ABSTRACT AND REFERENCES

TECHNOLOGY ORGANIC AND INORGANIC SUBSTANCES.

PHASE EQUILIBRIA OF NITROBENZENE – n-HEPTANE SYSTEM WITH TiO_2 NANOPARTICLE ADDITIVES (p. 4-8)

Sergiy Artemenko

Phase behavior of nitrobenzene – n-heptane system under the influence of titanium dioxide nanoparticle additives was considered in the paper. Based on limited experimental data, parameters of one-fluid Peng-Robinson models for a binary mixture were recovered and evaluation of the phase equilibrium shift lines and critical parameters of a binary mixture with titanium oxide nanoparticle additives was performed. At low concentrations of nanoparticles, the II type of phase behavior, for example, of the system under consideration, does not undergo any changes. Recovered cross interaction parameters have allowed to calculate phase equilibria for the base system and predict the phase behavior of nanofluid in a wide range of temperatures and pressures. The shift of the liquid phase separation lines, final critical point and critical lines of the mixture with the titanium oxide nanoparticle additives was first evaluated.

Keywords: nanofluid, liquid-liquid equilibrium, critical lines, nitrobenzene, heptane, titanium dioxide.

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DEVELOPMENT OF COMPREHENSIVE OIL SLUDGE RECYCLING METHOD (p. 8-12)

Sergii Vdovenko, Sergii Boichenko

Current efficiency of using fuel and energy resources in Ukraine and CIS countries can be defined as one that does not meet modern requirements. This issue is particularly acute in the oil processing industry. One reason is excessive loss of hydrocarbons, including through the accumulation of oil sludge in open barns. The paper describes one of the solutions to the urgent problem, namely comprehensive recycling of oil sludge formed during oil processing in refineries. The composition and properties of oil sludge formed in the Turkmenbashi Refinery (Turkmenistan) and PJSC «NPK-Halychyna» (Ukraine) were investigated. Fundamental possibility of recycling organic oil sludge by shallow thermal degradation at temperatures of 420460 °C was defined. It was shown that thermal degradation residual can be used as an additive to raw materials for the bitumen production in an amount of up to 10 % by weight.

Based on the results, the current oil sludge utilization scheme was proposed.

Keywords: oil sludge, thermal degradation, oxidized bitumen, refinery, environmental safety.

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COMPLEX OXIDE CATALYSTS OF ACRYLIC ACID OBTAINING BY ALDOL CONDENSATION METHOD (p. 13-16)

Roman Nebesnyi

The present work is dedicated to solving the problem of diversification of the raw materials base for acrylate monomers obtaining,

first of all acrylic acid. Acrylic acid and its derivatives are bulk products of organic synthesis with a wide range of applications. The main industrial method of acrylic acid production is propylene oxidation. But this method has instable economic indicators as propylene is petroleum origin raw material.

It is possible to expand the resource base of acrylic acid production, in particular, by creating a technology of its production by aldol condensation of acetic acid and formaldehyde. The key step of this technology creation is improvement of the process catalysts efficiency.

For this aim, new composite oxide catalysts B_2O_3–P_2O_5–WO_3–V_2O_5/SiO_2, allowing to obtain acrylic acid with 57.4 % yield and formation selectivity 93.7 %, have been developed and explored. In this paper the effect of the catalyst components content on the initial reactants conversion and acrylic acid formation selectivity has been researched; the optimal catalyst composition and optimal conditions for the aldol condensation of acetic acid with formaldehyde to acrylic acid have been determined.

The high performance of the developed catalyst confirms prospects of using the method of acrylic acid obtaining by aldol condensation as an alternative.

Keywords: acrylic acid, heterogeneous catalysis, aldol condensation.

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INFLUENCE OF HYDROGEN PEROXIDE ON ACID LEACHING OF VANADIUM FROM SPENT CATALYSTS (p. 16-21)

Anna Nikiforova, Oleg Kozhura, Oleksandr Pasenko

Vanadium leaching from spent catalysts of sulfur dioxide conversion in sulfuric acid solutions with the addition of an auxiliary agent – hydrogen peroxide was investigated. It is shown that the formation of peroxide derivatives of vanadium improves the leaching degree by 30–40 % for low-temperature catalysts, containing rubidium and cesium sulfates as promoters. Acid concentration has a weak influence on the leaching degree and may be limited to 5–10 g/l. Low acidity of leaching solutions allows to carry out the thermohydrolytic deposition of pentavalent vanadium without prior neutralization and introduction of extraneous cations with alkali. Solutions, after vanadium deposition, can be returned to the leaching stage, which contributes to their concentrating on valuable rare-metal salt components and reduces the cost of evaporation. 90–95 % vanadium extraction in leaching solution was reached, through vanadium extraction is 86–90 %.

Keywords: catalyst, vanadium, leaching, hydrogen peroxide, thermohydrolysis.

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ABSTRACT AND REFERENCES

TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

DEVELOPING THE COMPLEX ANTIOXIDANT FROM WALNUT LEAFS AND CALENDULA EXTRACTS (p. 22-26)

Olesia Bilous, Igor Demidov, Svitlana Bukhkalo

This article is devoted to research the oils and fats oxidation processes. The methods of protection oils, fats and fat-containing products from oxidative damage are given. The most attention is paid to products protection from oxidation with the help of inhibitors. Natural antioxidants from plant material are reviewed. Complex antioxidant based on walnut leaves and calendula extracts are developed and investigated. The ability of the developed oxidation inhibitor to inhibit the oxidation of sunflower oil is demonstrated. The antioxidant feature was estimated from the values of induction periods. By adding an extract of the walnut leaves in amount of 0,025 % (counting dry substance) and calendula extract in amount of 0,025 % (counting dry matter) into sunflower oil, the induction period is doubled. The synergy between sunflower oil tocopherols and antioxidants based on walnut leaves extracts and calendula extract was found. Thus, the complex herbal antioxidant that can increase the stability of sunflower oil to oxidation is developed.

Keywords: inhibition of oxidation, plant oxidation inhibitors, sunflower oil, induction period.

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PRINCIPLES OF BLENDING FATTY ACID BALANCED VEGETABLE OILS (p. 26-32)

Oksana Topchiy, Ievgenii Kotliar

An effective method of obtaining fat products of a set fatty acid composition is blending (mixing) vegetable oils. The method is expedient since even cold-pressed oil composition is not optimal. Blended fat systems with a set ratio of polyunsaturated fatty acids (PUFAs) are effective in recipes that contain fat components, especially in meat products for functional and recreational nutrition.

Two- and three-component blended systems are mathematically calculated.

Composition of three-component vegetable oil blends is calculated at two stages. The purpose of the first stage is to identify the ratio of two main components, while the aim of the second stage is to calculate the share of the third component.

The study presents findings on fatty acid composition of produced in Ukraine vegetable oils, which allows to prognosticate their use in blended systems. More accurate prognoses on possibilities of obtaining multi-component blended oils are possible due to the suggested mathematic method. We have modeled recipes of blended vegetable oils for foodstuffs, particularly for nutrition of healthy people, with correlation ω-6/ω-3—10:1, as well as for preventive nutrition—ω-6/ω-3 equal to 5:1. Organoleptic analysis of the established systems has proved that savoury peculiarities of each of the blended oils are reflected in the completed blend.

The suggested technology is economically expedient since it does not require any peculiar expenses on additional equipment.

Keywords: technology, vegetable oils, blending, blends, refined oils, crude oils.

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DEVELOPMENT OF COMBINED PROTEIN-FAT EMULSIONS FOR SAUSAGE AND SEMIFINISHED PRODUCTS WITH POULTRY MEAT (p. 32-38)

Vasil Pasichniy, Andrii Marynin, Elena Moroz, Alina Geredchuk

The research on the possibility to improve the rheological characteristics of standardized 1 and 2 % solutions of whey, modified potato starch and "Extra" starch when adding pyrogenic silica A300 to the system for further use of these ingredients in protein-fat emulsions for meat products is presented.

The prospects of using combined protein-fat emulsions and protein-containing fillers of animal and vegetable origin in the production of sausages and semi-finished products from poultry meat were considered.

It was revealed that the pyrogenic silica A300 at a concentration of 0.3% is able to significantly improve the effective viscosity of standardized solutions of modified potato starch and "Extra" starch and this effect increases after heat treatment of solutions.

Using this effect has allowed to develop new types of combined protein-fat emulsions, which in an amount of 20...40 % enhance technological characteristics of poultry minced meat.

The results allow to expand the possibilities of meat-processing enterprises to use poultry meat in technologies of sausage and semifinished products.

Keywords: whey, starch, pyrogenic silica, viscosity, rheology, meat products.

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CHILLING-INJURY REDUCTION DURING THE STORAGE OF TOMATO FRUITS BY HEAT TREATMENT WITH ANTIOXIDANTS (p. 38-43)

Olesia Priss

Despite the proven effectiveness of heat treatment and antioxidants, their combined effect for chilling-injury reduction during storage of tomato fruits has not been investigated. The influence of heat treatment with antioxidant compositions on the level and severity of chilling injury during storage of tomato fruits is considered in the paper. It was found that the chilling-injury rate of tomato fruits depends on the weather conditions during vegetation. There is the closest relationship with the hydrothermic coefficient of fruit development and ripening period(r=–0,79...–0,90) and the number of days, when the maximum temperature exceeds the biological maximum of the crop (r=0,76...0,90). Frequent temperature drops during the vegetation of tomatoes can result in could reduce susceptibility during storage, as evidenced by the inverse correlations with the chilling-injury level of tomato fruits. Using thermal treatment with complex antioxidant based on horseradish root extract, ionol and lecithin postpones the appearance of chilling symptoms by 3 weeks and reduces the percentage of injured fruits by 9,8...11 times compared with untreated tomato fruits and by 5.6...7.5 times compared with conventional heat treatment. Chilling index in experimental fruits, depending on the variety of tomato fruits and antioxidants is 7.0...14.7 times lower compared with the

untreated fruits and by 3.3...7.7 times than in tomato fruits with water heat treatment.

Keywords: tomato fruits, storage, chilling-injury index, antioxidants, heat treatment, abiotic factors.

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DETERMINATION OF OPTIMUM AGING TIME FOR CUVEE OF ROSE SPARKLING WINE (p. 43-48)

Mariia Skorchenko, Marina Bilko

To assess the aging effect on the pink sparkling wine quality, mass concentrations of phenolic and coloring substances, optical and redox properties of the cuvee of Pinot Noir, Chardonnay and Cabernet Sauvignon were analyzed. It was shown that the mass concentrations of anthocyanins and phenolic substances have reached their minima in the 10th and 11th months of aging, respectively. In addition, the optical characteristics had the best value until the 10th month. The value of the redox characteristics also varied in the process of aging. Steady growth of Eh0 during the period from 0 to 10 months is most likely caused by the appearance of unoxidized autolysis products in the system. However, this figure began to decline in the 11th-12th month of aging that indicates the beginning of oxidation. The research results have shown that the aging time of pink sparkling wine should be consistent with a number of characteristics. It was recommended to hold aging of pink blended cuvee no longer than 1011 months.

Keywords: pink sparkling wine, cuvee, anthocyanins, phenols, optical properties, aging.

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STUDY OF MOISTURE STRUCTURIZATION AND BINDING FORM CHANGES IN PECTIN GELS BY DIFFERENTIAL SCANNING CALORIMETRY (p. 48-52)

Irina Krapivnytska, Volodymyr Potapov, Petro Gurskyi, Fedir Pertsevyi

During thermal cycling, changes in the structure and moisture-holding capacity of the samples of pectin gels with different formulations were investigated using differential scanning calorimetry by their cyclic heating and freezing.

The fact that pectin gels are used for a wide variety of foods and semi-finished products, subjected to heat treatment in a wide temperature range from positive to negative was also taken into account during thermal cycling.

The influence of the main formula components on the bound water volume increase, structure stability and gelation duration in pectin gels when heating and freezing was proved.

Temperature ranges of phase transitions, which suggest that low-esterified pectin gels, containing sugar, citric acid and calcium citrate retain their structure and ensure the final quality of finished products, in which they are used were determined.

Keywords: thermal cycling, thermal destruction, gelation, structurization, phase transitions.

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THERMOGRAVIMETRIC RESEARCH OF THE EXTRUDED AND NATIVE TYPES OF STARCH (p. 52-56)

Vitaly Pichkur, Maxim Lazarenko, Oleksandr Alekseev, Volodymir Kovbasa, Mykhailo Lazarenko

Most of the literature data, aimed at studying the structural features of native starch contain a large amount of information based on X-ray diffraction, which allows very accurately characterize the structure of starch granules. However, the issue of the number and forms of moisture bonds in the starch composition is still not fully disclosed.

Using thermogravimetric and differential-thermal research methods, the values of the amount of capillary- and adsorption-bound moisture, as well as the values of the activation energy of water molecules in the extruded and native types of starch of different origin were obtained. During the data analysis, a parallel between the type of crystal structure and the amount of capillary- and adsorption-bound moisture for native types of starch was drawn in the paper. The results characterize the influence of crystal structures of the output starch on the properties of extrudates and their amorphous structure.

The results obtained allow a better understanding of the fundamental differences in the technological indicators of native and extruded types of starch.

Keywords: thermogravimetric analysis, extrusion, starch structure, adsorbed moisture, activation energy.

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INVESTIGATION OF VITRIFICATION AND PHASE TRANSITIONS IN DOUGH SEMI-FINISHED PRODUCTS WITH PLANT ADDITIVES (p. 57-61)

Andriy Odarchenko, Alina Sergienko

The aim of the paper was to investigate the processes of phase transitions and vitrification of water in dough semi-finished

product with the plant additive during the freezing and heating, as well as to study the physical state of water at temperatures below 0 °C.

Fresh and pre-frozen dough half-finished products were used as the subject of the research. The study of phase transitions and vitrification was performed on a differential scanning calorimeter, designed and manufactured in the IPC&C of the NAS of Ukraine.

As a result of the studies, it was determined that the effect of additives on the water state and nature of phase transitions in the water component in the dough at a temperature below 0 °C is caused by the additional content of sugars, proteins and starch, introduced with additives.

The state of water in the dough semi-finished products was investigated by nuclear magnetic resonance, during which the spin-spin relaxation time of the samples was determined.

It was also found that the pre-freezing increases the water mobility in the samples and introducing additives that contain extra solids by the type of colloids - reduce the water mobility, which in turn provides a better integrity of dough semi-finished products during cold storage.

Keywords: dough semi-finished products, freezing, phase transitions, vitrification, NMR, DSC, cold storage.

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RESEARCH OF THIXOTROPY OF EMULSION SAUCE WITH BUTTERMILK CONCENTRATE DURING STORAGE (p. 61-65)

Tatiana Yudina

The paper provides the technology of the emulsion sauce (ES) using dry milk-protein concentrate (DMPC) with buttermilk with the fat content of 30 %, which allows to expand the range of emulsion sauces with high nutritional and biological value, rationally use protein-carbohydrate raw milk.

Thixotropic properties of the developed emulsion sauce using DMPC with buttermilk were investigated. Based on rheological studies, it was found that the emulsion sauce does not lose the ability to restore the structure and has thixotropic properties after 24, 72 hours and 90 days of storage at 4±2°C. The equations of effective viscosity of the emulsion sauce hysteresis loop after 24, 48 and 72 hours of storage were given. The results confirm the ES shelf life, previously established based on microbiological studies – 72 hours without preservative and 90 days with the preservative. With the specified shelf life, the developed emulsion sauce using dry milk-protein concentrate with buttermilk is within excellent quality.

Keywords: emulsion sauce, dry milk-protein concentrate with buttermilk, thixotropy.

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DEVELOPMENT OF THE POST-ALCOHOL STILLAGE DRYING PROCESS ON INERT BODIES AND OUTPUT OF CRITERION DEPENDENCE (p. 65-70)

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The mechanism of the post-alcohol grain stillage drying process on inert bodies (fluoroplastic crumbs) in a fluidized bed is considered in the paper.

Based on the analysis of a physical model of the process by similar transformations of the differential equation system, generalized (criterion) equation, which is post-alcohol grain stillage drying process on inert bodies in a fluidized bed with accounting grinding and abrasion of the material from the inert body surface was obtained.

As a result of the pilot study, the explicit form of the heat transfer equation for the post-alcohol grain stillage drying process on inert bodies in a fluidized bed was obtained. The first series of experiments served to determine the functional relationship between the Nu and Gu criteria at constancy in all other criteria. The next series was carried out at different heights of dense layers of inert bodies with the same initial moisture content.

The third series of experiments was performed to identify the impact of the Re criterion on the stillage drying process speed.

Keywords: particulate matter, drying, fluoroplastic crumb, fluidized bed.

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