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SEARCH FOR NEW BIOLOGICALLY ACTIVE COMPOUNDS BASED ON 6-METHYLURACIL-5-SULFOCHLORIDE AND ALCOHOLS

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The object of research is the interaction of 6-methyluracil-5-sulfochloride (MUSC) with aliphatic alcohols (C_1–C_{10}) in order to obtain new methyl ether sulfate esters not described in the literature. With the help of the PAAS program, it is shown that these esters exhibit biological activity. They exhibit antioxidant properties, and can also find use as cytostatics.

One of the most problematic places in the synthesis of methyluracyl sulfonic esters is obtaining the final compounds in the most pure form and with the greatest yield. This goal is achieved by the fact that the used alcohol is previously absolute, heating it with calcium oxide or calcined copper sulfate. In the obtained absolute alcohol, the quota part of Na or K is dissolved, and after the reaction termination, the quoted portion of MUSC is added.

In the course of the studies, the principle of sulfochlorination of methyluracil is changed. In order to increase the yield and improve the quality of the final product, the reaction of methyluracil with freshly distilled chlorosulfonic acid is carried out in an inert solvent such as dichloroethane, followed by the addition of thionyl chloride.

To improve the quality of synthesized compounds and simplify the synthesis, the methyluracil used is reacted with metallic sodium or potassium to form an alcoholate. Further, the obtained alcoholate reacts with the calculated amount of the sulfochloride, forming an almost chemically pure final product.

With the help of the program, the preliminary biological activity of synthesized compounds is determined and the possibility of using the compounds obtained as cytostatics is determined. And with the help of NMR spectroscopy and elemental analysis, the composition and structure of the obtained compounds are confirmed, the data of which are given in the form of a table.

A number of new compounds not described in the literature have been obtained. This is due to the fact that the proposed method has a number of features, in particular, the use of available raw materials, the improvement of synthesis methods.

Keywords: biologically active compounds, synthesis of alkyl sulfonates based on 6-methyluracil-5-sulfochloride and alcoholates, reactivity.

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INVESTIGATION OF METHODS OF OBTAINING WHISKERS IN COMPOSITE MATERIAL

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The object of this research is various methods for obtaining whiskers in composite materials. The method of obtaining whiskers by reduction of metal halides by the example of the basic scheme of

this process is investigated. And also, with the example of another scheme, the process of growing of SiC whiskers by the «vapor-liquid-solid» method is analyzed. The problematic issue of the investigation of the application of both methods is the temperature interval for carrying out the processes, which is connected with the process of recrystallization of a particular whisker. When writing the work, various methods of scientific research were used, such as the method of statistical analysis, the method of analyzing the results of research, the hypothetical deductive method and the method of generalizing the results. As a result of the in-depth review of existing ideas about some methods of obtaining whiskers in a composite material, it is shown that the application of the method of obtaining whiskers during the chemical interaction between a gas and a whisker makes it possible to obtain a high concentration of solute, which ultimately affects the structure of the crystal. When analyzing the method of obtaining «vapor-liquid-solid» whiskers, it is justified that the number of crystallization centers increases significantly, which leads to an acceleration of the crystal growth process.

Keywords: methods of obtaining whiskers, composite materials, chemical interaction between gas and contact material.

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MEASURING METHODS IN CHEMICAL INDUSTRY

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SOFTWARE FOR PRODUCTIVITY CALCULATION OF POLYPROPYLENE FILTERING ELEMENT IN DEPENDENCE FROM ITS APPLICATION

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The object of research is the process of FVNM manufacturing. One of the most problematic places in the production of filter materials is the lack of recommendations for determining the structure of these elements, depending on the field of application.

In the course of research, the main application areas of the elements, which are made of «foamed» polypropylene, were analyzed. As a result of the analysis it is revealed that the main functions that these elements perform are mainly drainage or filtering. A one-component model of suspension flow through a porous medium is considered, granulometric analysis of the purified liquid is carried out and the percentage state of the filtrate is obtained depending on the particle size. This result allows to see that the distribution of the filtrate as a function of time can be divided into groups: almost 30 % – 1–5 μm; almost 60 % – 10–50 μm. It is found that, depending on the field of application and the purpose of the filter element, it can have a different number of layers and a different structure of these layers. Using the results of granulometric analysis, it can be concluded that 70 % of the filter elements have a three-layer structure.

The construction of a multilayer filter element by changing the air pressure on the equipment to form FVNM is experimentally proved. The technique for organization of calculations of the amount of filtering material of a certain structure is obtained depending on:

– filtration process that involves determining the input data of a liquid or gas that will be filtered;

– formulas for calculating the luminous efficiency of the filter and the filtration performance. This technique is practical in nature and can be applied in production.

This technique has improved the interaction with customers by 40 %, due to a faster calculation of the required amount of filter material and the formation of the final cost of the order.

Thanks to the obtained calculations, a prototype of a software tool has been developed that allows selecting the structure and dimensions of the filter element depending on the application and media. After the testing phase, this software will be used as one of the modules of the process automation system for production of polypropylene mechanical cartridges with subsequent introduction at the enterprises that manufacture filter elements.

Keywords: filtration of liquid in a porous medium, selection of the structure and size of the filter element, process automation.

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ECOLOGY AND ENVIRONMENTAL TECHNOLOGY

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LABORATORY STUDIES OF THE COAGULATION PROCESS OF WASTE WATERS OF MILK PROCESSING ENTERPRISES BY CHANGING THE MIXING RATE

page 24–29

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The object of research is the process of mixing the coagulant with the waste water of the milk processing industry by means of a stirrer at different speeds of rotation. In case of incomplete mixing, there is a local lack of concentration of the reagent or vice versa local overdose, which leads to a poor quality of the purification process. Therefore, the definition of mixing parameters is one of the most important tasks.

The following instruments and materials were used for carrying out experimental studies:

– sample of sewage – 5 liters;
– 3 % solution of ferric chloride $FeCl_3$;
– stirring devices (electromagnetic stirrer MS-H280-Pro, Poland);
– device for determining the comparative characteristics of water turbidity (spectrophotometer DR 1900, USA).

The order of the study: the total sample of model sewage was divided into several portions of 150 ml each (2 series of experiments in 5 portions). After processing a portion of the model runoff with reagents and stirring with a magnetic stirrer, the light absorption coefficient was determined on a spectrophotometer after 60 minutes for sedimentation. Based on the obtained results, the light absorption coefficient was plotted against the mixing rate.

Based on the results of the experiments, graphical and mathematical dependences of the change in the light absorption coefficient on the intensity of mixing were obtained. The character of the obtained curves indicates that at a rotational speed of the mixer of 100–800 rpm, the purification efficiency was 79.7 %, and at a rotational speed of 800–1500 rpm – 89.1 %.

The carried out researches have shown expediency of definition of mixing modes of coagulant with processed waste water for maintenance of optimum mixing parameters in mixing devices. This will allow for more complete use of the coagulant capacity of the reagents, complete and rapid mixing with the waste liquid. This will ultimately lead to cost savings for reagents and to optimize the operation of the whole technological scheme for wastewater treatment of milk processing enterprises.

Keywords: sewage sample, coagulation of impurities, stirrer, speed and mixing time, light absorption coefficient.

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VISUALIZATION OF THE POOL FIRE ACTION ZONES WITH USING MAPINFO GIS FOR THE NUMBER OF FILLING STATIONS OF THE ODESSA (UKRAINE) RESIDENTIAL DISTRICT

page 30–39

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The object of research is a system of filling stations (traditional filling stations) of the traditional type within the Malinovsky district of Odessa (Ukraine). One of the most problematic places of functioning of filling stations, as potentially dangerous objects, is their location within residential areas, on motorways with high traffic intensity, close to other infrastructure facilities. A significant danger is the location of several filling stations in a limited area, in close proximity to each other.

The radii of the action zones of thermal radiation from a pool fire at various intensities for 4 types of fuel (gasoline A-80, A-95, A-95, diesel fuel) are calculated. It is shown that dangerous for a person distances from filling stations are reached at 650 m. The safest of all fuels is diesel fuel, and the safety of gasoline rises with the growth of the octane number.

In the course of the study, a method for visualizing the action zones of the pool fire factor is developed using MapInfo GIS. The proposed method makes it possible to visualize the calculated radii of damage by thermal radiation on the map of the Malinovskiy district based on the geology of each filling station. It is clearly shown that the filling stations cover the territory of the district with a dense network and create the risks of damaging the consequences of an emergency fire of its most part.

Due to this, the possibilities of visualizing not only the mutual location of the filling stations as sources of negative impacts and potential accidents, but also of the respective recipients under specific urban conditions

In comparison with similar examples of assessments of the consequences of accidents at filling stations, the geo-information system makes it possible to identify the groups of filling stations for which the development of an emergency situation is possible by the mechanism of «dominoes». In the presence of an external ignition source, an escalation of the accident may develop, which in turn can initiate dangerous events at the next filling station.

Keywords: potentially dangerous object, filling station, pool fire, geo-information system, domino effect.

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BIOINDICATIVE STUDIES OF ROADSIDE ECOSYSTEMS

page 40–45

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The object of the research is the ecosystems that are directly adjacent to the Ukrainian highways of interstate, state and regional importance. The areas on the roads M02, M03, H07, H12 and P44 were under investigation. Assessment of the emissions of roadside ecosystems is a perspective and difficult task. One of the key problems is the detection of the trends of vehicles movement impact on roadside ecosystems.

During the study, bioindicative methods were used. The lichen indication method was used to study the pollution of atmospheric air by sulfur oxides. Phytotesting of soils from the studied sites was also applied.

The results of bioindicative studies have shown that the level of air pollution by sulfur dioxide along the highways of inter-state importance is higher than others. At the sites of these roads, the concentration of sulfur dioxide exceeds the maximum permissible. This can be explained by the intensive movement of vehicles, including trucks. After all, combustion of diesel fuel is a significant source of sulfur dioxide. According to the calculation of phytotoxicity effect of the soil, selected on the studied sites, the highest level of soil contamination is also observed along the interstate highways. The studies have shown that the impact on roadside ecosystems depends on the category of a highway, as well as its technical condition. The impact level is higher on the roads with high traffic density and areas with poor technical roadbed condition.

Keywords: roadside ecosystems, Ukrainian highways, bioindicative methods, index of atmospheric purity.

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ANALYSIS OF THE TECHNOGENIC LOAD ON THE ENVIRONMENT DURING FORCED VENTILATION OF TANKS

page 45–52

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The object of research is an above-ground vertical steel tank, used as storage tank for light oil products (gasoline, diesel fuel, kerosene). One of the most problematic places of this operation is extremely high level of explosion and fire risk, and therefore, a significant danger to the life and health of people in the zone of influence of reservoirs. Within forced ventilation of the VST-5000 tank, 1.5 tons of petroleum products vapor enters the atmospheric air. To address this shortcoming, the application of the absorption-condensation technology of vapor recovery of oil products, the efficiency of which reaches 99 %, is proposed in this paper.

During the study, software ALOHA was used that allows to enter details about a real or potential chemical release, and then it will generate threat zone estimates for various types of hazards. The results of the study have shown that the size of the zone of acute toxic effects on the population reached 1.2 km, the fire danger zone was 80 m and the explosion zone did not exceed 13 m. Such indicators indicate a high level of environmental hazard.

The use of the ejector method of air supply during forced ventilation of tanks with the subsequent capture of petroleum fumes by means of an absorption and condensation unit ensures prevention of such a risk. The caught oil products are subject to further use, which provides additional income. Thus, the proposed method allows not only to reduce the technogenic load on the environment (ecological effect), but also has an economic effect.

Keywords: forced ventilation, ejector method of air supply, environmental hazard, storage tanks for oil products, risk assessment.

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FOOD PRODUCTION TECHNOLOGY

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DEVELOPMENT OF ROBOTOTECHNOLOGICAL COMPLEX OF INTELLECTUAL MANAGEMENT BY BREAD MANUFACTURING FOR TECHNOLOGICAL LOADING TERRITORIES

page 53–58

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The object of research is a technological line for production of bakery products. One of the most problematic places in the technological process of industrial production of bakery products is the incoming quality control and preliminary preparation of ingredients, as well as the implementation of the processes of preparation of dough and kneading dough. To improve and intensify the relevant processes, it is proposed to use robotic technological complexes with an intelligent control system and built-in intensifiers. The principle of the intensifiers of the technological process is based on ultrasonic technologies of water treatment, mixing of components, intensifica-

tion of physical and chemical processes of bread production, quality control of the process.

For the production of bread with therapeutic and prophylactic characteristics, the controlled ultrasonic cavitation effects are studied. It has been proved that processes of ultrasonic cavitation, disintegration, coagulation of water, flour, oil, liquid yeast, hydrochloric and sugar solutions and other ingredients promote the production of medical type. Ultrasonic cavitation causes increased fluid mixing of the micro streams that form around the oscillate bubbles. Such mixing is especially useful in the technological process of producing bread for dispersion when enriched with vitamins and minerals.

Systems for automated control of parameters of pre-dough-dough based on high-frequency ultrasonic vibrations are developed. It is proved that robotic technological complexes with developed sensor system allow to reduce the salt and sugar content in bread by 15–20 % without changing the taste of the product.

A multi-level intelligent system of automated management of the technological process of bread production has been developed. The architecture of this system uses a robotic technology complex with:

– intellectual decision support system and training blocks;
– databases and knowledge;
– block output information on the corporate performance monitor;
– automated workplace with an interface system;
– artificial neural network for recognition of emergency, abnormal and normal situations.

Thus, with the help of the robotic technological complexes built into the technological process of bread production, it is possible to achieve a higher quality of bakery products.

Keywords: ultrasonic cavitation, pre-dough-dough process, bread production, environment of robot-intensifiers.

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RESEARCH OF SURFACE PROPERTIES OF WATER-FLOUR SUSPENSIONS IN THE PRESENCE OF HYDROCOLLOIDS AND PROTEIN SUPPLEMENTS

page 58–63

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An important issue of improving the technology of non-yeasted gluten-free bread is the development of measures to improve the structural and mechanical properties of dough and bread. To this end, the use of polysaccharide and protein supplements in the dough phase has been proposed. It is shown that the introduction of hydrocolloids and animal protein concentrates into freeze-free gluten-free dough improves the foaming characteristics by reducing the surface tension in water-flour suspensions. This indicates the formation of more stable systems for improving the porous structure of gluten-free non-yeasted bread. It has been found that the proposed supplements-structure improvers as a whole cause a reduction in shape stability, to the greatest extent – in the case of joint application. Thus, the shape stability index of the control sample (water) is 32, and in the presence of 0.5 % sodium carboxymethyl cellulose with supplements 0.5...1.0 % of Scanpro T95 – 20...21. Under the conditions of the introduction of ScanPro T95 in the amount of 1.5 % there is an increase in the surface tension of the liquid phase of the dough (indicator – 27.4). Explain the decrease in the effectiveness of ScanPro T95 in an amount of 1.5 % can be achieved through possible drag-drop processes with this amount of supplement.

Thus, experimental studies have confirmed that the presence of hydrocolloids and animal protein concentrates in the aqueous-flour suspension with flour mix reduces the shape stability index of the drop due to a decrease in its surface tension.

Keywords: shape stability of drops of water-flour suspensions, wetting angle, sodium carboxymethyl cellulose, concentrate of animal protein.

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