IMPROVEMENT OF PRODUCTION BY AEROSOL NANOCATALYSIS TECHNOLOGY WITH MECHANICAL ACTIVATION OF CATALYST PARTICLES

page 4–8

Currently, the chemical and oil industry uses a heterogeneous catalysis with catalyst on support. The results of a large number of studies marked its main drawbacks. They are insufficient strength and heat resistance of supported catalysts. The solution to this problem is to increase the strength of the catalyst support. This article proposes a new future-proof solution. It is the use of the aerosol nanocatalysis technology for the processes of chemical and oil industries. The basic principle of this technology is the total exclusion of the use of the support from industry practices. This principle together with the chemical and mechanical activation of the catalyst showed an increase in the reaction rate and reduction of the catalyst concentration. It also influences the contact time reduction and productivity increase in the main component. Mechanical activation of the catalyst particles by the dispersing material successfully multiply return the catalyst into the reactor. The aerosol nanocatalysis technology has no analogues in the world. It will look at the industrial world in a new way. It is planned in the future to carry out targeted synthesis of chemical processes in the conditions of an aerosol nanocatalysis technology.

Keywords: aerosol nanocatalysis, mechanical activation, heterogeneous catalyst, activity, strength and heat resistance of surface.

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INVESTIGATION OF BARRIER PROPERTIES OF PACKAGING POLYMER FILM MATERIALS

page 9–16

The main types of interactions of packaged food product and packaging are analyzed. These interactions may occur between the polymer film packaging material and the product. It is found that the most simple to implement an insilation of internal space of polymer film packaging from environmental impact. It is noted that the permeability of gases and gas mixtures through nonporous film polymer packaging is typically considered within the «dissolution — diffusion» mechanism. Usually the study of these processes requires special equipment.

The main factors that affect the permeability of the polymer film packaging material are analyzed. It is noted that the permeability of the multilayer polymeric film materials is dependent on the physical and chemical properties of the components and process parameters. The main parameters are: temperature, pressure

and concentration of the substance. It is noted that molecular interactions with packaging materials can be classified into the following types: permeability of compounds through the polymer film packaging; sorption of compounds by polymer film packaging and migration of compounds from a polymer film packaging. It is indicated that obtained results may be used for the design of packaging film materials with the necessary and stable barrier properties.

The technique of experimental studies of the barrier properties of various polymer film packaging materials and absorption capacity of packaged products is proposed and its results are described. This technique is realized using available equipment. The dynamics of moisture penetration inside the packaging is investigated. It is found that the absorption capacity of silica gel remained stable for 15–20 days from the beginning of the experiment. The highest moisture permeability has an ethylene and vinyl acetate copolymer and low-density polyethylene, and the lowest — polypropylene

Keywords: polymer packaging, moisture permeability, diffusion, barrier properties, mass transfer.

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OBTAINING OF PURIFIED SOLUTIONS OF SODIUM HYDROXIDE FOR SYNTHESIS OF FERRATES(VI)

page 17–21

One of the important problems in the production of ferrates(VI) is the presence of impurities of heavy metal compounds (HMC) in the feedstock, which reduce the yield and quality of target products. Therefore, for HMC removal from alkaline solution serving as a medium for the synthesis of Fe(VI), it is proposed to use pre-processing by a constant electric current.

The study of the processes occurring in the electrolysis of concentrated NaOH solution is the aim of this research.

During experiments it was found that most of impurity metals (Fe, Ni, Pb, Sn, Zn) are discharged at the cathode with the formation of metal deposits and therefore can be easily removed from the solution. It is shown that the speed and completeness of HMC removal are significantly different. Thus, the degree of chromium extraction does not exceed 5 %, and aluminum is not removed at all. Lead, iron and nickel are fastest removed from the system.

Research of the basic laws of electroextraction for a number of metals has allowed to establish the influence of the main factors (current density J, temperature T and electrolysis time τ) on the efficiency of removal of impurities. It was shown that with increasing current density increases the completeness of the removal of impurities. T increase leads to an increase in the recovery rate, which is obviously due to the decrease in electrolyte viscosity and increase of diffusion coefficient of the discharging particle.

Decrease in the rate of decomposition of the anion FeO_4^{2-} is recorded in sodium hydroxide treated with the proposed method. It confirms the feasibility of electroextraction in ferrate synthesis technologies.

Keywords: synthesis of ferrates(VI), sodium hydroxide, heavy metal impurities, purification, electrolysis.

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PERMEABILITY EVALUATION OF NATURAL SAUSAGE CASINGS

page 22–27

One of the main factors of inadequate use of natural casings is their high permeability, which leads to technological defects of finished products, substantial losses in the manufacturing and storage of sausages and economically making production less profitable. The problem of permeability adjusting of natural casings is related to its definition. Despite the changes in chemical composition and functional and technological properties of raw meat in recent years, significant differences in the gastrointestinal tract of animals, data on the permeability of the intestinal casings is currently available. In addition, methodology for permeability evaluation of natural sausage casings isn't developed, and known methods for artificial casings need to be improved in order to adapt them to the intestine.

Disadvantages of the known methods of determining water permeability, aroma permeability and fat permeability are identified as a result of the studies. The necessity is proved to develop measures to improve methods aimed to reproduce the conditions as realistic manufacturing technology and storage of sausages. The methods for determining aroma permeability and fat permeability of intestinal casings are improved and adapted. The proposed method of determining aroma permeability excludes a necessity for sealing of intestinal casings and ensures integrity of vessels, closed by intestine casings using an aluminum cap and circular PTFE membrane. The weighing method for determining fat permeability is improved because the pressure on pork fat deposited on a substrate pattern was created by placing the cargo, samples of intestinal casings were dried to constant weight before the tests .Fat permeability is measured at set of intervals.

The results of permeability evaluation of different kinds of natural sausage casings indicate their significant difference (in 2,1 times — for water and vapor permeability, in 1,6 times — for aroma permeability, in 1,9 times — for fat permeability), which leads to feasibility of differential approach to forecasting and rationing losses in storage technology of sausages in the intestinal casings. It is established that the main factors that cause the obtained data of intestinal casing permeability are kind of slaughter cattle from which they are derived, the degree of technological processing, anatomic origin (the components of the set of casings) and lifetime function.

Keywords: natural (intestinal) sausage casings, permeability, water permeability, aroma permeability, fat permeability, methods for determining permeability.

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INFLUENCE OF BOTTLE AGING ON THE DYNAMICS OF QUALITY INDICATORS OF WINES OF CONTROLLED NAMES OF ORIGIN

page 27–31

The method of bottle aging is used in the production of still and sparkling wines of high quality, pre-aged in barriques and without it in various wine regions of the world. The result of the study is investigation of bottle aging effect on the dynamics of quality indicators of white table wines of controlled names of origin produced in LLC «Industrial-trading company Shabo» (Odessa region, Ukraine). The object of the study were prototypes of white table wine-making materials produced from grape of Chardonnay, Riesling and Telti Kuruk varieties according to technological instructions developed by LLC «ITC Shabo».

The main groups of aromatic components were defined, namely aliphatic aldehydes, dimethyl sulfides, acetaldehyde, aromatic aldehydes and aliphatic lactones, which were changed during the experiment. Prototypes of white table wines of controlled names of origin were prepared according to the technological instructions developed in the production of LLC «ITC Shabo» from Chardonnay, Riesling, Telti Kuruk varieties. Modes and bottle aging parameters for white table wine were developed: 6 months at a temperature of 12–15 °C.

Analysis of the research results showed that the dominant flavor was furfural and 5-metilfurfurol that may be indicative of more than 6 months potential of these wines in the bottle.

Keywords: bottle aging, aromatics, wine of controlled names of origin, quality.

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RESEARCH OF EFFECT OF CALCIUM URONIC COMPLEXES ON THE BASIC QUALITY INDICATORS OF THE CURD

page 32–36

The content of free calcium in order to implement the chemical potentials of ionotropic gelling agent and Ca^{2+} ions, which are the part of the milk-protein complex in the system of the liquid phase of cottage cheese, is investigated. Water-holding capacity (WHC) of food systems based on cottage cheese and calcium alginate gel is investigated to determine the concentration of a rational ionotropic polysaccharide solution. Calcium alginate gel is formed between anions of sodium alginate uronic acids and calcium ions contained in the liquid fraction of cottage cheese. Conservation modes of the food systems based on cottage cheese and uronic complexes are determined. It is proved that the use of sodium alginate ionotropic polysaccharide in cottage cheese-based semi-finished products will create a completely new product. This product will be based on the principle of controlled ionotropic gelation, which is an innovative technological solution to the problem of water holding in CCPC system. It is important to extend the shelf life and regeneration of technological functions after conservation while maintaining the high quality performance of cottage cheese and culinary products based on it. And there are no changes in the physical state, structure, organoleptic properties and nutritional value.

Keywords: cottage cheese, ionotropic gelation, quality, uronates, calcium, water-holding capacity.

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RESEARCH OF TECHNOLOGICAL PROPERTIES OF GRAPE SKIN POWDER AS AN FUNCTIONAL INGREDIENT OF MAYONNAISE SAUCE

page 36–41

The improvement of the technology of emulsion foods as the most consumed by all groups of the Ukrainian population, by introducing as a functional ingredient, as well as capable of influencing the rheological characteristics of vegetable raw material powder was proposed. The object of this research is grape skin powder, which is a source of natural antioxidants polyphenol nature, dietary fiber and pectin substances. One of the basic requirements applicable to mayonnaise production is to obtain a stable emulsion having optimum viscosity. This is achieved by introducing into the formulation the starches as thickening agents. However, the production of mayonnaise products of health improvement requires a presence in formulation components having a high biological and physiological value. It is proposed to add into the mayonnaise sauce grape skin powder as an ingredient with specific technological properties. This technological decision will allow to change the rheological properties of mayonnaise products, and will give it the wellness status. The technological properties of grape skin Black Pearl powder, namely the water-holding capacity, the effective viscosity and surface tension were studied. Determination of these properties of grape skin powder was conducted on the respective equipment and by standard techniques. The influence of pre-treatment temperature and acid concentration on changes in terms of technological properties of the samples suspensions of grape skin powder was analysed. The optimal parameters (the temperature and acid concentration) to convert of protopectin in the soluble state and an increase in the water retention capacity, the effective viscosity and surface tension of sample suspensions of grape skin Black Pearl powder was proposed. It is proved technological solution proposed by introduction of a plant raw material powder in the formulation of mayonnaise sauces for the possibility of changing the rheological properties and assigning these products to health improvement food status.

Keywords: grape skin powder, technological properties, mayonnaise sauce, acid concentration, temperature.

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COMMODITY ANALYSIS OF SPREADS WITH INCREASED BIOLOGICAL VALUE

page 42–46

Two samples of spreads from different manufacturers that are sold in the trade network of Kharkov (Ukraine) are selected as the object of research — «Poltavchanka» and «Farmer», and water-oil extract of oats seedlings. The samples were manufactured in accordance with DSTU 4445:2005.

For obtaining a new spread specie with high biological activity and stable emulsion in each sample at room temperature was introduced certain amount of oats seedling extract (10 %, 20 %, 30 %, 40 %, 50 %) depending on the amount of sample weight, respectively. The disadvantage of this method is the use of energy-intensive equipment, high labor input in the preparation of raw materials.

Research of the properties of raw materials, model samples of spreads and finished products was carried out by conventional and modern methods, including chromatography, spectrophotometry, and cytomorphologobiophysical diagnosis. Mathematical and statistical processing of the experimental results was performed using PC in environment MS Excel 2007.

Research proved the feasibility of use and rational concentration of natural antioxidant capable with immunostimulatory action, water-oil extract of oats seedlings in obtained new spread for the purpose of inhibition of oxidative and hydrolytic processes and acceleration of spread digestion time and metabolism acceleration. The complexity in the preparation of raw materials was also reduced by reducing manufacturing operations.

Thanks to the addition of this extract it is expected to get the biologically optimal formula in balance of fatty acids and polyunsaturated fatty acids of ω_3 and ω_6 groups with high content of essential α-linolenic acid of ω_3 group, carotenoids, tocopherols and low content of trans-isomers of fatty acids.

Keywords: spreads, water-oil extract of oats seedlings, commodity science, increase of biological and nutritional value.

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PRACTICAL USE OF DRY MAGNETICALLY CONTROLLED BIOSORBENT IN PURIFICATION SYSTEM OF DOMESTIC SEWAGE

page 46–51

The object of research is domestic sewage of sewage treatment facilities in Slavutich (Ukraine) and sorption capacity of the new dry magnetically controlled biosorbent (MCB) in relation to conventional pollutants of domestic sewage. The research found that the existing problem in wastewater treatment — exceeding MPD standards for indicators such as COD, ammonia nitrogen, nitrite, total iron, phosphates, smell — can be solved by using dry modified biosorbent obtained by magnetohydrodynamic mixing (MHDM) in crossed electric and magnetic fields. It was also selected optimal dose of dry MCB, which is 4 g/dm^3 and optimal biosorption time — 20 minutes. The optimum particle size of dry MCB for effective biosorption is 0,1 mm. Efficiency of removal was determined not only for heavy metal ions by dry MCB on the basis of Sacharomyces CEREVISIAE yeast, obtained by MHDM in crossed electric and magnetic fields, but also for effective removal of such indicators of domestic sewage as: smell, COD, ammonia nitrogen, nitrite, phosphate, total iron.

As a result of researches it was found that dry MCB completely neutralizes the smell of sewage from the V points to 0 points. The effect of COD treatment is 48,1 %; ammonia nitrogen — 46,7 %; nitrite — 91,7 %; phosphates — 64,4 %; total iron — 51,7 %.

Efficiency of dry MCB is in reduction of concentration of pollutants to MPD level. The advantage of dry MCB, obtained by MHDM in crossed electric and magnetic fields, is in storage and transportation. Research is useful because dry MCB, obtained by MHDM in crossed electric and magnetic fields, can be removed in speed mode using magnetic separation.

The results of this research can be used for dose selection of dry biosorbent for wastewater sewage of sewage treatment facilities, where there is a problem with the purification of the above parameters. This will allow treatment facilities to purify sewage water to MPD standards and reduce the negative impact on the reservoir.

Keywords: dry magnetically controlled biosorbent, biosorption, magnetite nanoparticles, wastewater, magnetohydrodynamic mixing.

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DETERMINATION OF FLAME IONIZATION GAS ANALYZER ERROR

page 52–56

Flame ionization method is developed for automatic control of hydrocarbons in the atmosphere of the city in real time. This method measures the amount of concentration of hydrocarbon vapors and gases.

In modern gas analyzers of hydrocarbons, excluding methane, there are following main basic schemes:

1. Differential measurement scheme with two detectors and one amplifier. One detector gives a signal to the amount of hydrocarbons, other — only to methane.

2. Measurement scheme with one detector and one amplifier. Pneumatic scheme works by switching the flow of analyzed air into two streams, one of which is the flow of air through the device of methane separation in each measurement cycle.

3. The scheme contains two detectors, two gas blocks, one of which is equipped with a separation column of hydrocarbons and two measuring blocks.

Depending on the conditions and purpose of the application, it is necessary to select the right measuring system of flame ionization analyzer. Determination of the main sources of errors in measuring circuits of flame ionization gas analyzers with various basic schemes allowed conducting theoretical calculation of total errors, roughly estimating their size and selecting the optimal measuring circuit.

According to theoretical calculations, the basic error of differential measurement scheme with two electrometric amplifiers is 7,7 %. The values of basic errors of differential measurement scheme with one amplifier and scheme with one detector and adsorbing device are close to each other and are 10,26 % and 10,24 % respectively. The last measurement scheme, however, is characterized by large additional error due to the influence of often useless measurement parameters on the signal of flame ionization detector and is 18,63 %.

It is determined that the most optimal from considered gas analyzer schemes with the least basic error is differential measurement scheme with two electrometric amplifiers.

Keywords: measurement of hydrocarbons, methane, detector, flame ionization analyzer, errors of measurement channels of gas analyzers.

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INCREASE OF ECOLOGICAL SAFETY OF MINE WATER DISPOSAL IN THE LVIV-VOLYN COAL BASIN

page 57–63

The object of research is the process scheme with adjustable mine water disposal mode of «Lubelska» № 1–2 mine via the channel «Butynsky» in the river Rata (Ukraine), and — the impact on the most vulnerable components of the environment — surface water and groundwater of Lviv-Volyn coal basin. In connection with the change in the projected method of shaft sinking it is necessary to review and adjust the system of mine water disposal during the building period. For this work it is analyzed and summarized hydrogeochemical data obtained in the course of monitoring observations in the course of 3 years in the control supervisory sections of «Butynsky» channel and the river Rata.

As a result, the technical possibilities and environmental friendliness for adjustment of mine water disposal scheme in the second stage of shaft sinking (during building) are shown. The method of flow diagram adjustment of mine water disposal is chosen. It can be done in two modes, on the basis of the prediction of quantity and quality composition of the mine water.

The first mode — discharge in accordance with the predicted value of the mine water inflow: minimum periods of water inflow — 30–40 m^3/h with a salinity of 20 g/dm^3 and periods of high water inflow — 80–90 m^3/h with a salinity of 10 g/dm^3.

The second mode — the accumulation of mine water in the settling ponds, mixing them with drainage water formed as a result of drainage of the industrial site of «Lubelska» № 1–2 mine and with rain water, then — averaging and discharge in a volume up to 90-100 m^3/h with salinity up to 5–7 g/dm^3.

This disposal scheme will improve the environmental safety of mine water disposal into surface water bodies, regulate the conditions of mine water discharge, as well as their quality within the allowable concentrations and, thus, minimize the impact on the hydrochemical regime of surface water of Butynsky channel and the river Rata.

Keywords: mine water, building of coal mines, system of controlled discharge of mine water.

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