## TEST OF POLYVINYLCHLORIDE PIPES OBTAINED BY OPTIMAL EXTRUSION DEGREE ORIENTATION METHOD

page 4–7

The object of research in the article is unplasticized polyvinylchloride (UPVC) pipe with outer diameter of 90 mm and a wall thickness of 3,5 mm. Oriented PVC (PVC-O) pipes were made of this pipe. Parameters of these pipes: 110*2,9 mm; 125*2,5 mm; 140*2 mm. For this purpose it was determined with which optimal extrusion degree PVC-O pipe would have better properties and would be less expensive to manufacture than conventional UPVC pipe.

To investigate the optimum extrusion degree it was chosen the acoustic emission research method because it provided the best necessary analytical data.

The result to determine the optimal extrusion degree of PVC-O pipes were obtained during the studies and showed the right choice of research method was shown, namely: an optimal variant for obtaining PVC-O pipe from UPVC pipe 90*3,5 mm is the pipe with extrusion degree 1,4, namely 125*2,5, because it can simultaneously reduce wall thickness by 40 % and have more time resource of exploitation to the destruction of 77 % compared to the dimension-type pipes 110*2,9 and 140*2,0, one of which has a rougher wall, which increases the cost of the pipe and the other has less time resource of exploitation to the destruction.

**Keywords:** pipe, unplasticized polyvinylchloride, orientation method, acoustic emission, extrusion degree, temperature.

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## THERMODYNAMIC ANALYSIS OF REACTIONS IN THE SYSTEM $Al_2O_3$–$SiO_2$–CaO–$P_2O_5$

page 7–11

The object of the research is identification of the coexisting phases in the system $Al_2O_3$–$SiO_2$–CaO–$P_2O_5$. To achieve this aim it is necessary to use the thermodynamical method. This method allows to study the physical and chemical processes in the system $Al_2O_3$–$SiO_2$–CaO–$P_2O_5$. Output thermodynamic data are calculated in the article: enthalpy $\Delta H^o_{298}$, entropy $S^o_{298}$, dependence formula of heating capacity from temperature $C_p = f(T)$ for some combinations of system $Al_2O_3$–$SiO_2$–CaO–$P_2O_5$, by different methods. This is important for carrying out thermodynamic analysis of phase equilibriums in this system. An opportunity of coupled reactions is determined. It is indicated about restructuring of conodes in the researching system. Knowledge of the structure of this system (due to the thermodynamical data) will allow to predict the phase transformations in the process of obtaining new refractory products.

**Keywords:** enthalpy, entropy, Gibbs energy, coupled reactions, coexisting phases.

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## RESEARCH OF CHROMIUM (VI) ION ADSORPTION BY MONTMORILLONITE MODIFIED BY CATIONIC SURFACTANTS

page 11–15

Montmorillonite has high cation exchange capacity and can be used as a sorbent for the removal of metal cations. But anions adsorption on the surface of the mineral is limited.

Targeted regulation of hydrophobic and hydrophilic surface properties using sorbents provides an opportunity to increase its absorption properties in relation to anions.

The results show that the degree of Cr(VI) extraction by the sorbents obtained at montmorillonite modification increases with increase of CEC/S. Organoclays that modified at CEC/s ≥ 1 showed higher adsorption capacity in relation to Cr(VI), but a part of HDTMA isn't related to the mineral surface and involved in the removal of Cr(VI) from solution with precipitation in the form of alkyl ammonium chromate. HDTMA in free form is harmful to the environment, so CEC/S for these sorbents must not exceed 1.

Adsorption of Cr(VI) compounds essentially depends on pH of a solution. The highest values are obtained at pH from 1 to 6. Adsorption properties of organoclays are decreased at pH 6 to 8. Removal of Cr(VI) is not significant in the alkaline environment.

These studies will form the basis for the study of structural and mechanical properties of organoclays to use their suspensions for removal of anions of heavy metals and radionuclides using the latest environmental technologies directly from the soil layers.

**Keywords:** organoclay, montmorillonite, hexadecyltrimethylammonium bromide, adsorption, chromium.

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## DEVELOPMENT OF SIMPLIFIED MATHEMATICAL MODEL OF CARBON PRODUCTS FORMATION

page 16–22

Production of carbon products is characterized by considerable resource and energy consumption, so it is important to improve the efficiency of this production through the introduction of optimal modes of its component processes. A simplified mathematical model of carbon products formation is developed and studied. It is differed from the known models by the almost zero time to calculate it. Developed simplified mathematical model provides an opportunity to increase the research effectiveness of temperature conditions of carbon products formation by reducing the time for research and determine the temperature at any point in the process. Accuracy research of simplified models was conducted by comparing the temperature values calculated according to these models with temperatures calculated according to the original complex model, which in this case is considered as experimental data. As a result, a simplified mathematical model can be used for the synthesis of process control system, as well as in the real time control system.

**Keywords:** carbon products, formation, mathematical model, temperature conditions.

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## SIMULATION OF INTELLIGENT SENSORS DIPPING INTO THE MELTING POLYMER COMPOSITE

page 22–26

One of the most important parameters of the finished product for intelligent sensors dipping into the melting polymer composite is the dipping depth of the sensors. Indeed, under the control of stress-strain state and other parameters using the sensor it is important to correlate obtained data with the sensor location — namely, the depth of its dipping for continuous product. In this regard, it is important for production to achieve accurate dipping of intelligent sensors at a given depth of the finished product, as, for example, stress measurement error for bending is directly proportional to the level of accuracy of the sensor dipping depth. The depth can vary from zero to mid-thickness of the product.

Dipping simulation of intelligent sensors in the flow of the polymer material is carried out on the basis of the finite element method. Stationary problem is solved in the isothermal approximation. The basis is a generalized Newtonian flow model based on the continuity equation solution of incompressible fluid and momentum conservation.

The study allows to reveal the required pressure ratio in primary and secondary channel with the dipping of intelligent sensors to the desired depth into the melting polymer material. An appropriate size of the finite element, material properties and boundary conditions for calculation are determined. Also the optimum angle of sensor dipping, which is 25°, and empirical equations of pressure ratio impact into additional and main channel to a depth of sensor dipping using approximations of dependencies obtained by numerical simulation are determined.

**Keywords:** polymer composites, extrusion, intelligent sensors, intelligent polymer materials.

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## THE CHOICE OF PARAMETERS FOR THE COMPARATIVE EVALUATION OF WEAR RESISTANCE OF THE EPOXY COMPOSITE MATERIALS

page 26–31

Creating new wear-resistant epoxy composite materials for machine parts and mechanisms subjected to abrasive degradation by the solid particles or by using new components in the applied compositions, it is necessary to establish estimation parameters, which determine the wear and performance of these materials with minimal experimental cost.

As an evaluation parameter for such materials in the literature it is proposed to use a quantity of used energy for formation of surface area unit (specific surface energy of the material), because the wear is separated the particles from material surface that lead to formation of a new free surface. In addition, for comparison of the wear resistance of the polymer composites, the ratio of their specific energy surfaces was used taking into account the molecular weight of monomer units of the polymers without accounting an interaction of atoms and groups in the molecules of the polymers as a long-range measure of interacting molecules.

The comparative wear evaluation of highly silicon carbide-contained epoxy composite materials that are hardened by industrial polyamines of different nature is done. The evaluation showed the feasibility of the proposed evaluation parameter - the dynamic elasticity modulus of the materials to choose the most effective hardener of the compositions - Epikure F-205, which provides a dynamic elasticity modulus of the silicon carbide-contained composite materials at the level of $2{,}92 \cdot 10^{10}$ N/m$^2$.

Production tests were carried out for sand nozzles and drain pipes of the hydrocyclones of developed highly silicon carbide-contained epoxy composite materials. As a result, it was confirmed their high operational durability, for comparative evaluation of which we used the values of dynamic elasticity modules of the materials, exceeding 3–5 times the durability of the same products from the widely used cast iron.

**Keywords:** epoxy materials, polyamines, silicon carbide, wear, surface energy, elastic modulus.

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## RESEARCH OF HYGIENE AND SAFETY INDICATORS OF TEXTILE CHILDREN'S CLOTHING

page 32–38

The article is devoted to one of the actual problems of today — establishing quality and safety of modern clothing. The problem of clothing safety has a particular relevance according to the child population due to the incomplete process of growth and development, sensitive of growing organism to external factors.

The object of research is a child's shirt of «DONI» company (Turkey) for boys 4–5 years made of filling-knitted uniformly dyed fabric, mixed according to the raw composition (cotton, polyester and elastane). The selected object is a common type of clothing for children of preschool age.

It was established that the current regulatory documents in Ukraine has not fully disclose all aspects of textile safety and especially children's clothing. Therefore, it is appropriate to continue the practice of harmonizing standards with the European Union and not to weaken state supervision in conformity.

As a result of studies it was found that the content of the raw ingredients does not comply with applicable regulatory documents as it includes fibers of cotton, polyester and elastane.

In terms of water absorption 12,3 % and breathability 183 $dm^3/(m^2 \cdot s)$, the samples are within normal limits. The results of the odorimetry test show no smell (0 points) of the knitted fabric of the children's clothing. As for hygiene and safety indicators, knitted fabric of underwear children's products meet the requirements of regulatory documents, as well as the value of pH was 7,6 pH units; content of free and partially released formaldehyde was less than 0,3 $mg/m^3$; residues of heavy metals that can extracted (mercury — 0,0043 mg/kg of arsenic — 0,0312 mg/kg, cadmium — 0,0489 mg/kg, copper — 0,52 mg/kg, lead — 0,16 mg/kg); content of pesticides was less than acceptable norm.

**Keywords:** hygiene, safety, children's clothing, water absorption, breathability, formaldehyde, heavy metals, pesticides.

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## RESEARCH OF SHAPE STABILITY OF THE KNITTED FABRIC FOR FENCING CLOTHING UNDER DYNAMIC AND STATIC LOADS

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Shape stability of the knitted fabric for making fencing clothing under static and dynamic loads is investigated. The study is carried out to further develop methods that will predict the shape stability of the clothing for sport fencing during wearing.

It is established that irreversible deformation of the test material under uniaxial tension and stress by the standard method (according to GOST 8847-85) did not occur. Results of experimental wearing showed the presence of irreversible fabric deformation in the different parts of clothing from 1 to 4,5 %, which is the reason assert the impossibility of objective evaluation and prediction of the properties of investigated fabric during wearing. The values of limit stretching and constant load (60 and 80N) are calculated using the «load-extension» diagram. Irreversible deformation of investigated fabric at the time of a balanced state is defined for given parameters of the constant multi-cycle load.

It is analyzed and shown that the performance measurement results of the fabric deformation for multi-cycle stretching using laboratory method and results of measurement of these parameters for products that have been in a wearing for a year, are convergent. The proposed test method simulates the load on the clothing and changes their linear dimensions during the wearing. Established research parameters can be used in the method of determining and prediction of the shape stability of fencing clothing during the wearing.

**Keywords:** shape stability of the knitted fabric, fencing clothing, knitted fabric stretching limit.

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## ANALYSIS OF MARKET CURRENT STATE AND HISTORICAL ROOTS OF ICE WINE PRODUCTION

page 46–53

Number of ice wine companies is increasing every year due to unique chemical composition and consumer demand. Unfortunately, processes associated with outputs of exclusive wines are examined only by Canadian winemakers in scientific literature. Despite of the strict requirements in non-classic technology that largely influence on obtaining of frozen grapes in winter season, other companies and wineries have included ice wine to their product offering.

This study surveyed comprehensive information related to first ice wine producers and present definition of rare wine production that are the objectives of current research. Thus, data about primary frozen vintages, wine regions in each producing country and famous winemakers had influenced the expanding of dessert special styles were described; differences in the titles wines were shown. After the experience of the Germans in winter technology, other countries also began to introduce the wine of the premium segment. The current state of production and the wineries, which produce special wine, were reviewed and enterprises developed winter technologies were highlighted in the North America, Europe and Asia. Placement of the wineries, their number and ranges of ice wine were represented and argued according to agro-climatic conditions of each producing lands.

The entire world situation referring the existing of ice wine producers in the main regions of European and other territories supplemented special beverages to their profiles suggesting by our study afford an opportunity to fully understand the significant centres of production and changes in wine market supply. Furthermore, current research can conduce to the further publications of ice wine data compositions from different producing areas to evaluating of sensory and physical-chemical parameters and, perhaps, to find the solutions of challenges in ice wine production considering the experiences of each countries.

**Keywords:** Icewine, ice wine, Eiswein, roots, market, commercial production, premium segment.

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## DEVELOPMENT OF COMPLEX ACIDIFIER FOR EMULSION FOODSTUFFS FOR WELLNESS PURPOSES

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An improvement of the technology of emulsion foods as the most consumed by all groups of the Ukrainian population, by complex acidifier addition in the formulation was proposed. The object of this research is the process of developing a low-calorie sauce formulation on the basis of secondary products of juice production and winemaking. The main disadvantages of emulsion products in the Ukrainian market can be called a low biological value, the use of acetic acid as the main acidifier, and not a wide range of such products. The complex acidifiers include malic, citric and acetic acid. Such technological solution will expand the range of mayonnaise products due to changes in organoleptic parameters of quality, such as a taste. The choice as components of complex acidifier — malic and citric acids — like the ingredients of high biological activity and the ability to change the taste qualities of mayonnaise sauce based on vegetable raw materials. The taste quality of the samples of model water-fat emulsion with the addition of selected organic acids of various concentrations was studied. Tasting tests were carried out by the expert group in the research laboratory of vegetable oils and fats processing technologies in Ukrainian Research Institute of vegetable oils and fats of the National academy of agricultural sciences of Ukraine (Kharkov). An addition of the acetic acid in the complex acidifier in the smallest possible quantities was justified. Concentration ranges of the components of the complex acidifier having an optimal performance in terms of taste was selected as well as studies on the pH of water-fat emulsion samples values in the selected range of concentrations of organic acids were conducted. Determination of pH for samples of model water-fat emulsion was conducted in accordance with DSTU 4560:2006. It was proved that the pH of the water-fat emulsion samples meet requirements of regulatory documents for mayonnaise products. Technological solution about addition of proposed complex acidifier in mayonnaise sauces for assigning them the status of wellness foodstuffs was substantiated.

**Keywords:** food additives, biological value, low-calorie sauce, malic acid, complex acidifier.

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## DEVELOPMENT OF THE PROTEIN-FATTY BASE OF THE SUGAR CONFECTIONERY FOR NUTRITION OF THE SPORTSMEN

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The process of calculation, preparation and use of the protein-fatty base with increased biological value in the sugar confectionery for rational nutrition of sportsmen is the object of study. For obtaining such products it is often use the raw materials having a high cost or low shelf life, or unreasonable and unbalanced nutrient composition. According to the requirements of physician-nutritionists, the content of essential amino acids for nutrition must match the ratio between leucine, isoleucine and valine — 2:1:1, and between groups of polyunsaturated fatty acids of ω-6 and ω-3 groups from (9,1:1) to (10,5:1).

The solution of creating enriched food for sportsmen may become is the latest knowledge in the field of food chemistry and science of nutrition, which is an integrated approach of the theoretical and experimental study of assessment of nutritional status, lifestyle and health of sportsmen. A promising raw material for the production of sustainable food is a raw material of plant origin — oil seeds and their vegetable oils.

A protein-fatty base that enriched by essential amino acids, polyunsaturated fatty acids, ω-3 group and antioxidant is developed according to the physiological needs of sportsmen, rough labour workers, the military and other sectors of the population. The possibility of using this protein-fatty base in the production of the candies is investigated in order to increase their biological value, oxidative stability and reduce calories. Organoleptic parameters of the candy mass using the obtained protein-fatty base are defined.

**Keywords:** vegetable oils, oil seeds, essential amino acids, polyunsaturated fatty acids, confectionery mass.

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