalii Buzovskiy

The calculation method of the ejection apparatus, which operates with flammable and explosive vapor-gas flow is considered. Calculation of the apparatus is performed without prior experimental research of the operation with gasoline vapor. The calculation method is based on two models. The first Pazhi-Galustov model is theoretical, the second Andreev model uses similarity criteria. The Stefan formula, as applied to the polar coordinate system was derived, which has allowed to give a more rigorous description of the mass transfer mechanisms at the droplet interface. The results of Andreev E.I., obtained for the nozzle chambers of air conditioners were used for deriving the heat-mass transfer intensity equation according to the first model by numerical simulation. The approach, which has allowed to develop recommendations for a constructive design of the ejection apparatus for condensing gasoline vapors without dangerous experimental research was proposed. In particular, the numerical experiment has shown that in order to reduce materials consumption, the length of the apparatus is advisable to be

no more than 1.5 m, and the ratio of mass flows of brine and vapor-gas mixture, providing the necessary gasoline vapor recovery degree must be at least 5:1.

Keywords: ejection heat exchanger, heat-mass transfer, convective and molecular diffusion, mathematical model.

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DEVELOPMENT OF METHOD OF USE OF ACID-RESISTANT SELECTIVE ACTION ENZYME PREPARATIONS (p. 38-44)

Petro Shiyay, Tatiana Mudrak, Anatoliy Kuts, Iaroslav Boiarchuk

A lot of studies were conducted nowadays in distilling industry on biocatalysis and fermentation of wort from starch-containing raw material using selective action enzyme complexes, but operational parameters for hydrolysis of starch-containing raw material biopolymers are not sufficiently investigated at low pH of the substrate. On the market of enzyme preparations in Ukraine there are acid-resistant enzymes that enable hydrolysis of grain mashes in low pH environment. This article concentrates on determination of efficiency of use of acid-resistant enzyme preparations (EP) when producing worts from starch-containing raw material. The results of studies on content in wort of water-soluble carbohydrates and insoluble starch depending on pH, temperature of termofermentive processing (TFP) and enzyme activity stabilizer Ca^{2+} ions are demonstrated. In terms of bioconversion efficiency of raw grain material components and assurance of microbiological purity of intermediate products of alcohol production, optimum pH is 3.8–4.0, mash processing time is 90 minutes.

Keywords: mash, enzyme preparations, fermentation of wort, wort, water-soluble carbohydrates, insoluble starch, concentration.

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INVESTIGATION OF INTERACTION OF AMINOETHYLETHYLENEDIAMINE WITH SUNFLOWER OIL (p. 44-49)

Anatoliy Melnik, Olga Chumak, Serhii Malik, Alisher Khusanov

The interaction reaction of sunflower oil with hydroxyethyl-ethylenediamine at molar ratios of reactants of from 1:1 to 1:3, and

temperatures of 393–433 K by changes in the amine concentration over time was investigated, based on which the rate constants, activation energy and entropy were calculated. Using a kinetic first-order reaction model, the estimated thermodynamic parameters, changes in the amine concentration over time were calculated and compared with the experimental values. Analysis of variance between concentrations indicates that the amine concentration can be used for the sunflower oil amidation reaction control only at the initial stage. This is caused by the fact that both nitrogen and oxygen-containing products that also react with amine are formed in the oil amidation.

Keywords: sunflower oil, amidation, hydroxyethylethylenediamine, composition, kinetics, model, adequacy.

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RECOVERING OF FATTY ACIDS FROM SOAP STOCK USING CARBON DIOXIDE (p. 50-53)

Svitlana Molchenko, Igor Demidov

Since the domestic oil and fat industry is characterized by a steady production growth, the amount of waste is constantly increasing, which adversely affects the ecological situation in Ukraine. In particular, these products include soap stock – waste of alkaline

refining of vegetable oils, which is a source of fatty acids. Fatty acids are a commodity product, the demand and the cost of which is much higher in the soap stock.

The method of recovering fatty acids from the soap stock by carbon dioxide decomposition of their soaps was proposed. The effect of temperature, pressure of carbon dioxide and concentration of the aqueous solution of soap on the decomposition depth was experimentally proved in the paper. Studies have shown that the decomposition process of potassium salts of fatty acids by carbonate acid proceeds at a depth of over 90 %. The resulting fatty acids are well suited for use in many industries. Rational technological parameters were determined, and the approximation model of the process was obtained. It was found that after the decomposition of potassium salts of fatty acids by carbonate acid, fatty acid composition of resulting fatty acids, which was determined by gas-liquid chromatography, changes slightly.

Keywords: vegetable oils, soap stock, waste, fatty acids, carbon dioxide, decomposition.

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STUDY OF EMULSIFIER NATURE EFFECT ON THE PROCESS OF HYDROCARBON FRACTION COOLIGOMERIZATION IN THE EMULSION (p. 54-57)

Ulyana Fuch, Bogdan Dzinyak, Roman Subtelnyy

The process of emulsion cooligomerization of C₉ fraction unsaturated hydrocarbons of cooligomers production (synthetic low-molecular petroleum resins), which are obtained from cheap petrochemical raw materials – hydrocarbon fractions of liquid pyrolysis products (LPP) or cracking of oil, refined products and gas was investigated in the paper.

Since the emulsifier and initiator nature, as well as the emulsification process have the greatest effect on the cooligomerization process in the emulsion, the research is aimed at studying the influence of the main factors – the nature and concentration of emulsifiers and

initiators on the yield and physicochemical properties of cooligomers obtained, namely bromine number, softening temperature, color and molecular weight. For that, surface-active properties of emulsifiers used were thoroughly studied, the surface tension isotherm for the given emulsifiers (sodium stearate and oleate, emulsifier E-30) was obtained. To determine the optimal emulsifier concentration, the critical micelle concentration (CMC) and surface tension at the point corresponding to the CMC was defined. It was found that the emulsifier amount increase to the CMC point promotes the yield enhancement (up to 17.8 wt%) and improves the physicochemical properties of the product.

Based on the studies, optimal concentrations of cooligomerization components: potassium persulfate initiator – 0.1 wt%, emulsifier E-30 – 0.7 wt% were selected.

Keywords: emulsion cooligomerization, C₉ fraction, initiator, emulsifier, cooligomer.

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ANALYSIS OF SPECIFICITY OF FINISHED FORMS OF ANTIMICROBIAL PREPARATIONS FROM STREPTOMYCES ALBUS (p. 58-63)

Tetiana Todosiichuk, Olena Pokas

The antimicrobial activity of the developed experimental forms of antiseptic preparations relatively common infectious agents was investigated. The complex action of the antiseptic solution from *Streptomyces albus* UN 44, caused by the activity of bacteriolysins and antibiotic of the strain, defining a wide range of antimicrobial activity was shown. The maximum ability of such an antiseptic to

destroy and inhibit the growth of microorganisms is determined in relation to the Gram-positive bacteria of the genera *Corynebacterium*, *Bacillus*, *Streptococcus*, *Staphylococcus*.

The ability of the strain *Streptomyces albus* UN 44 to accumulate an antibiotic in the cell and to secrete it exogenously was revealed. The leading fungistatic antibiotic activity in the finished forms of dry producer biomass and complex liquid antiseptic, the combination of substances with different mechanisms of antimicrobial action in the complex preparation were shown.

Finished forms of antiseptic preparations (solution, extract, dry biomass) for use in veterinary, medicine, canning were proposed.

Keywords: *Streptomyces albus*, bacteriolysins, antibiotic, finished forms, antimicrobial activity, antiseptics.

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