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MODERNIZATION OF FERRATE(VI) TECHNOLOGY FROM THE IRON HYDROXIDES

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As an alternative of the solid iron salts to improve the ferrate(VI) technology it is proposed to use Fe(II) or F(III) hydroxides that are synthesized using special technique. The patterns of Fe(VI) compounds production from iron hydroxides by hypochlorite method are studied in the article.

The effect of the main factors (OH^- and Cl^- ions concentration, temperature, duration of the synthesis, the molar ratio of the reactants $[ClO^-]/[Fe(II)]$ or $[ClO^-]/[Fe(III)]$) to yield of the desired product is studied.

It is shown that conversion degree of iron hydroxides into ferrates reaches 80–86 %. It is found that using the $Fe(OH)_2$, except ferrate anions FeO_4^{2-}, byproduct (Fe_3O_4 magnetite) is formed in an amount not exceeding about 4 % of total Fe.

It is found that ferrate(VI) yield is reduced with increasing temperature, therefore for reducing the rate of FeO_4^{2-} decomposition it is recommended to carry out the synthesis at low temperatures.

It is found that conversion degree (α) of hydroxides into ferrates is also increased with increase of $[ClO^-]/[Fe(II)]$ or $[ClO^-]/[Fe(III)]$ values. Therefore, it should be maintained 2–3 fold excess oxidant to ensure the optimal values of α.

The practical guidelines of ferrate(VI) production from Fe(II) and Fe(III) hydroxides are developed on the basis of experiments.

Keywords: synthesis of ferrate(VI), sodium hydroxide, hypochlorite, Fe(II) and Fe(III) hydroxides.

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DESIGN OF POLYMERIC COMPOSITE MATERIALS FOR COATINGS AND SEALANTS WITH INCREASED WEATHER RESISTANCE

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In order to develop polymeric composite materials (PCM) for coatings and sealants with good weather resistance and physical and mechanical properties, the object of research is oligomeric composition based on hydrogenated oligobutadienedions with finite hydroxyl groups. The main disadvantage of oligobutadienedion-based compositions is unsatisfactory chemical resistance to air, due to the presence of double bonds in the polymer chain.

In order to maximize eliminate the main disadvantage, it is decided to use oligomers that are subjected to partial hydrogenation.

It is revealed that GI oligomers can be considered as binding bases of mortarless elastomeric compositions for coatings and sealants with good weather resistance due to the low viscosity and sufficiently small unsaturation values. Analysis of the kaolin effect as a filler on structural and mechanical properties of GI oligomers is determines that due to the low structural viscosity of GI oligomers for practical use as a binding PCM bases, it is necessary further inject the structuring additives into them, for example – Aerosil.

The presence of hydroxyl groups makes it possible to perform composition structuring using diisocyanates at room temperature to obtain ozone resistant sealants and protective coatings. It is determined that the coatings, derived from kaolin-filled (20 % wt.) and aerosil (5 % wt.) GI oligomer, are characterized by high adhesion to steel Ст3, more than 5 MPa for separation, without the use of primers and adhesives.

Keywords: protective coatings, hydrogenated oligobutadienedion, rheological properties, effect of filler, weather resistant properties.

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REPRODUCING OF SECURITY AND LIMITED VISIBILITY OF FIRE WEAPONS OF DEFENCE LINE FROM AERIAL RECONNAISSANCE

page 15–18

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The object of the research is a process of an elastic interaction of ultrasound beam with a cylindrical module in the form of two circular shells with same length coaxially connected to their ends. Sealed gap between two circular shells is filled with fluid.

Outside irradiation by the ultrasonic beam affects the properties of the module, including the emergence of local characteristics of the outer shell, and to change energy state of liquid-static gap between shells.

It is great interest in the applied use of these changes for echolocation tasks in terms of artificial formation of «acoustic transparency» situation.

The following research methods are used: methods of construction of fencing structures, methods of radiation acoustics and methods of hydroacoustics.

The features of the studied mechanical system are revealed at the resonant level of wave coincidence. The content of aberration phenomena of sound waves that are emitted into the liquid is defined and surface barriers in the form of caustic zone with a high degree of turbulence and energy state is built. Economic conditions for use of ultrasound beam energy to the desired «acoustic transparency» of the outer shell at low and below the limit frequencies are outlined.

Comparative analysis of the object photos inside the inner shell for the original time and during irradiation allows qualitatively assess change clear outline of the object to blurred patch that was the aim of research. Opportunities for quality improvement of effect are related to the choice of physical and chemical, in particular, optical properties of the liquid.

Thus, caustic zone, which is formed artificially by ultrasound, will block echolocation means and make invisible military equipment of open field fortifications.

Keywords: wave size, aberration, caustic zone, wave coincidence.

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A STUDY OF FORMATION PECULIARITIES AND PROPERTIES OF IRON COATINGS WITH REFRACTORY METALS ON GRAY CAST IRON SCH18

page 19–28

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The features of the formation of iron multi-component coatings with refractory metals (molybdenum and tungsten) from citrate electrolytes based on iron(III) on substrates made of gray cast iron SCH18 are studied. It is shown that the electrolysis mode and the density of cathodic polarization effect on the current efficiency, the content of alloying elements in coatings and their distribution over the surface, allowing to control electrodeposition process. It is found that with increasing current density coatings are enriched with alloying components while increasing the porosity as a result of the intensification of hydrogen release. Rational intervals of current densities are determined for galvanostatic regime and pulse polarization regime for formation of iron-molybdenum and iron-molybdenum-tungsten coatings with a high content of alloying elements, the output flow is up to 85 % and coating deposition rate of 25–30 μm/h.

It is shown that the addition of the refractory metals in the thin film results in an amorphous coating structure and formation of extended microglobular surface consisting of grains of various sizes. It is found that a high degree of surface extension and substantial contents of tungsten and molybdenum provide high wear resistance performance and corrosion resistance, and low friction coefficient compared with the substrate material. These materials can be used as reinforcement and protection in a variety of industries.

Keywords: iron coating, gray cast iron, refractory metals, electrodeposition, electrolytic alloy, corrosion resistance.

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CONSTRUCTION OF MATHEMATICAL MODEL OF DISSOLUTION PROCESS OF SOLIDS UNDER ACTION OF ULTRASOUND

page 28–33

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An influence of the ultrasound beam on the process, dissolution of solids in liquid solvents is considered: influence of frequency, intensity, velocity of acoustic vibrations, cavitation and acoustic flows on mass transfer process.

Experimental researches show that the intensification of dissolution process of solids in liquid solvents under action of ultrasound is influenced by acoustic flows, microflows and under influence of cavitation bubbles. Development of new efficient equipment for solution requires the development of calculation methods of dissolution processes of solids in liquid solvents under conditions of ultrasonic irradiation. Such methods should take into account the characteristics of ultrasonic generators, irradiation frequency of ultrasonic vibrations, power and intensity of ultrasonic vibrations.

Mathematical model of dissolution process of the granule is constructed. It identifies the change of size of the granule over time under influence of the source of ultrasonic irradiation. Mathematical model consists of three differential equations used to calculate depending on the ratio of the granule size and the maximum turbulence scale of acoustic flows and for cavitation.

The mathematical model will enable use in conducting numerous studies as a basis of equipment calculation methods for dissolution process of granular material.

Keywords: dissolution, ultrasound, diffusion, mass transfer, intensification, cavitation, bubbles, solid granule, rate.

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ECOLOGY AND ENVIRONMENTAL TECHNOLOGY

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INFLUENCE OF REDOX POTENTIAL OF DIFFERENT WATER QUALITY ON THE HUMAN BLOOD

page 34–38

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The problem of influence of redox potential of water on human blood is considered and some of research results in this area are given. Results of clinical experiments indicate a positive therapeutic effect of water consumption with the negative value of the redox potential. However, the influence of salt content of such water on the human body isn't analyzed. Distilled, tap and natural mineral medical-table water «Polyana Kvasova» (Ukraine) are analyzed. Distilled water doesn't have drinking water properties. The value of the total salt content of «Polyana Kvasova» mineral water far exceeds the standard value of allowable salt content in the water. Tap water (Lviv, Ukraine) is characterized by physiological full value of mineral composition.

All water samples in accordance with pH value, except distilled water, meet drinking water quality indicators. The value of the redox potential is most favorable to the human body for «Polyana Kvasova» mineral water. The source water saturation with molecular hydrogen and activation in electric activator can reduce its redox potential for negative values. Change of the quality parameters for activated water (catholyte) indicates their non-compliance with drinking water indicators. Quality of hydrogen-saturated water hasn't changed. Water consumption with negative redox potential improves blood condition of the experimenter compared to the reference Consumption of activated water (catholyte) has immunomodulatory effect rather than an antioxidant effect. The powerful antioxidant effect of hydrogen-saturated water is indicated. Blood state close to ideal is observed after consumption of natural mineral medical-table hydrogen-saturated water «Polyana Kvasova».

Saturation of water with hydrogen can be considered as a method of improving drinking water quality and, thus, human health.

Keywords: drinking water, redox potential, hydrogen-saturated water, electroactivated water.

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RESEARCH OF WAYS TO REDUCE MECHANICAL INFLUENCE ON FLOCCULES IN A CENTRIFUGE

page 39–45

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The ways to reduce the mechanical influence on flocculed aggregates of polydisperse sludge at its dewatering in the centrifuges are studied. It is determined that by changing the design of the feed pipe and the conditions of slurry supply in the centrifuge can be reduced hydromechanical effect on sludge floccules, providing their minimum destruction. It is proposed to install the guide channels along the side surface of the feed pipe so that the direction of slurry flow from the channels coincides with the direction of rotor rotation. Pulp flows along a tangent to the drum surface and only a small part of the flow experiences shear stresses. Installation of booster sleeve with guide pipes, preventing suspension spraying, in the drum allows the slurry to flow down smoothly directly on the surface of the rotor bath depth. It is found that such improvement of centrifuge design increases the efficiency of treatment of flocculed sludge to 99 % and reduces the entrainment of solids with centrate by minimizing destruction of floccules.

Keywords: sludge treatment unit, polydisperse sludge, destruction of floccules, strength of floccules, centrifuge improvement.

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STUDY OF MODIFICATION OF MAGNETICALLY LABELED YEASTS *Saccharomyces cerevisiae* FOR COPPER CATIONS Cu^{2+} REMOVAL

page 45–49

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Research of biosorption and search for the cheapest and effective biosorbents of heavy metals are important for wastewater treatment, recovery and allocation of precious metals. Biosorbent artificially provided with magnetic properties quickly and efficiently can be removed from the workspace. Magnetically labeled biosorbent obtained by multi-vortical MHD stirring of yeast *S. cerevisiae* with nanoscale magnetic labels is able to remove from solutions a wide range of metals, and is the subject of the study.

Sorption properties of cell walls in the case of passive biosorption are dependent from represented on its surface functional groups such as carboxyl and amino groups. Quantitative analysis of the contribution of functional groups, lipids and proteins in sorption capacity of magnetically labeled cells of interest for understanding the sorption of metal cations, interactions of particles of magnetite with cell wall and sorption of metal cations by immobilized magnetite. There is a need to detect how many functional groups are blocked by magnetite during multi-vortical MHD stirring.

To solve this problem it is prompted to investigate and analyze the sorption capacity of magnetically labeled yeast by modifying the surface of biosorbent by extraction or blocking in terms of biosorption by functional groups.

The results showed that the carboxyl groups, and after them the amino group of the cell wall of native and magnetically labeled yeasts have the greatest contribution to the sorption of copper cations. Magnetic labels interact with –COOH groups and block them – about 15 % of the cell wall components extracted using NaOH. At the same time 1 % by weight of magnetite provides biosorbent equivalent amount of copper cations binding sites on the surface of cells, which in turn leads to the same sorption capacity of native and magnetically labeled yeasts.

Keywords: magnetically labeled yeast *S. cerevisiae*, sorption capacity of biosorbent, functional groups.

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FOOD PRODUCTION TECHNOLOGY

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DEVELOPMENT OF INNOVATIVE TECHNOLOGIES OF FONDANT CANDIES WITH SYNBIOTICS

page 50–55

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Confectionery products are an addition to food and their weight in the diet is about 10 %. However, candies based on sugar fondant consist of carbohydrates and are the sources of «empty» calories. In this connection, in recent years, the issues of confectionary functionalization become relevant.

The object of this research is the process of formulating the fondant candies using synbiotic complex

Functional ingredients in synbiotic composition are bifidobacteria and lactulose. Microencapsulation technology is used for «protection» of microbial cells from the effects of physiological and technological factors.

Research on the effect of synbiotics on the structural, mechanical and chemical properties of fondant is conducted. It is determined that in test samples of fondant with increasing amount of lactulose there is a decrease in viscosity. It plays a positive role in candy mass molding by casting method. Experimental data on the content of dry and reducing substances in the finished product is possible to determine the optimum amount of lactulose.

Biomedical research of fondant candies with synbiotics proves that they have antidisbiotic properties and are able to attach therapeutic effect at a dysbiosis.

Keywords: microencapsulated bifidobacteria, prebiotic, lactulose, synbiotics, microencapsulation, fondant candies.

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DETERMINATION OF QUALITY AND SAFETY OF SWEET ALMONDS, WHICH ARE IMPORTED INTO UKRAINE FROM SPAIN

page 56–61

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Globalization leads to expansion of market foreign trade relations between the countries. This encourages the development of competition and, thus, improves product quality. However, the important aspect is the unification of regulations in all countries, because in practice, the requirements for some products are differ, making difficult entering products into world markets. Ukraine is a developing country, so it is a very timely issue for bringing standards into line with European standards. This determines the importance of comparison and study of regulatory requirements for quality of goods in different countries. Requirements for quality and safety of sweet almond nuts in various countries are analyzed and compared. It is established that the existing standards in Ukraine have some differences from European, particularly for the separation of the commodity grades. Investigation of product quality for compliance with Ukrainian standards is carried out. The following organoleptic properties are tested during the study: appearance, density and surface, state of the kernel, taste and smell of the kernel. Moisture and ash content are investigated among the physical-chemical parameters. It is established that sweet almond nuts is the high-quality nuts according to organoleptic and physico-chemical parameters. Due to the frequent cases of information falsification that is common among imported product, product labeling and packaging are analyzed in detail and its compliance with applicable regulations is established. Analysis of the product in terms of safety, such as the content of toxic substances (lead, cadmium, copper), allow to assert that imported products are safe to use, because the level of cadmium and copper is almost twice lower than the permitted limit, and the level of lead is lower by 5 times. The research results can be used for updating expert methods of almonds by expert institutions and customs authorities during the expertise of almonds and its customs clearance. The research results are promising for the development of new methods for determining the quality of sweet almond nuts. Important issue of future research is to determine the stability of quality and safety indicators during storage.

Keywords: inventory pomological group, Nonpareil almond, California almond, Mission almond, quality indicators, safety indicators.

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