

ABSTRACT AND REFERENCES

ECOLOGY. MATERIALS SCIENCE

MICROALGAE CULTIVATION USING WASTES (p. 4-9)

Nataliia Golub

The process of cultivation of *Chlorella vulgaris* in photoheterotrophic conditions at illumination 12 hours of light - 12 hours of darkness is studied. It is shown that the sugar beet extract in concentrations of 0.0 - 0.05 mol/L (on glucose), added to the nutrient medium Gromov №6 positively influences the gain of the biomass of microalgae *Chlorella vulgaris*. The greatest gain of microalgae biomass ($35 \cdot 10^6$ cells/mL) occurs at simultaneous use of mineral (CO_2) and organic (extract) carbon. It is shown that the gain of biomass and lipids depends on the nutrition source on nitrogen. The yield of biomass and lipids increases in conditions of nitrogen deficiency in the culture medium at replacing the nitrate form of nitrogen with the ammonium form. Using the extract from poultry manure, the concentration of lipids reaches 26 % (in medium Gromov №6 - 21 %, modified on ammonium - 24 %). Optimum concentration of the total nitrogen is up to 0.035 mol/L. The increase in the biomass gain using the extract from the manure is explained by the presence in the medium of nitrogen, primarily in the nitrate and ammonium forms and urea, as well as organic substances (amino acids, carbohydrates, etc.), which are used without the decomposition of *Chlorella vulgaris* and do not require additional energy sources.

Keywords: *Chlorella vulgaris*, manure, cultivation, waste, photoreactor, lipids, biomass, microalgae

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ENVIRONMENTALLY FRIENDLY EPOXYAMINE FILLED COMPOSITIONS OF LOW-TEMPERATURE CURING (p. 9-12)

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It is established that in comparison with other polymeric binders, the processes of obtaining the epoxy-amine compositions, used in construction, meet 8 of 12 principles of "green" chemistry. It is shown that the use of low-molecular weight substances as acid catalysts of the curing reaction reduces the value of E-factor by one order and the value of atom efficiency of the process by two orders. It is experimentally proved that the disperse mineral fillers, which have hydroxyl groups with various functions of acidity on the surface, can be used for the acceleration of reaction of cross-linking in the production of polymeric construction materials based on the epoxy-amine compositions. This will allow to improve the environmental safety of the preparation, application, use and utilization of these materials by the exclusion of toxic and environmentally hazardous to humans and biosphere low-molecular weight substances.

Keywords: epoxy-amine compositions, disperse mineral fillers, catalytic effect, E-factor, atom efficiency.

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TECHNOLOGY OF OBTAINING NITROGEN FERTILIZER FROM CALCIUM-CONTAINING SLUDGE OF CALCIUM SALTPETER PRODUCTION (p. 13-16)

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The new technology of obtaining nitrogen fertilizer from calcium-containing sludge of calcium saltpeter production is considered in the paper. The main objective of the research is the development of processing technology of sludge of calcium saltpeter production into alkaline nitrogen fertilizer, analysis of the composition of initial material and finished product, testing of fertilizer by means of vegetative studies and determination of expenditure of drying agent that is exhaust gases of the nitrate acid production unit after recuperation turbine. The main properties of initial sludge and finished product were studied, their composition was determined using the method of atom-absorption spectral analysis. It is shown that the obtained fertilizer contains bound nitrogen and other nutrient elements (Na, K, Ca, Mg, P), and the content of water-insoluble residue is the precondition for the prolonged effect of fertilizer. The technology of obtaining cheap nitrogen fertilizer on the basis of sludge of calcium saltpeter production - calcium-containing sludge, which includes extrusion of initial sludge and two-phase drying, using exhaust gasses of the nitrate acid production unit after recuperation turbine as drying agent, was developed. The efficiency of the obtained fertilizer was proved by vegetative tests, carried out in laboratory conditions on the example of wheat.

Keywords: calcium-containing sludge, composition, fertilizer, calcium saltpeter, extrusion, drying, vegetative tests.

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ABOUT NO (NITRIC OXIDE) PHOTOSYNTHESIS AT INCOHERENT RADIATION (p. 16-20)

Inna Kravchenko

The paper considers the alternative possibility of obtaining salt-forming nitrogen oxides by photochemical oxidation of atmospheric nitrogen using sources of incoherent radiation.

It is shown that nitrogen dioxide, which is capable of two-photon absorption, in the process of which its photolysis is realized with the formation of singlet oxygen atom of O (1D) configuration and NO, can act as an oxidant. The latter, being oxidized, turns into NO₂, and thus, the initial reagent is not lost in the system.

In large-scale productions, it is rather difficult to carry out coherent (laser) radiation of reagents, therefore, the influence of incoherent irradiation on a product yield is studied in the paper, and mercury lamps with different radiation spectra were selected as sources.

It was experimentally established and theoretically proved that maximum additional amount of NO is formed when using lamps DRT-125 with the operating range of wave lengths of 230-445,3 nm.

The research results can be used in the chemical industry, namely in production of nitric acid for the transition to a non-catalytic ammonia-free method of obtaining NO, and in the production of adipic acid to reduce the consumption index on nitric acid, where flue gases contain molecular nitrogen, nitrous oxide and oxygen. Besides the economic aspect, the ecological aspect – reduction of greenhouse nitric (I) oxide emissions is observed in the paper.

Keywords: N₂, photolysis of NO₂, singlet atom of oxygen, radiation sources, NO yield.

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IMPROVEMENT OF METHOD OF DRYING PETROLEUM, OIL AND LUBRICANTS BY INDIFFERENT GAS (p. 20-23)

Igor Trofimov

The issue of enhancing the performance properties of petroleum, oil and lubricants (POL) using indifferent gas by an environmentally safe method is considered in the paper. The main purpose of the research was the improvement of the method of drying POL by indifferent gas, which lied in using exhaust gases of the truck tractor instead of the generator of indifferent gases, which are pre-purified from CO₂ in the exhaust gas purification catalysts, which are also proposed to add to the circuit diagram. The improved scheme of drying petroleum, oil and lubricants by indifferent gas allows solving such problems as dehydration of POL, saving physicochemical and

performance properties of POL, reduction of losses of oil products from vaporization, improvement of fire safety during the transportation of POL. The improved scheme, proposed in the paper, meets modern requirements for oil products purification systems, technical and environmental requirements, has low net cost of equipment. The research results can be applied in the operation of mobile equipment for storage and refuelling of POL and hydraulic fluids, as well as in the field of ecology and environmental protection. The research results can be applied by chemotology experts, experts in the field of operation of equipment for refuelling and storage of POL, as well as ecologists.

Keywords: petroleum, oil and lubricants, hydraulic fluids, performance properties, gas, dehydration, catalyst, generator

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ESTIMATION OF COMPLEX INDEX OF QUALITY OF TOILET SOAP WITH OIL EXTRACTS OF PLANT RAW MATERIALS (p. 28-32)

Zakharenko Vitaly, Sorokyna Svetlana, Akmen Vyktorya

Taking into account modern needs of consumers and ecological impact on a human body, it was proposed to improve the consumer properties of toilet soap by the introduction of oil extracts of plant raw materials (a mixture of oil extracts of brier and common nettle) that does not affect the organoleptic properties of hard toilet soap, and promotes a positive impact on the improvement of its antioxidant and antibacterial properties. The estimation of complex index of the quality of new soap samples was conducted, for what the hierarchical tree of evaluation of the quality of new soap was proposed, where the overall complex quality index is based on blocks of parameters, which characterize the most important parameters (properties) for consumer, they were quantitatively weighed, and the overall estimate was calculated with their further analysis. It was proved that the proposed hard toilet soap has higher antioxidant and antibacterial properties in comparison with traditional hard toilet soap, and 1.1 times higher quality estimate than the control sample that indicates the possibility of competitiveness.

Keywords: soap, antioxidant properties, antibacterial properties, herbal supplements, composite quality index.

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EFFECT OF COBALT AND MANGANESE ON RADIONUCLIDES ADSORPTION BY MODIFIED CLAY SORBENTS (p. 24-27)

Marianna Petrova, Ivan Movchan

The process of decontamination of liquid radioactive wastes, containing Cs-137 and Sr-90, by the sorption method using clay sorbents, modified by copper and copper-potassium ferrocyanides, and also antimony hydroxide was studied in the paper. The adsorption capacity of samples of the modified clay in the presence of equipment corrosion products, ions of cobalt and manganese, was studied. It was found that the modified clay sorbents are effective in the process of decontamination of liquid radioactive wastes since Cs-137 is removed by 99-100 % and Sr-90 - by 70-97 %. Ions of cobalt and manganese do not inhibit the adsorption of Cs-137 while the adsorption of strontium is reduced by 5-10 %. Based on the analysis of results of adsorption of Cs-137 in the presence of cobalt, the hypothesis on a significant adsorption capacity of modified clay samples on cobalt was stated.

Keywords: radioactive wastes, adsorption, cesium, strontium, cobalt, manganese, modified clay, bentonite.

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CAVITATION-EROSION WEAR RESISTANCE OF COMPOSITE ELECTROLYTIC COATINGS IN NEUTRAL MEDIUM (p. 37-41)

Yuriy Bilyk, Miroslav Stechyshyn, Andriy Martynyuk

The technology of forming wear-resistant composite electrolytic coatings on the nickel base is given in the paper. The CEC contained the filler of powders of silicon carbide of various fractions: nanopowders of up to 50 nm, 5 (M5) μm , 20/28 μm , 40/50 μm and amorphous boron with the size of particles of about 1 μm to form solid solutions during further heat treatment. Accordingly, the following designations are accepted in the paper: Ni-SiC_{nano}; Ni-SiC₅; Ni-SiC₂₈; Ni-SiC₅₀.

The setting to form the CEC was built which allows adjusting the resistance of the near-electrode layer of electrolyte, which in turn, allows forming the CEC in a wide range of technological parameters of electrolysis both on horizontal and vertical cathodes (Patent of Ukraine №55154 from 10.12.2010.).

The study of cavitation-erosion wear resistance in hard water and in 3 % solution of NaCl showed that the CEC formed can be divided into 2 groups: group I - CEC of the composition Ni-SiC_{nano} and Ni-SiC₅ and group II - CEC of Ni-SiC₂₈, Ni -SiC₅₀. Thus, the CEC of Ni-SiC_{nano} and Ni-SiC₅ (group I) are the most effective to enhance cavitation-erosion wear resistance of parts which are operated in sodium chloride solutions, particularly in sea water (3 % solution of NaCl).

Thermal annealing at 400 °C for 1-2 hours increases the cavitation wear resistance of the CEP Ni-SiC_{nano} by 20 % in hard water and 30 % in NaCl solution due to the increase of micro-hardness, leveling of internal tension of coating and increase of corrosion resistance by reducing the electrochemical heterogeneity. Vacuum annealing of the CEC with particles of silicon carbide and boron at 1080-1090 °C allows to obtain dense and smooth coatings, the cavitation wear resistance of which increases on average more than 2 times as a result of formation of a solid frame from eutectic Ni-Ni₃B and borides Ni₃B.

Keywords: composite electrolytic coatings (CEC), cavitation, heat treatment, corrosion-active medium.

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EVALUATION OF INTERFIBER PORE-SIZE DISTRIBUTION BY THE METHOD FOR MODELING FIBER STRUCTURE (p. 47-51)

Vasiliy Sys

Impregnation of reinforcing fabric by a viscous self-hardening composition is one of the most difficult technological processes in production of composite materials. Inhomogeneities in the form of air bubbles, despite the use of vacuum impregnation technology, can have a negative effect on the solidity and strength of the composite.

To develop new technical solutions for the improvement of the impregnation process, information on the nature of inter-fiber pore-size distribution is needed. The most promising approach to obtaining such data is the construction of a computer model of the fiber structure based on a preliminary stage of its research.

The existing systems of modeling the structure of textile materials are rather difficult and universal and are developed for commercial use. In such systems, user functions are limited to entering the source data and getting ready results, it can not control the modeling process.

Therefore, the goal of creating the own simple and transparent model for the level of inter-fiber spaces is set in the paper. In this model, the main thing is a geometric aspect of the fiber structure, important from the point of view of the process of its impregnation. The geometric parameters of inter-fiber pores of the flat fiber in the structure of reinforcing fabric were defined. The function of inter-fiber pore-size distribution was constructed.

The obtained results can be used in the development of new technical solutions on the improvement of the process of impregnation of the fiber structure of reinforcing fabric.

Keywords: pore-size distribution, inter-fiber pores, modeling, fiber structure, impregnation.

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ELECTRICAL INSULATION HEAT-RESISTANT PAPER WITH USING PARA-ARAMID FIBRIDS AND PULP AS BINDER (p. 42-47)

Tetyana Demyshok, Lyudmyla Antonenko

The possibility of using of para-aramid fibrids and pulp as a binder of para-aramid fibers during production of electrical insulation heat-resistant paper have been studied. It has confirmed by microscopy the presence branched structures in para-aramid pulp and fibrids, as well as presence of the film structure in fibrids. The Influence of consumption of fibrids and pulp on general indicators such as density, tensile strength, elongation, tear resistance, electric strength, capillary rise, air permeability of non calendered and calendered heat resistant insulating paper have been obtained. It has been determined that after calendering the density of para-aramid paper increases about by three times. Based on the obtained results the optimal consumption of a binder has been found. It has been showed that using para-aramid fibrids or pulp as a binder is possible during production of para-aramid electrical insulation paper. The using of fibrids (at the same consumption) more increases the main indicators of quality of para-aramid paper than pulp.

Keywords: electrical insulating heat resistant paper, a binder, para-aramid fibrids, para-aramid pulp, density, breaking force, electric strength

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STUDY OF RESISTANCE OF MODIFIED WOOD TO MICROBIOLOGICAL DEGRADATION (p. 52-55)

Yuriy Tsapko

Identification of damage wood in building structures in the early stages, as well as forecasting, will appreciate the use of the products, to determine the effectiveness of the methods and means of protection. Analyzed the kinetics of biological populations in the organic mass, which depends on the concentration of media components, as well as models, that describe these processes. The simulation of the biological breakdown of the wood. According to the obtained dependence of the calculated population dynamics of microorganisms in the amount of plant material and the proportion of damaged material. The dependence of the intensity of the destruction of plant material by microorganisms. The results of experimental investigations of the rate of the biological breakdown of the wood and established the influence of the modification antiseptics to reduce the speed and depth of biological destruction.

Keywords: impregnation, wood preservatives, the effectiveness of the modification, biological degradation, biological durability of wood

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STRUCTURE OF FACE BRICK AND LYOPHILY OF ITS SURFACE (p. 56-61)

Petro Varshavets, Valentin Sviderskyy

The dependence of the kinetics of water saturation and capillary suction of ceramic material on the lyophilicity of its surface and porosity, connected with the chemical and mineralogical composition of the feedstock, the degree of sintering during firing and phase composition is shown.

Based on the analysis of experimental data, it was concluded that the interaction of ceramic material with water can be determined by the ratio between its composition, structure, degree of defectiveness, energy state of the surface. This is confirmed by quantitative parameters of such indicators as porosity and its nature, water absorption, wetting angle. These properties of the brick material play a crucial role in the processes of diffusion of aqueous solutions and the formation of efflorescence on the surface. In practical terms, these are two interrelated processes, which can proceed in the following sequence: water absorption by the ceramic material → its interaction with water-soluble salts → formation of saline water solutions → diffusion of the latter as a result of the change in gradients of concentration, humidity, temperature.

Keywords: ceramics, brick, raw materials, clay, composition, porosity, water absorption, surface, lyophilicity, properties.

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INCREASE OF HEAT STABILITY AND HIGH-TEMPERATURE STRENGTH OF COMPOSITE MATERIAL IN CERMET SYSTEM (p. 61-65)

Nickolay Kosicyn

Development of modern industry requires the increase of mechanical, physical and chemical properties of structural materials of

machinery and technological equipment. Traditionally used materials often can no longer provide a full range of necessary requirements: strength, lightness, rigidity, chemical resistance, wear-resistance, heat stability, etc. One of solutions to this problem is the use of composite materials comprising several heterogeneous elements.

The paper gives the analysis of properties of composite materials, and also new solutions to the scientific and technological problem, which lies in the development of an economic process of shaping of structural elements based on material of selective structure with improved mechanical and physical-thermal characteristics. The practical value of the obtained results is in the reduction of energy consumption by 1.8 times and improvement of mechanical properties.

The new technology for the production of structural elements based on the stabilized silica, wastes of metallurgical and glass production at the reduction of time of structure shaping, was developed.

The improvement of mechanical characteristics is realized by the optimization of the components of the structure. Reinforcing elements, introduced into the composite material in the form of scale, which is not recyclable waste of production and provides the necessary strength, and also reduces the temperature of heat treatment, necessary for sintering of composite material on the basis of the stabilized silica. Wastes of glass production serve as additional binders. The method of shaping on the basis of slip casting in hydrophilic equipment is also more economical in comparison with the pressing and sintering methods.

Keywords: stabilized silica, high-temperature strength, heat stability, slip.

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