CHEMICAL AND TECHNOLOGICAL SYSTEMS

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INFLUENCE OF VEGETABLE FATS ON CONCRETE OF AGRICULTURAL STRUCTURES

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The object of the study was concrete samples with different penetration depths of vegetable oil. For the experiment, concrete samples were taken from the foundation for the oil pan equipment, in the form of cylinders with a diameter of 100 mm and a height of 200 mm. It was found that the experimental sample No. 1 has a decrease in compressive strength of about 6 %, sample No. 2 has a decrease in strength of about 19–20 %, sample No. 3 has a decrease in strength of about 48 % from the control sample No. 4. The study using scanning electron microscopy showed the presence of a layer of solidified oil and plant residues on the surface of the concrete samples. Mycelium of microscopic fungi was detected at a depth of 2 cm from the surface. The study of concrete samples using TPD MS showed that CO was intensively released at a temperature of 583 °C from samples 2 – 0.03 and 3 – 0.05. At a temperature of 552 °C, CO_2 was released with an intensity of 0.1 from sample 2 and 0.18 from sample 3. In other samples, carbon was not released, which is associated with biochemical corrosion of concrete. At a temperature of 100 °C, H_2O was released from concrete samples 2 – 0.8 and 3 – 0.4. Sulfur was released when heated to 90 °C from sample 4_2 in insignificant quantities – 0.0035. SO was released from samples 2 (0.014), t=764 °C and 3 (0.012) t=809 °C. Sulfur dioxide was released at a temperature of 794 °C with an intensity of 0.005 from samples 2 and 3. The conducted study is distinguished by the fact that correlations were established between the depth of oil impregnation of concrete and loss of strength. Destructive changes in concrete samples, the presence of a layer of solidified oil and microscopic fungi were detected. The presence of carbons, sulfur and its oxides in concrete samples that were least damaged by corrosion processes is associated with the composition of sulfur concrete to give it greater strength. The practical significance of the results obtained is that the negative influence of vegetable fats on concrete is proven, namely a decrease in strength, destruction of the microstructure and the growth of microscopic fungi.

Keywords: vegetable oil, loss of strength, corrosion of concrete, thermal properties, microscopic structure.

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THE EFFECT OF ADDING QUICKLIME ON STABILIZATION OF EXPANSIVE SOILS

pages 12–17

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The object of this research is Ampelgading clay (Malang, East Java), known for its high plasticity and low strength, which impact building stability. This study focuses on how varying proportions of quicklime affect soil properties. One of the main issues is clay instability, caused by volume changes due to water fluctuations, which poses a major challenge for infrastructure, particularly in high-rainfall and humid areas. In the study, expansive clay from Ampelgading with quicklime percentages of 0 %, 5 %, 10 %, 15 %, and 20 % was tested. Geotechnical and mechanical tests, including water content, specific gravity, Atterberg limits, compressive strength, and swelling, were conducted. The results show that adding quicklime significantly alters the physical and mechanical properties of the clay, reducing water content from 58.20 % to 35.64 % and specific gravity from 3.362 to 2.118. Volumetric weight initially increases at low quicklime levels but decreases at higher levels. Quicklime alters soil microstructure through a pozzolanic reaction with calcium hydroxide ($Ca(OH)_2$) and silica/alumina, forming calcium hydrates that enhance cohesion and strength. However, excessive quicklime creates non-uniform aggregates, reducing density and stability. Optimal compressive strength occurs at 15 % quicklime, but at 20 %, stability decreases, plasticity reduces, and swelling accelerates. Furthermore, lower moisture content improves compaction and enhances soil stability. Compared to cement or fly ash, quicklime reacts faster, provides immediate stability, and minimizes long-term swelling and shrinkage. The pozzolanic reaction further strengthens the soil by forming stable calcium hydrate and calcium aluminate compounds.

Keywords: quicklime, soil water content, soil specific gravity, soil tension, volume swelling, soil stabilization, expansive soil.

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MEASURING METHODS IN CHEMICAL INDUSTRY

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DEVELOPMENT OF TEXTILE STRUCTURES USING 3D PROTOTYPING TECHNOLOGIES

pages 18–23

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The object of the research is pseudotextile mesh structures with three-dimensional hinged joints, manufactured by 3D prototyping methods. One of the main tasks in the field of 3D printing of textile materials is to ensure their flexibility, elasticity and adaptability to the shape of the human body. Materials produced by traditional 3D printing methods have high rigidity, which limits their application in the light industry. During the study, a concept for creating pseudotextile materials based on flexible network structures using spherical three-dimensional hinges was developed. The proposed structure allows for achieve the necessary flexibility and deformation capabilities characteristic of traditional textile materials. Modeling and experimental samples demonstrated that structures with three-layer hinged joints provide spatial variability of shape, while the use of eccentricity in the hinges allows to adjust the rigidity of the structures. The obtained results can be attributed to the use of three-level spherical hinge joints, which provide spatial mobility of individual elements of the structure, as well as numerical modeling to optimize the sizes of structural elements. The implemented models confirm that the mechanical properties of the synthesized structures can be controlled by changing their geometry. The developed structures can be utilized in the clothing production where high flexibility of the material is required, as well as in the creation of adaptive textile products for medical purposes, in particular for compression therapy or automated massage. Additionally, such materials can be used in the decorative design of fashion products.

Keywords: 3D prototyping, textile structures, additive manufacturing, spherical joints, pseudotextiles. material flexibility.

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ECOLOGY AND ENVIRONMENTAL TECHNOLOGY

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REDUCING THE RISK OF AIR POLLUTION IN WORKING AREAS BY CONSTRUCTION DUST USING A COMBINED DUST COLLECTOR

pages 24–30

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The object of research is methods for reducing the level of air pollution in working areas with industrial dust. The problem of reducing the impact of dustiness of production premises on the workers' health is solved by improving the aspiration air purification system.

A new approach is proposed that provides the blower (fan) with an additional purification function by attaching a dust collector to its housing. By organizing the circulation movement of the dust-gas flow, part of the dust settles in the dust collector before it enters the main dust collector. Such a combined dust collector can be used as an independent device in closed aspiration systems or as part of complex dust removal systems, reducing the load on the main device. A methodology for calculating purification indicators has been developed, which is based on the discretization of the differential dust mass distribution curve by particle size. The method allows to assess the efficiency of the process, determine the dimensions of the dust collection container and the frequency of dust discharge from it. The technology was used for the air aspiration system of the working area of the building materials processing facility to reduce the risk to workers' health from air pollution. The calculations have established the conditions of acceptable non-carcinogenic risk at the level of construction dust concentration not higher than 61.42 mg/m^3, and with the introduction of the proposed combined dust collector, it is possible to increase the dust level to 99.1 mg/m^3 without exceeding the risk threshold.

The proposed technology is cost-effective, requires minimal design changes and can be implemented at most industrial facilities, especially in conditions of high dustiness of production premises.

Keywords: air purification, combined dust collector, differential distribution curve, non-carcinogenic risk, dust removal systems.

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DEVELOPMENT OF A METHOD FOR RAPID DETECTION OF FIRES BASED ON COMBINED CURRENT SAMPLING AND DISPERSIONS OF A CONTROLLED HAZARDOUS ENVIRONMENTAL PARAMETER

pages 31–35

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The object of research is the process of detecting the ignition of materials in a premise based on the joint use of current sample means and variances of the controlled hazardous gas environment parameter. The problem is to develop a method for detecting the ignition of materials based on the joint use of current sample means and variances of the controlled hazardous gas environment parameter in a premise. The synthesis of the optimal method for detecting fires was achieved by moving from the space of controlled hazardous gas environment parameters to the spaces of sample means, sample variances, and also the space of joint sample means and variances. Under conditions of large samples, the distribution of sample means, sample variances and its joint values asymptotically tends to a Gaussian distribution. This allows to use the likelihood ratio criterion, which is optimal, in the synthesis. Unlike the traditional approach, the likelihood ratio is current and is determined for a fixed Gaussian distribution in the case of a reliable absence of ignition. It is established that the optimal method of fire detection based on the joint use of sample means and variances with the same quality indicators outperforms the optimal methods of fire detection based only on the sample mean or sample variance of the controlled hazardous parameter of the gas environment. This is explained by the fact that the optimal method of fire detection based on the joint use of sample means and variances uses a larger amount of information contained in the controlled parameters of the gas environment. The results obtained are useful from a theoretical point of view for the proposed optimal methods of fire detection. The practical significance of the work lies in the further improvement of existing fire protection systems of facilities in order to prevent fires.

Keywords: fire detection, premises, hazardous parameters of the gas environment, sample means, sample variance.

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ASSESSMENT AND FORECAST OF ATMOSPHERIC POLLUTANT DYNAMICS IN THE URBAN ECOSYSTEM OF ZHYTOMYR

pages 36–42

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The object of the study is the atmospheric air of the urban environment and the dynamics of concentrations of the main pollutants (CO, VOC (H_2CO), PM10, PM2.5, PM1.0, NH_3, NO_2) for the period 2019–2024. One of the most problematic areas is the steady upward trend in CO concentrations with a projected increase of 15–20 % every 2–3 years, which poses significant risks to public health. Also, of concern are seasonal peaks in PM1.0 concentrations in winter and a tendency to increase the baseline level of this pollutant by 5–10 %. The study used statistical analysis of time series of pollutant concentrations, graphical and mathematical data processing, analysis of seasonal fluctuations and long-term trends. Forecasting was carried out taking into account climatic, anthropogenic and technological factors that affect the distribution of pollutants in the city's air basin.

A comprehensive assessment of the temporal dynamics of atmospheric pollutants with the identification of multidirectional trends and seasonal fluctuations is obtained. This is due to the fact that the proposed approach has a number of features, in particular, taking into account the relationship between different pollutants and impact factors, as well as the introduction of predictive models taking into account seasonal cycles. This makes it possible to develop scientifically based recommendations for reducing the anthropogenic load on the urban air environment. Compared to similar known studies, this provides such benefits as the ability to more accurately predict changes in pollutant concentrations, optimize the environmental situation, reduce risks to public health and increase the effectiveness of environmental protection measures.

Keywords: atmospheric pollutants, air quality, temporal dynamics, forecasting, environmental monitoring, PM1.0, PM10, PM2.5, CO, NO_2, NH_3, urban air basin.

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FOOD PRODUCTION TECHNOLOGY

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COMPARISON OF TECHNOLOGICAL OPERATIONS IN PROCESSING ALFALUFER HAY IN TERMS OF THEIR IMPACT ON FORAGE QUALITY AND QUANTITY

pages 43–51

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Haymaking is a key stage in feed production, as the choice of technological methods directly affects its quality, nutritional value, and digestibility by animals. One of the most significant challenges in this process is the mechanical loss of alfalfa leaves during harvesting and processing of the mown mass. It is well known that leaves contain the majority of protein, carotene, and other biologically active substances.

Research results have confirmed the significant impact of windrow processing frequency on dry matter losses and the nutritional value of the feed. It has been established that a single windrow treatment during drying reduces dry matter losses by 2.6–4.5 % compared to multiple tedding operations. This has a positive effect on the chemical composition of the hay and promotes the preservation of essential nutrients, particularly carotene. The carotene content in the natural mass with single windrow processing reached 32.4 mg/kg in the first experiment and 30.4 mg/kg in the second, which significantly exceeds the values for hay subjected to intensive mechanical processing.

Optimizing the haymaking process not only reduces nutrient losses but also shortens drying times, which is especially important under unfavorable weather conditions. Reducing the time that mown mass remains in the field minimizes the risk of feed quality deterioration due to precipitation and promotes uniform drying of stems and leaves.

Thus, improving the technological processes of alfalfa haymaking enables the production of high-quality feed with a high nutrient content and stable feed characteristics. Compared to traditional harvesting methods, the use of optimized technologies helps reduce dry matter losses, increase carotene and protein content, and improve the overall nutritional value of the hay. This contributes to a more efficient supply of high-quality roughage for livestock farming, which is a crucial factor in enhancing the productivity of agricultural animals and the profitability of the industry as a whole.

Keywords: drying, consortium, chemical composition, hay, mechanical losses, alfalfa seeds, drying, active ventilation.

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DEVELOPMENT OF A DEHYDRATED PROTEIN FOOD PRODUCT FOR MILITARY PERSONNEL

pages 52–57

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The object of research is the process of developing a dehydrated protein food product enriched with lupine flour, intended for nutrition of military personnel in extreme conditions. The use of lupine flour is promising in technologies to produce dehydrated products for military personnel. It contains more protein than other legumes and has a less pronounced effect on the organoleptic quality of finished products.

It was determined and experimentally proved that white food lupine is a protein enricher in the diet of military personnel, which allows authors to obtain a combined meat and vegetable product balanced in chemical composition. The average protein content in lupine flour is 36–40 % by dry matter, which is 3 times higher than that of first-grade wheat flour and 2.2 % higher than that of soybean flour. A recipe for experimental meat and vegetable protein minced meat with 10 % beef meat substitution was developed. It was found that with an increase in the content of lupine flour in the minced meat, the protein content increases to 10.3 %. It was found that the meat and vegetable protein minced meat of the experimental sample corresponds to the control in taste, smell, color, consistency, but is better in juiciness and has a high rating. The microstructure of the developed meat and vegetable protein minced meat was determined. A technological scheme of production was drawn up and a volunteer test of the production of a dehydrated food product in the diet of military personnel based on meat and vegetable protein minced meat was conducted. The hygienic control of the production of health food products for military personnel was carried out. The express method of hygienic quality control showed that the luminometer readings were within the range of 1.356–1.793 RLU, which is clean, confirming compliance with the hygienic standards of the technological process.

The technology of a health product for nutrition of the military personnel of the Armed Forces of Ukraine in extreme conditions was developed. The influence of lupine flour on the protein content in the technology of meat and vegetable protein health-improving minced meat was scientifically substantiated. The possibility of introducing the technology into the diet for dry rations, according to Norm No. 10 for military personnel, was confirmed.

Keywords: dehydrated food, diet, HACCP, lupine flour, meat and vegetable product, military personnel, protein.

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DEVELOPMENT OF GLUTEN-FREE PRODUCTS TECHNOLOGY USING FLAX FLOUR

pages 58–63

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The object of research is the production of gluten-free products. 4 samples of dough and finished products with different ratios of corn, rice and flax flour were studied. Organoleptic analysis showed that compared to the assessment of the control sample (4.7 points), sample No. 3 (4.9 points) with a ratio of corn, rice and flax flour 60:20:20 (experiment 3) is rational.

Europe and other countries of the world are showing increased interest in the implementation of innovative technologies for the production of special and functional food products. Therefore, the current task is to introduce new technologies and functional formulations into production, taking into account the needs of today, aimed at preserving and increasing the biological value of food products.

It was found that the physical and chemical indicators of the finished gluten-free bakery product in terms of porosity, acidity, and crumb moisture exceed the control sample. The results of the studies show that an increase in the amount of rice and flax flour leads to an increase in dough porosity by 2 % compared to the control sample. The acidity of the dough increased from 2.70 degrees to 3.1 degrees and exceeded the control sample by 0.3 degrees. The dimensional stability is almost the same as that of the control sample. The specific volume compared to the control increased by 20 cm^3/100 g and amounted to 268 cm^3/100 g.

Based on the research results, a basic technological scheme of production has been developed and substantiated, parameters and modes of the technological process have been given. The possibility of creating functional technologies and recipes not only with high sensory, physicochemical quality indicators, but also with high nutritional value has been confirmed. This is achieved due to the content of vegetable proteins, unsaturated fatty acids and dietary fiber, minerals and vitamins in flax flour, which have a positive effect on lipid metabolism.

Keywords: corn flour, rice flour, flax flour, modeling compositions, gluten-free bakery products.

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DETERMINATION OF RELEVANT SENSORY CHARACTERISTICS OF BAKED DAIRY PRODUCTS

pages 64–70

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The paper considers approaches to increasing the objectivity of determining the organoleptic quality indicators of baked dairy products, in particular fermented baked milk, as one of the most common products in this segment. The main attention is paid to the analysis of key organoleptic parameters – color, appearance, consistency, taste and smell. Thus, the object of research is baked dairy products, in particular fermented baked milk, which are characterized by the spinning process, which involves prolonged heat treatment of the product. Such processes are accompanied by the Maillard reaction, which forms specific organoleptic characteristics. The problem being solved was to establish how the general choice of the consumer regarding a baked dairy product is formed based on the results of organoleptic evaluation, namely color, appearance, consistency, taste and smell. Since the consumer often only has an assessment of the color before purchasing the product, this parameter was considered in quite some detail. The fermented baked milk products available on the market differ in organoleptic indicators, both between manufacturers and between batches produced in different seasons.

The study applied a quantitative quality assessment method based on a total quality indicator (TQI), which takes into account the set of organoleptic characteristics. Color parameters were determined in the RGB and CIELab systems, which allows to objectively assess color – as the level of milk baking. A one-factor analysis of variance (ANOVA) was performed to assess the complex influence of individual organoleptic characteristics on others. This method was used to test hypotheses about the influence of individual organoleptic characteristics on the perception of other indicators.

Using a comprehensive approach to quality assessment allows not only to objectively determine the quality characteristics of the product, but also to establish the relationship between the technological parameters of production and its consumer properties. Focusing on consumer needs is an integral part of a successful, competitive market operator.

It is proposed to change the approaches in the technological control of baking by color characteristics to ensure stable quality of baked dairy products and optimize the parameters of the technological process.

Keywords: sensory analysis, organoleptic indicators, baked dairy products, fermented baked milk, color, duo-trio, ANOVA.

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STUDY OF THE AMINO ACID PROFILE OF ALTERNATIVE PROTEINS (*HELIX POMATIA*, *LISSACHATINA FULICA*, *HELIX ASPERSA*) AND THEIR POTENTIAL APPLICATION IN A HEALTHY DIET: OPTIMIZATION OF A MODERN BRANDADE RECIPE

pages 71–79

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Integrating traditional European cuisine with alternative protein sources can strengthen food security and provide the population with healthy food. Previous scientific works indicate the nutritional and environmental potential of alternative proteins. However, there is a research gap regarding their practical integration into authentic European recipes to improve nutritional value, sensory characteristics, and promote healthy eating. This study focuses on the problem of improving cod brandade for healthy nutrition. One of the problematic aspects of traditional brandade is its high fat content, limited protein content, and the use of predatory fish. This raises questions about its compliance with healthy eating principles. The object of the study is the recipe and quality of cod brandade and its modifications with alternative protein. Four samples were developed using salted semi-finished products: A0 (control *Gadus morhua*), A1 (*Helix pomatia*), A2 (*Lissachatina fulica*), A3 (*Helix aspersa*), and four samples using salted and cooked semi-finished products (50 % w/w): F0 (control *Gadus morhua*), F1 (*Helix pomatia*), F2 (*Lissachatina fulica*), F3 (*Helix aspersa*). In the experimental samples, olive oil was replaced with pumpkin seed cake protein isolate (50 % w/w). Among the snails, the highest amount of essential amino acids was found in *Helix pomatia* (8.39 g/100 g), although this was 23.72 % lower than the control. The protein from the *Helix pomatia* sample had the highest potential biological value (87.01 %), which was 3.85 % higher than the control. The chemical composition of the brandade changes significantly. The control sample (A0) is distinguished by a higher fat content, having the highest value at 29.96 %, which is 14.46 % more than A1. Samples with snails have a higher protein content, with A1 having the highest at 35.20 %, which is 15.86 % more than A0. Sample A1 achieved the highest sensory score of 8.6, surpassing A0 by 0.4 points. Texture and emulsion homogeneity indicators were better in the experimental samples due to the protein isolate. The obtained results highlight the significant potential of using alternative proteins for modernizing European cuisine and creating innovative food products for healthy nutrition.

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Keywords: European cuisine, fish products, snail fillet, essential amino acids, food industry by-products, pumpkin seed meal protein isolate, future food.

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