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DEVELOPMENT OF A METHOD FOR RAPID IGNITION DETECTION BASED ON CURRENT SELECTIVE DISPERSION OF HAZARDOUS PARAMETERS OF THE GAS ENVIRONMENT

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The object of the study is the current sample dispersion of arbitrary hazardous parameters of the gas environment during the ignition of materials. A theoretical justification of the method of operational detection of ignitions based on significant deviations of the current difference of sample dispersions of the measured arbitrary hazardous parameter of the gas environment has been carried out. In this case, the significance of the current difference of sample dispersions will allow detecting the ignition occurrence in real-time observation of an arbitrary hazardous parameter of the gas environment. The method allows setting the level of significance for the current deviation and ensuring the maximum power of fire detection. Laboratory experiments were conducted to verify the proposed method. At the same time, the differences of sample dispersions of hazardous parameters of the gas environment correspond to the general sets of reliable absence and occurrence of ignition. The results of the verification showed that at a given level of significance, the method allows detecting current ignitions of materials based on significant deviations of sample dispersions of the considered parameters of the gas environment. It was found that the most sensitive in terms of ignition detection are the CO concentration and the temperature of the gas medium. The maximum rate of increase in the CO concentration during the ignition of alcohol, paper, wood and textiles are 0.7 ppmm^2/s, 0.3 ppmm^2/s, 6.4 ppmm^2/s, 0.0025 ppmm^2/s, respectively. During the ignition of alcohol and paper, the rate of temperature increase is about 1°C/s, and during the ignition of wood and textiles – 0.25°C/s, respectively. The practical importance of the research lies in the use of significant deviations of the sample dispersions of parameters of the gas medium for the detection of material ignition.

Keywords: ignition detection, sample dispersion, hazardous parameter, gas medium, material ignition.

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DETERMINATION OF OPTIMAL OPERATING MODES OF THE SELECTIVE CATALYTIC REDUCTION SYSTEM FOR MARINE DIESEL EXHAUST GASES

pages 12–22

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The object of research is the process of ensuring the minimum level of carbon dioxide emissions when using selective catalytic reduction of exhaust gases from nitrogen oxides. It is noted that catalytic reduction systems provide the most effective purification of exhaust gases from nitrogen oxides. At the same time, due to the use of urea as a reagent in these systems, carbon dioxide emissions increase. This increases the greenhouse effect and reduces the energy efficiency of the ship. The research results presented in the work were carried out on a Gas Carrier class ship with a displacement of 127,645 tons with two main engines 5X72DF Hyundai-WinGD and three auxiliary engines 6H35DF Hyundai-HiMSEN. 5X72DF Hyundai-WinGD diesel engines were equipped with a high-pressure catalytic reduction system, 6H35DF Hyundai-HiMSEN diesel engines – with a low-pressure catalytic reduction system. It has been experimentally established that within the recommended range of urea supply to the catalytic reduction system of exhaust gases, there are optimal modes that ensure a minimal increase in carbon dioxide emissions while maintaining a high level of reduction in nitrogen oxide emissions. In these modes, the relative increase in carbon dioxide emissions does not exceed 2.3% for both types of diesel engines. Nitrogen oxide emissions for 5X72DF Hyundai-WinGD diesel engines do not exceed 3.3 g/(kW · h) and do not exceed 2.4 g/(kW · h) for 6H35DF Hyundai-HiMSEN diesel engines, which meets the requirements of Annex VI MARPOL. The relative reduction in nitrogen oxide emissions in these modes is 66.7–83.4% for 5X72DF Hyundai-WinGD diesel engines and 60.8–78.3% for 6H35DF Hyundai-HiMSEN diesel engines. The coincidence of the obtained values for the low-speed diesel engine 5X72DF Hyundai-WinGD and the medium-speed 6H35DF Hyundai-HiMSEN indicates the correctness of the research and the possibility of implementing their results on all types of diesel engines and catalytic reduction systems.

Keywords: environmental indicators, maritime transport, exhaust gas purification, marine diesel, catalytic reduction system.

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ASSESSMENT OF THE RISK OF POLLUTION OF THE ECOSYSTEM AND AGRICULTURAL PRODUCTS IN THE ZONE OF MILITARY CONFLICT

pages 23–28

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The object of research is the content of toxic elements in soils, pasture grass and cows' milk in settlements located near the combat zone. However, there is virtually no data on the contamination of territories located near the epicenter of military events. This does not make it possible to assess all potential risks of ecosystem contamination caused by military actions. The samples were collected in the territory of the Mykolaivka village community (Ukraine), which is located within a 50-kilometer zone from the state border with Russia. It was found that with an increase in the intensity of drone attacks (by 40%) and missile attacks (by 25%), an increase in the content of toxic metals Cd, Pb, and Cu in the soil was observed. The concentration of Cd (17.63 ± 0.27 ppm) found in sample S5 is the most threatening, as it is 294 times higher than the WHO recommended permissible level. In the tested soil samples, the maximum permissible concentration of lead is observed to be exceeded by 0.2–1 ppm. In May 2025, its content in the soil sampled in the village of Ulyanivka increased by 2.89 ppm, in the village of Tovsta by 2.57 ppm. In the pasture grass sample G3, an excess of Cd (0.07 ± 0.04 ppm), Pb (1.59 ± 0.44 ppm), and Zn (15.45 ± 4.74 ppm) was recorded. Cd content in milk in May 2025 ranges from 0.012–0.016 ± 0.01 ppm, which is 5–6 times higher than the WHO recommended values. Exceedance of the permissible lead level was also recorded in all samples, with the highest proportion (< 0.23 ± 0.11 ppm) in sample M9. The findings highlight the harmful effects of military activities on ecosystems and the safety of agricultural products, even in regions near conflict zones where no active combat is taking place. To address this, ongoing monitoring of soil and vegetation contamination, along with regular assessments of milk quality in these areas, is strongly recommended.

Keywords: heavy metals, soil, milk safety, ecosystem contamination, military influence.

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FOOD PRODUCTION TECHNOLOGY

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ASSESSMENT OF THE CONTENT OF FLAVONOIDS IN GREEN BUCKWHEAT FLOUR

pages 29–34

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The object of research is green buckwheat flour (GBF) from various brands, including Ecorod, Ecoorganic, Ms. Tally, Ecosmak, and Ahimsa, which is considered a promising raw material for functional food production. One of the main challenges in studying GBF is the insufficient amount of data on the quantitative content of individual flavonoid compounds, particularly quercetin and rutin, as well as the lack of systematic comparison of these indicators between different manufacturers. This limits the possibilities for the targeted use of GBF as a source of biologically active substances for the development of products with enhanced antioxidant activity.

The study applied absorption spectrophotometry based on the formation of chelate complexes with aluminum chloride ($AlCl_3$), which allowed the determination of total flavonoid content and subsequent calculation of quercetin and rutin equivalents. This approach enables a quantitative assessment of the bioactive potential of the raw materials under study and reveals variability depending on the brand.

The obtained results indicate a significant concentration of flavonoids in GBF: quercetin content ranged from 0.8 to 2.6 mg/100 g dry matter (DM), and rutin content ranged from 1.62 to 5.25 mg/100 g DM. This can be explained by the fact that green buckwheat, unlike heat-treated grain, preserves natural enzyme activity and its phytochemical complex, with flavonoids playing a leading role.

The applied approach provides a more reasonable evaluation of the functional value of green buckwheat grain and flour, which is of direct practical importance for the food industry. The results confirm the potential of GBF as a gluten-free ingredient for functional food products aimed at reducing oxidative stress and preventing chronic non-communicable diseases.

Keywords: green buckwheat, green buckwheat flour, flavonoids, rutin, quercetin, functional nutrition.

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OPTIMIZATION OF FORCES IN CUTTING POULTRY CARCASSES WITH DISC KNIVES

pages 35–41

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The object of research was the process of cutting poultry carcasses of chickens, ducks, and geese using disc knives. In the food industry, when processing poultry, and especially when disassembling it, which divides the carcasses into certain parts and sizes, carcass cutting operations are widely used. This process significantly affects the level of energy consumption of the entire production and the quality of the finished product. The main working parts of cutting machines are knives, the purpose of which depends on the entire technological process of chopping.

The dependence of the cutting forces of meat with bones of chickens, ducks and geese on the rotation speed of the disk knife and its sharpening angle at different product temperatures was experimentally established. It was established that with an increase in the cutting speed, the cutting force decreases. Approximate relationships were obtained for quantitative description of the influence of cutting speed on cutting force for different types of poultry, which allow to predict the energy consumption of the process. For producers, the range of cutting speed of poultry carcasses by the disk cutting body of the machine can be recommended from 6.5 to 9 m/s. The influence of the blade sharpening angle on the energy intensity of grinding poultry carcasses was studied; a rational range of sharpening angle was determined, at which cutting forces are minimized while maintaining the stability of the tool. Taking into account the structural and mechanical characteristics of poultry carcasses, operational indicators and technological requirements for the quality and cleanliness of the cut surface, the range of sharpening angle of the knife cutting edge is 20–26°. An applied aspect of using the obtained result is the possibility of improving the design parameters of disk knives and will ensure increased equipment productivity and cutting quality. However, the cutting force depends not only on the species and fatness, but also on the age, sex of the bird and the location of the muscles.

Keywords: cutting force, poultry carcasses, blade sharpening angle, disc knife, disc rotation speed.

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IDENTIFICATION OF PATTERNS IN SUGAR BEET STORAGE CONDITIONS DEPENDING ON ENZYMATIC ACTIVITY

pages 42–48

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The object of the research is the storage conditions of sugar beets (*Beta vulgaris*). One of the most challenging areas is the reduction in sucrose content during storage under normal conditions prior to processing. The study focused on storing sugar beets in a refrigerated chamber to preserve the quality of the raw material, slow down respiration processes, minimize sugar loss, and extend shelf life. This allows for the use of sugar beets not only during the mass harvest but also over a long period, ensuring a uniform plant load and creating a reserve of environmentally friendly and technologically suitable raw materials for the stable operation of sugar production during the off-season.

The study utilized various methods of storing sugar beets in a refrigerated chamber, including storage at temperatures of +2 to +3°C and at a relative humidity of 85–95%. The study also employed the same storage conditions but with the use of sulfur dioxide. It was found that when stored in a refrigerated chamber with sulfur dioxide fumigation every ten days, sucrose content decreased by 2.6%. After 90 days, a decrease of 5.9% and 3.3%, respectively, was recorded, and on the last day of storage, i. e., after 120 days, a decrease of 7.2% and 3.9% was recorded. This is due to the fact that the use of sulfur dioxide inhibits the activity of oxidoreductases and hydrolases, which reduces the consumption of sucrose and other nutrients in the respiration process. This increases the shelf life of sugar beets and allows them to be used not only during the mass harvest but also over a long period, ensuring a uniform plant load. Under these conditions, the content of sucrose and other nutrients decreases slightly, and the yield of granulated sugar increases. Compared to similar known sugar beet storage methods, this method provides a supply of environmentally friendly and technologically suitable raw materials for the stable operation of sugar production during the off-season.

Keywords: sugar beet, storage, sulfur dioxide, enzymes, oxidoreductases, hydrolases, quality indicators.

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DETERMINING THE INFLUENCE OF PHYTOEXTRACTS ON THE QUALITY FORMATION OF BAKERY PRODUCTS

pages 49–59

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The object of the study is the technology of bakery products using *Clitoria ternatea* extracts and establishing their impact on the consumer characteristics of buns. The paper considers the possibility of using environmentally safe plant raw materials in the production of food products.

One of the problem areas in the use of the extract is the sensitivity of *Clitoria ternatea* anthocyanins to technological influences (temperature, acidity), color instability, specific organoleptic indicators of finished products and the impact on the physicochemical quality indicators of the semi-finished product and the finished product.

During the study, *Clitoria ternatea* and *Malva mauritiana* extracts were used. It was found that the extract from *Clitoria ternatea* has a significantly higher content of coloring substances at all levels of the hydromodule (0.5:50; 1.5:50; 2.5:50), which reflects a higher concentration of pigments in the raw material or their higher solubility, therefore *Clitoria ternatea* extracts were chosen. Increasing the concentration of flowers in the extract contributed to an increase in the content of polyphenols, flavonoids, a decrease in the acidity of the extracts, the density of the solutions almost did not change. Replacing water with *Clitoria ternatea* extract in the technology of bakery products contributed to a change in the physicochemical parameters of the dough and the finished product. The acidity of the dough and the finished product increased, the humidity decreased, the porosity of the finished product decreased.

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As a result of the study, a technology of bakery products was developed using an aqueous extract of *Clitoria ternatea* flowers (hydromodulus 3.0:100), which provides a balance between technological and organoleptic properties. The samples had an exotic blue color, demonstrated better microbiological stability compared to the control, and the study of friability confirmed a positive effect on the preservation of crumb freshness compared to the control for 72 hours.

Keywords: food colorants, phenolic compounds, anthocyanins, *Clitoria ternatea*, extraction, antioxidant activity.

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