THE INVESTIGATION OF LIQUID PHASE REACTION OF 4-AMINOTOLUENE WITH OZONE IN THE PRESENCE OF MANGANESE BROMIDE CATALYST

page 4–7

A new catalytic system Mn(II)-KBr-H_2SO_4-Ac_2O to obtain 4-aminobenzaldehyde treatment by ozonation of 4-aminotoluene is developed. It has been shown that injection of potassium bromide significantly increases the depth, speed and selectivity of substrate oxidation, the main reaction product is 4-acetylaminobenzylidendiacetate with the discharge of 84,5 %.

Active particles responsible for the inclusion of 4-aminotoluene oxidation by a methyl group in the presence of manganese (II) acetate and potassium bromide is manganese bromide radical-ion (Mn(II) $Br^{\bullet}$), which is more active than Mn(III) and because of the higher rate of initiating oxidation by a methyl group.

It is proposed the mechanism of the process by which the substrate oxidation is carried out by ion-radical unchain mechanism in which manganese-bromide radical is generated mainly in reaction with ozone.

The main functions of sulfuric acid in the system are determined. It affects the main stages of the catalytic cycle: reduces the rate of manganese bromide complex reaction with ozone, significantly increases the rate of substrate oxidation by a methyl group and catalyzes the acylation reaction.

These data are the basis for laying the foundations of technology of 4-aminotoluene oxidation by ozone to 4-aminobenzaldehyde and development of preparative and industrial methods for obtaining of aromatic aldehydes.

Keywords: oxidation, 4-acetylaminotoluene, ozone, acetic anhydride, sulfuric acid, selectivity, potassium bromide.

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FILLING STATIONS: RESEARCH OF EMISSION VOLUME, INFLUENCE ON ENVIRONMENT

page 8–12

The features of influence of filling stations (FS) on the environment and the characteristics of the formation sources and emissions are characterized. It is considered the technological features of the filling station, «small» breathing, «big» breathing. The gross emissions from the filling station are investigated. It is considered the scheme of construction of automatic analyzers used to monitor the condition of air pollution at the filling station.

Due to the lack of reliable data on the storage and release of fuel we obtain an incorrect assessment of the concentration of harmful substances in emissions of the filling station. Due to instrument calibration by atmospheric air of filling station it is reduced the measurement accuracy.

It is described an improvement of method of fuel vapor concentration measuring in the gas station air by removing of gas analyzer additive error (zero error) for continuous operation. To calibrate the zero reading of analyzer uses an atmospheric air that is pre-cleaned by hydrocarbon vapors in the spiral electric heater. Thus, it is achieved zero setting of analyzer scale without special calibration gas, as well as reducing additive measurement error and improving accuracy.

This method will perform a set of works on environmental measurements of the actual concentration in the atmosphere of filling stations and assess the impact on the environment in accordance with environmental, sanitary — hygienic, fire standards and safety standards.

Keywords: mass, emission, filling station, thermocatalytic, gas analyzer, flame-ionization, evaporation, fuel.

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CONTENT NORMALIZATION OF THE DISSOLVED OXYGEN IN WASTE WATERS ENTERING IN WATER BODIES

page 13–16

The scientific and legal demand for composition normalization of the wastewater discharged into water bodies (in particular in the natural waterways) in order to prevent environmental contamination above accepted level are grounded in the article. The existing methodological approaches to determining the permissible wastewater composition are considered. It is noted that these approaches are not applicable to the calculation of permissible content of dissolved oxygen. It is proposed to define the minimum acceptable oxygen content in wastewater by solving the optimization problem. Optimization criterion is the maximum permissible anthropogenic impact on the ecosystem. The problem is considered for a watercourse. It is proposed the full dilution of sewage water of a water body. It is given an example of the calculation for the two issues, showing performance of the proposed method. The given research aimed at improving the valuation methodology of wastewater disposal.

Keywords: wastewater, water body, dissolved oxygen, allowable concentrations.

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APPLICATION OF THE WATER POLLUTION RATE FOR ASSESSMENT OF CONDITION OF WATER OBJECTS

page 17–19

For integrated assessment of water quality are encouraged to use the water pollution rate (WPR). The WPR allows you generically (one number) to assess the level of water pollution in the range of water-polluting substances from the maximum allowable concentrations to extremely high pollution. The WPR is calculated in accordance with formulas that correspond to a piecewise linear approximation of the logistic curve, reflecting the nature of the changes the status of aquatic ecosystems.

Analysis of the theoretical foundation, expert testing and practical application of WPR confirms its suitability for assessing the condition of water objects. The WPR can be used to identify trends and advance detection of potential water protection problems. The WPR is recommended for the harmonization of regulations to address cross-border water protection issues.

Keywords: water pollution, water quality indices, condition of water objects, logistic curve, Deininger test.

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THE ACCOUNTING OF THE UNCERTAINTY OF VALUES OF INPUT VARIABLES IN THE MODELING OF BENZENE NITRATION PROCESS IN A CONTINUOUS REACTOR

page 20–25

On the basis of deterministic model in the form of a system of nonlinear equations it is developed a «soft» model of stationary process of benzene nitration with a mixture of nitric and sulfuric acids in the reactor of ideal mixing, which allows to take into account the effect of uncertainty of input variables of the process on output variables: stationary temperature and conversion degree. The model algorithm is random assignment of input variables: speed and the heat of reaction and heat loss coefficient of the probable range of admissible values and solving the system of equations of the model for given values of regulate parameters and random allowable value of residence time. The model is visualized as a bitmap image of the points on the plane and allows to take into account the uncertainty of input factors, such as the range of the lower and upper boundaries of the bitmap image («thick line»).

It was established that a decrease with increasing conversion module and its increase with increasing concentration of the waste sulfuric acid are occurred for the adiabatic and isothermal processes. However, in an adiabatic process, depending on the module, there is a significant increase in temperature significantly superior to the standard values (50–70 °C), even when the module is 12. Increasing the temperature of the mass in inlet from 20 to 40 °C also leads to significant increase in the degree of conversion and temperature the reactor outlet. With increasing the residence time is observed narrowing of the upper and lower boundaries of the fixed conversion rate and leveling of uncertainty.

Keywords: benzene nitration, stationary process, soft model, uncertainty effect, output variables.

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TECHNOLOGY AUDIT PROCESS OF NITRO MIXTURE PREPARING PROCESS FOR BENZENE AND TOLUENE NITRATION USING NON CONCENTRATED NITRIC ACID

page 26–31

It is developed a computer model of the material and thermal balance of preparation stage of nitration mixture and local concentration of the waste sulfuric acid in the nitration

of benzene and toluene with concentrated nitric acid containing 26–28 % of the main substance. The basis of the model is preparation of nitration mixture formally containing α kg of waste acid per 1 kg of base nitration mixture which composition is determined by the type nitrate connection. Nitration mixture is prepared from concentrated nitric acid and working sulfuric acid, obtained by a local concentration of waste acid. The heat input on the concentration of spent acid to a standard 92 % acid in the plant-wide units is used as a basis of comparison.

The simulation shows that the use of concentrated nitric acid in combination with a local concentration of the waste acid from the viewpoint of energy is more advantageous than the traditional use of deficient high-concentration nitric acid. This is due to the fact that the process of local concentration of the waste acid to the desired working concentration is more beneficial than centralized concentration to 92–96 % acid. With increasing value α, a positive effect on the local concentration increases, and with increasing the residual pressure in the distillation of water (from 13,3 to 80 kPa — decreases. The latter is associated with increase in the boiling temperature and enthalpy of the final state.

Keywords: mathematical modeling, benzene, toluene, nitration, concentration, nitration mixture, local process, wast acid.

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THE INTENSIFICATION OF MASS TRANSFER PROCESSES FOR THE REACTIONS IN COMPLEX-REACTIVE HETEROGENEOUS SYSTEMS

page 31–36

Based on the study of the theory of heat and mass transfer processes, known models of interfacial heat and mass transfer in the article concretized hydrodynamic side of transport processes. It allows reasonable approach to the methods of phase transfer intensification: mechanical, pulsating, thermal of formation and collapse of bubble, medium movement on the curved channels. It is shown that each method can be implemented in a corresponding design of the device. The basic constructions as devices and their contact devices are considered in detail, the advantages and disadvantages are shown. It is found that the development and investigation of these structures is a promising direction. For each construction it is analyzed and justified the influence of nonstationarity effects and persistence on the phase transfer also reviewed the related positive results. It is shown that research in this area will create intense mass transfer devices, which can be achieved by thermal mass transfer coefficients of growth exceeding the growth rate of the hydraulic resistance machines.

Keywords: mass transfer processes, intensification, heterogeneous system, interfacial surface, phase inversion.

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ANALYSIS OF CURRENT STATE AND CHOICE OF RAW MATERIAL OF SECONDARY CADMIUM TECHNOLOGY

page 37–41

It is considered the main sources of raw materials and final products containing cadmium. It is shown that in most case, they have unique properties and in the near future can't be changed without damage to other industries. It is conducted analysis of the production volumes of products containing cadmium and it is shown that in the near future is expected to decline in the production of such products. It is determined that more than 80 % of the cadmium can be re-used, and the main group of raw material of secondary cadmium technology are household nickel-cadmium current sources containing up to 30 % by weight of cadmium. It is proposed as the main raw material of secondary cadmium technology uses a small nickel-cadmium power sources. According to the analysis it is concluded that the development of technology for recycling of household nickel-cadmium batteries is promising both in terms of environmental protection, as well as from an economic point of view, as it will contribute to the development of safer and more efficient technologies for the use of cadmium in place of their ban.

Keywords: cadmium, toxicity, cadmium production, nickel-cadmium batteries, utilization.

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INVESTIGATION OF PHASE EQUILIBRIA IN POLYAMORPHOUS SYSTEMS

page 41–45

The phase behavior of polyamorphous systems based on modified Van der Waals equation with several critical points is investigated in the article. A model of phase equilibria in binary polyamorphous systems, including liquid—liquid equilibria in one-component systems and evaluation of critical lines in a binary mixture.

It is proposed an algorithm for the search of parameters according to the excluded volume for Van der Waals model from density and temperature, which makes it possible to generate more than one critical point in a one-component fluid. To test the hypothesis of the continuity of critical lines in binary mixtures of polyamorphous fluids as an initial approximation used parameters near the critical point of the second component. Calculation of critical curves for binary polyamorphous mixtures confirmed the continuity of the transition from a stable critical point of the first metastable point of the second.

Keywords: liquid — liquid equilibrium, critical lines, multicritical points, metastable states.

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SENSORS FOR THE STUDY OF THERMAL PROPERTIES OF FOOD

page 45–49

The aim of the research was the development and testing of compact temperature sensor with fast response and minimal deviations which can operate on the main band of thermal processing of foodstuffs.

Results of the work. There were formulated the main requirements to the temperature sensor for the study of the thermal characteristics of foodstuffs. There were analyzed the peculiarities of the use of common temperature sensors in the study of foodstuffs. It is also given the sensor circuit based on a semiconductor diode operating at a constant voltage mode.

The choice of recording equipment for the work with the developed temperature sensor has been proved. Using the example of developed sensor and thermocouple of K-type there has been described the peculiarities of operating the sensors with open contacts in acide and alkaline medium. Linearity of the sensor in the temperature range of 55...95 °C was proved.

Scientific novelty. The equipment for continuons temperature control of products during the thermal processing was improved, technology of temperature fixing using a semiconductor diode has been further development.

Practical value. Results of the development of temperature sensor of small size and with short response time allow to continuously record the temperature in separate parts of foodstuff that will promote optimal selection of thermal processing regimes.

Keywords: thermo physical properties, temperature sensor, thermocouple, sizing, linearity of indicators, calibration graph.

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INFLUENCE OF IMPURITIES AND CONDITIONS OF GROWING THE SILICON SINGLE CRYSTALS BY CZOCHRALSKI METHOD ON THE VALUE OF LIFETIME OF NON-EQUILIBRIUM CHARGE CARRIERS

page 50–54

It is investigated the influence of impurities contained in single-crystal silicon which is grown by the Czochralski method. These impurities are: oxygen, carbon, boron. Also it is investigated an influence of cooling rate of the grown single crystal on the lifetime of non-equilibrium charge carriers. The oxygen concentration was in the range $(6{,}45...9{,}75)\cdot 10^{17}$ cm^{-3}, carbon — $(1{,}60...10{,}20)\cdot 10^{16}$ cm^{-3}; boron — $(1{,}17...1{,}70)\cdot 10^{16}$ cm^{-3}. The cooling rate of the single crystal was varied from 1,8 to 3,6 K/min.

It was found that increasing the concentration of boron and oxygen increases the lifetime of the non-equilibrium carriers, and the increase of carbon concentration and the cooling rate of the single crystal silicon lead to reduction of the lifetime of non-equilibrium carriers. To identify factors that have the greatest influence on the lifetime of non-equilibrium charge carriers was developed a mathematical model in the form of the regression equation. Assessment of significance of the regression coefficients of equation was conducted by Student *t*-test value. Statistical reliability of the resulting multiple regression equation was checked by the total F-test that checks the null hypothesis of statistically insignificant of parameters of developed regression equation and the connection closeness indicator.

The developed statistically reliable mathematical model showed that in the investigated ranges of the factors most influence on the lifetime of non-equilibrium charge carriers has a carbon concentration and cooling rate of the silicon single crystal. The concentrations of oxygen and boron in the investigated ranges of factors have less influence on the lifetime of non-equilibrium charge carriers in silicon single crystals.

Keywords: silicon, single crystal semiconductor, cultivation, Czochralski method, impurity, cooling rate.

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RESEARCH ANALYSIS OF SAPONITE CLAY PROPERTIES

page 54–57

This paper analyzes the work aimed to research of natural material — saponite. The properties of this material are analyzed. An *X*-ray and metallographic analysis of three layers of saponite clay is conducted. In order to test the chemical composition, given by above authors, preliminary *X*-ray analysis of three saponite layers of Tashkovsky field is conducted. Researches were conducted to determine and compare the structure of each of the saponite clay layers. It is visible on the images that saponite has a large number of capillaries and pores of micron size. By the method of metallographic analysis it is established that saponite has an amorphous structure. It is determined that the proposed material has good sorption properties, which further leads to its use for filtering the drinking and waste water. The results of this research serve as an impetus for the research of saponite clays to expand their applications.

Keywords: saponite, clay, sorption, structure, metallography, *X*-ray photograph, mineral, filter.

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THE STUDY OF SANGIOVESE AND SYRAH VARIETAL WINES QUALITY

page 58–63

This article presents the results of studies of rose and red table wines from dry grapes Sangiovese and Syrah produced in Argentina, Greece, Israel, Spain, Italy and Chile. It is conducted a comparative analysis of organoleptic evaluation, physical and chemical characteristics, biological value at phenolic complex, the redox state of the wines produced in Ukraine from these grapes. It is shown that wine materials produced from grapes cultivated in the conditions of Ukraine are not inferior to foreign models according the organoleptic characteristics of wines from these grapes, and they also have a biological value and oxidation resistance. It is proved that for the production of red wines of high biological value from the grapes Sangiovese and Syrah the grapes must be processed with the intensification of must and pulp contact.

Keywords: Sangiovese, Syrah, red wines, rose, organoleptics, phenolic substances, biological value.

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INVESTIGATIONS OF FUNCTIONAL COMPOSITION «EFFECT» FOR SPECIAL FOODS (FOR OVERWEIGHT PEOPLE)

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This paper presents an analysis of development results of functional composition «Effect», which is balanced in the ratio of basic components, is well combined with all components of basic recipes, does not impair organoleptic, physical and chemical quality of the new food.

It is established an impact effectiveness of the functional composition on the functional state of the body, improving the metabolism in the body, blocking the synthesis of fat in adipose tissue, decreasing the absorption of carbohydrates and fats in the digestive tract and removing excess fluid, accelerating the adipolysis of fat molecules and transformation of fat in the free energy, increasing its expenditure.

It is confirmed a social and economic impact of the implementation of developments, which is to expand the range of sweets with certain functional actions for overweight people, which will accelerate the progress of metabolism process, rapid adipolysis (abdominal) in Ukraine, creating an effective alternative to imported sweets.

Keywords: overweight, obesity, functional composition, ingredients, special foods, sportsmen, body weight regulation.

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