ABSTRACT AND REFERENCES

TECHNOLOGY OF ORGANIC AND INORGANIC SUBSTANSE

PREVENTION OF SCALE FORMATION AND SALINE WASTEWATER DISCHARGE DURING DISTRICT HEATING SYSTEMS OPERATION (p. 4-8)

Sergiy Vysotskiy, Oleksiy Varyvoda

The factors, determining the intensity of scale formation in district heating systems, were considered. For "closed" systems scale formation intensity is defined by the carbonate index, which is standardized by the rules of technical operation depending on the temperature of water heating. For "open" systems, which have direct contact with the atmosphere (circulating water cooling systems), the intensity of salts accumulation is proportional to the product of calcium hardness and square alkalinity of water.

The equations were derived, which allow determining the required load by absorbed cations on weakly acidic cation exchange resins and, accordingly, the required amount of filters media. Replacing traditional technology of preparation of make-up water of heating systems using sodium cycling method by water treatment in filters, loaded by weakly acidic cation exchange resin with further decarbonization, allows reducing reagent consumption by 8 times and significant reduction of saline wastewater discharge into surface water reservoirs.

The results of studying the process of softening waste regeneration solutions by soda and lime are given. Reduction of wastewater hardness to the values<3mg·ekv/dm^3 requires precise dosing of reagents.

Keywords: heating systems, scale formation, carbonate index, weakly acidic cation exchange resins, reagents, softening.

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ADDITIVE BASED ON SYNTHETIC ALUMINOSILICATE FOR CEMENT SYSTEMS (p. 8-11)

V. Loganina, Igor Zhernovski, Maria Sadovnikov, Christina Zhegera

For regulating the structure and properties of lime-based and cement-based composites it was proposed to add synthetic aluminosilicates to the composition. Aluminosilicates were synthesized in acidic medium by means of their precipitation from the aluminum sulfate $Al_2(SO_4)_3$ solution and adding sodium silicate followed by washing the precipitate. It is shown that synthesized aluminosilicates are characterized by a high activity, being more than 350 mg/g. The specific surface area of powder, determined by the BET method, constitutes $S_{sp} = 86.5 \pm 3.5$ m^2/g. During the X-ray diffraction analysis of the composition it was determined that there is a crystalline phase (22%), represented by thenardite and gibbsite, as well as an amorphous component, represented by nanoscale cristobalite-like crystallites (78%). During the introduction of synthetic aluminosilicates into the lime composites, increased amount of chemically-bound lime and higher compressive strength can be observed. It is shown that the composite cement binder, containing synthetic aluminosilicates, is characterized by less setting time.

Keywords: synthesis of aluminosilicates, phase composition, dispersity, activity, properties of cement systems.

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lime using synthetic zeolites. Proceedings of the higher education institutions. Building, № 4, 37-42.

FEATURES OF ROTATIONAL MODES OF VIBRATIONS OF WATER MOLECULES IN FREE AND BOUND STATES (p. 11-15)

Nikolay Pogozhikh, Nikolay Malafayev, Iegor Ishtvan

The paper considers rotational (including librational - dimensional rotational) vibrations and the number of corresponding vibrational modes for molecules of water in its various physical phase states - liquid, ice and "bound". The main purpose of the research is comparative analysis of vibrational modes of molecules of water in different phase states, taking into account the results of previous paper [6] on vibrational modes of molecules in liquid water. The analysis of changes in the number of rotational modes of molecules of water for its various phase states and physical consequences of these changes for physical and thermal properties of water was conducted. Increased force of hydrogen bonds of water molecules in ice or bound ice-like state leads to reducing the number of rotational vibration modes, and accordingly, the number of degrees of freedom of molecules and heat capacity of the phase. State, mobility and structure of macromolecules in aqueous solutions are determined by the strength of ice-like "skeleton/corset" of their hydration shell formed by "bound" water molecules.

Keywords: bound water, rotational and librational vibrations, vibrational degrees of freedom, heat capacity.

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EVALUATION OF PHYSICO-CHEMICAL FACTORS INFLUENCE ON CORROSION ACTIVITY OF WATER (p. 15-19)

Anzhela Tamazashvili, Yuliya Mazna, Karina Malyhina, Mykola Gomelya

The paper investigated corrosion processes and determined the level of various aqueous media activity towards metals. Corrosion rate was determined by a manometric method and polarization resistance method. Tap water, artesian water and standard test solution were used as media of comparisons. The influence of pH, temperature and salinity on the rate of metals corrosion was defined. It was found that corrosion activity of neutral aqueous medium depends on the concentration of dissolved oxygen and the content of salt anions in water. It was proved that dissolved inorganic salts significantly accelerate corrosion process. It was found that at the temperature of 20 °C, with decreased oxygen concentration in static conditions, corrosion rate decreases. It was shown that at high temperatures, the initial concentration of oxygen as well as pH medium, have little effect on corrosion activity of water, since in this case, corrosion of steel is mainly determined by chemical interaction of metal with water.

Keywords: corrosion activity, metals, oxygen, salinity, corrosion rate, passivation oxygen film.

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METHOD OF ALKALI SOLUTION CONCENTRATION AT ELECTROCHEMICAL PROCESSING OF ELUATES CONTAINING SODIUM SALTS (p. 20-23)

Inna Trus, Mukola Gomelya, Iaroslav Radovenchyk

The paper gives the results of electrochemical concentration of alkali solutions, produced by electrolysis of sodium chloride or sodium sulfate. It was found that using two-chambered electrolyzer, the interelectrode space of which is separated by MK-40 membrane, allows increasing alkali concentration from 0.1-1.0D to 13D. It is shown that with anolyte alkalinity>0.1D alkali concentration in the anode region has little effect on electrolysis efficiency. Concentration is effective with alkaline solution in the anode region>0.1D. As a whole, efficiency depends on both alkalinity in the cathode and anode regions and current density. It is proved that increasing anodic current density from 10 to 20 A/dm^2 leads to increasing not only the speed of alkali concentration in the cathode region, but also alkali current efficiency. Further increase in current density is irrelevant because there is no increase in speed, but the solution heating. It was found

that partial reduction of alkali concentration in the cathode region is conditioned by reverse-osmotic water transfer.

Keywords: electrodialysis, catholyte, anolyte, current density, current efficiency, demineralization, dialysis.

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STUDY OF COMPOSITES PROPERTIES BASED ON MODIFIED SODIUM SILICATE (p. 24-26)

Natalia Sholukh

The research in the field of interaction between inorganic binder (sodium silicate) and organic hardeners (dicarboxylic acid esters) has been conducted. The kinetics of saponification of several dicarboxylic acid esters in a sodium silicate medium has been studied. In this case, the kinetics of saponification is described by the pseudo-first order equation. The results of kinetic researches allow predicting the selection of dicarboxylic acid esters aimed at decreasing or increasing the prolonged action of esters depending on their structure and nature during organic-silicate composites structurization. Interrelation of structural properties of organic-inorganic composites components and physicochemical properties of coatings based on them has been shown.

The hardeners effect on the properties of paint and adhesive composites has been verified. The improvement of operation properties when using the hardeners in organic-inorganic composites has been shown, namely increased paint coating water resistance and adhesive joint strength in adhesive composites. It is shown that the compounds containing ester groups can be used as hardeners of organic-inorganic composites.

Keywords: organic-inorganic composites, sodium silicate, hardener, dicarboxylic acid esters.

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FEATURES AND METHODS OF HEAVY SOUR CRUDE OIL REFINING (p. 27-31)

Oleg Grynyshyn, Mohammad Shakir Abd Al-Ameri, Yuriy Khlibyshyn

The features and properties of distillate fractions and residue of heavy sour crude Orkhovitsk oil were examined and promising methods for their use were proposed in the paper. It was found that with increasing the temperature of fractions boiling, the content of sulfur compounds in them increases. The main regularities of the process of viscosity breaking of Orkhovitsk oil residue in the temperature range 410-450°C were studied. It was established that the process of viscosity breaking can not be considered as an independent and final stage of refining of Orkhovitsk oil residue. It was shown that the method of co-oxidation of Orkhovitsk oil residue and 11-13% masses of heavy pyrolysis resin at the temperature of 250°C, air supply $2.5h^{-1}$ during 6 hours allows obtaining the bitumen, which, by the main quality parameters, meets the requirements for road bitumen of the grade BND 60/90 according to DSTU 4044-2001. As

a result of studying the basic regularities of modification of residual bitumen obtained from Orkhovitsk oil by the polymer latex Butonal NS 198, it was determined that inclusion of 2-3% masses of this modifier into bitumen, followed by mixing at 180°C for 2-6 h, allows obtaining the bitumen, which meets the requirements of the grade BND 60/90.

Keywords: heavy sour crude oil, bitumen, oxidation, modification.

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CALCULATION OF PHENOL-FORMALDEHYDE RESIN POLYCONDENSATION PROCESS ACCORDING TO ACTIVITY CRITERION (p. 32-35)

Vladimir Maslosh, Olga Maslosh, Natalia Taranenko, Helena Loshkova

Application of the activity criterion for calculating the polycondensation process of phenol-formaldehyde resins is considered in the paper. Reactive groups, their number and structure occupy a very important place in polycondensation oligomers.

The obtained formula for calculating the activity criterion is very simple and easy to use. Polycondensation constant - the molar ratio of polycondensation components, is always specified by the synthesis conditions. For determining the criterion of oligomers activity it is necessary to know the concentration of reactive groups in the oligomer.

Application of the activity criterion for calculating the polycondensation process greatly facilitates determining the calculation data of polycondensation process.

The calculation of activity criterion is given in the paper on the example of two phenol-formaldehyde resins – namely novolac and resole resins.

Experimental data allow revealing the dependence of the degree of polycondensation oligomer polymerization on the condensation constant and activity criterion.

Keywords: active groups, oligomer structure, polycondensation process, activity criterion.

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INVESTIGATIONS OF SEVERAL SURFACE-ACTIVE PROPERTIES OF ALKYLIMIDAZOLINE SALTS (p. 36-39)

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Investigations of surface active properties of amidoimidazolines and its salts described in this article. Imidazolines have been synthetized from linseed oil and diethylenetriamine under conditions determined before. Investigations have been conducted for samples of imidazoline which were got during synthesis in determined times. Acetic and alkylsulfuric salts of obtained imidazoline and intermediate samples have been used as well. Anticorrosive ability of alkylsulfuric salt of alkylimidazolines was much better than acetic salt and unneutralized imidazoline. The worst anticorrosive ability was shown by acetic salt of imidazoline. Defensive effect of alkylsulfuric salt is more than 99 % and by this parameter salt could be compared with well-known corrosion inhibitors. Interfacial tension and ability to form emulsion have been investigated for unneutralized imidazoline and its salts as well. The best ability to form emulsion has been shown by acetic salt. Minimum interfacial tension was shown by acetic salt of imidazoline as well. In the same time maximum interfacial tension was determined for alkylsulfuric salt and the same salt have the worst ability to form emulsion.

Keywords: imidazoline surfactants , surface activity, inhibition efficiency, alkylsulfuric salts, emulsion, interfacial tension

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RESEARCH OF SUSPENSION COOLIGOMERIZATION OF UNSATURATED HYDROCARBONS OF C_9 FRACTION, INITIATED BY ORGANIC PEROXIDES (p. 39-42)

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The issue of processing by-products of ethylene production - liquid pyrolysis products, is of current importance. Industrial methods of initiated cooligomerization of unsaturated hydrocarbons of C_9 fraction have several disadvantages, such as high temperature level and reaction duration, high cooligomer color indexes.

In order to eliminate the above mentioned difficulties it was proposed to conduct cooligomerization in suspension. Suspension cooligomerization of unsaturated hydrocarbons of C_9 fraction is a technologically initiated oligomerization in drops of monomer, dispersed in an aqueous medium mostly. Water-soluble stabilizers are used for suspension stabilizing.

As a result of experimental studies, the dependence of physical and chemical properties of cooligomer on the initiator nature was given, the optimal ratio of suspension components and cooligomerization duration were set. The influence of various stabilizers on physical and chemical properties of cooligomer was studied. It was proposed to extract cooligomer from oligomerizate using the precipitation method.

The results are of practical interest for processing by-products of diesel fuel pyrolysis.

Keywords: suspension cooligomerization, hydrocarbon fraction, initiator, cooligomer.

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UNHAIRING ANIMAL HIDES USING PROBIOTIC BACTERIA BACILLUS SUBTILIS (p. 43-46)

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The most efficient technology of processing natural raw materials into skin and fur is the use of enzyme products for soaking and liming processes. Therefore, the use of bacterial products, which produce enzymes of various functional effects, is considered to be very promising for the above mentioned processes.

Soaking and liming of flint-dried rabbit hides were carried out using probiotic bacreria Bacillus subtilis on 4 samples in a laboratory centrifuge at soaking temperature 36-38°C and working solution pH 6,7-7. Unhairing was made by painting method, except one sample, unhairing of which was made mechanically after having soaked the hides in solution for 36-48 hours.

Due to active action of Bacillus subtilis bacteria, the soaka ing process was reduced, unhairing was conducted without lime-sulfide painting paste, and the period of semi-finished product softening was decreased by 30 minutes. According to chemical analysis data, the concentration of chrome (III) oxide in spent solution is lower, and according to physical-mechanical tests of hides, the hygrothermal stability reaches its maximal value.

The obtained results prove the prospects of Bacillus subtilis bacteria use in developing effective technologies of soaking and liming processes of leather and fur production.

The technology elaborated allows combining soaking, unhairing, liming and desalting into a one-phase technological process. Advantages of this technology are 2 times faster soaking, comparing to the existing technology, with leather output increased by 20%, and reduction of chromium compounds in spent solutions by 34% that decreases the anthropogenic impact on the environment during its implementation.

Keywords: probiotic bacteria Bacillus subtilis, rabbit hides, soaking and liming processes.

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