CHEMICAL AND TECHNOLOGICAL SYSTEMS

DOI: 10.15587/2706-5448.2025.323268

DETERMINATION OF THE INFLUENCE OF PULP VISCOSITY ON THE ENRICHMENT PROCESS OF MAGNETITE SUSPENSIONS IN SCREW SEPARATORS

pages 6–18

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The object of research is the process of enrichment of magnetite suspensions in screw separators, taking into account the particle size distribution, the compressibility of the liquid in the interparticle space, and the shape of the particles, which allows to assess the influence of these factors on the value of the effective viscosity of the suspension. The viscosity of the suspension is one of the properties for ore suspensions with a wide range of particle sizes and different concentrations of solids in operations and products. It determines the nature of the movement of the liquid, the state of the solids in it – the degree of its loosening, the difficulty of sedimentation, and energy consumption for transportation during the enrichment of magnetite ores in screw separators. The studies were conducted using analytical and experimental methods. It was experimentally established that the dependence of the viscosity of the pulp suspension on the particle size in the range of less than 1 mm has an inversely proportional relationship. At a volume concentration of solids in the pulp from 10 to 70 %, the viscosity of the suspension increases with a decrease in the volume concentration of the minus 0.1 mm class from 100 to 20 %. It has been established that at temperature regimes from 28 to 50 °C, the viscosity of magnetite suspensions increases with a decrease in the grinding fineness in different ways. The viscosity of magnetite suspensions depends on the mass fraction of solids: material with a fineness of 80 % minus 0.044 mm increases the viscosity of the suspension at concentrations above 40 %, and at a fineness of 80 % minus 0.031 mm – above 60 %.

The obtained scientific result, in the form of a calculation of the effective viscosity of the pulp, is based on a theory that takes into account the influence of particle size as a function of their average effective diameter, concentration and shape of suspended particles. From a practical point of view, the research results allow to develop optimal conditions for gravitational enrichment of magnetite ores in screw separators and avoid additional losses of valuable components.

Keywords: suspension viscosity, screw separator, magnetite pulp, particle shape, solid concentration, temperature regimes.

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ISSN-L 2664-9969; E-ISSN 2706-5448

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DOI: 10.15587/2706-5448.2025.323870

INCREASING THE SORPTION CAPACITY OF THE NATIVE FORM OF CLINOPTYLOLITE FOR Mn^{2+} IONS TO OBTAIN SORBENTS MODIFIED WITH MANGANESE OXIDES

pages 19–23

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The object of the research was the process of sorption of Mn^{2+} ions by natural clinoptilolite (native form) under the influence of ultrasonic (US) radiation for the subsequent production of sorbents modified with manganese oxides, which have additional catalytic and oxidative capacity. Such sorbents with additional functions will be widely used in water purification processes from iron and manganese ions, hydrogen sulphide and a number of organic compounds, as well as highly dispersed and colloidal particles. This will allow combining the processes of purification of dispersed particles and soluble compounds of Fe^{2+}, Mn^{2+}, sulphides. The research was carried out with a clinoptilolite fraction of 1.0–1.5 mm, which is used in water purification processes. It was found that the native form of clinoptilolite has a lower sorption capacity for Mn^{2+} compared to clinoptilolite previously enriched by washing out impurities. The process of modifying clinoptilolite under the influence of ultrasound made it possible to significantly increase the sorption capacity of the zeolite for Mn^{2+} ions, compared not only to the native form of clinoptilolite, but also to the previously enriched one. Thus, at ultrasound powers of 8.0; 10.2 and 12.5 W, the sorption capacity of the native form of clinoptilolite increased by 1.66; 2.14 and 2.41 times, compared to the control experiment (without ultrasound). Compared to the enriched clinoptilolite, an increase in sorption capacity is also observed, although somewhat smaller: at powers of 8.0; 10.2 and 12.5 W it increased by 1.14; 1.47 and 1.65 times. It was found that the increase in temperature has little effect on the value of the sorption capacity of clinoptilolite. The value of the temperature coefficient γ close to 1.1 indicates the course of the process in the diffusion region. EDX analysis has shown that the sorption of Mn^{2+} ions occurs mainly by the mechanism of selective ion exchange. The sorption capacity of clinoptilolite modified under adiabatic conditions is lower than under isothermal conditions. However, this method of modification has prospects at a higher mass ratio between the modification solution and zeolite. The results obtained have prospects for use in obtaining sorbents based on natural clinoptilolite with additional catalytic properties.

Keywords: sorption capacity, manganese(II) ions, manganese oxides, oxidative catalysis, water purification, iron ions, hydrogen sulphide.

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DOI: 10.15587/2706-5448.2025.323963

DEPENDENCE OF THE CATALYTIC ACTIVITY OF ZEOLITE CATALYSTS ON THE TYPE OF MODIFICATION IN THE LOW-TEMPERATURE CRACKING OF POLYSTYRENE

pages 24–30

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The study focuses on the catalytic cracking of polystyrene in a hydrogen atmosphere in the presence of catalysts based on natural zeolite. The catalysts were synthesized through acid activation of zeolite, followed by its modification with nickel(II) oxide, cobalt(II) oxide, and titanium(IV) oxide. One of the most pressing issues is that, despite the rapid accumulation of plastic waste in the environment, particularly polystyrene, cost-effective and efficient industrial technologies for its conversion into valuable products remain largely unavailable. Modern plastic recycling methods often require high temperatures and significant energy inputs, which reduce their economic and environmental feasibility. Therefore, the development of technologies utilizing inexpensive natural materials for the production of plastic cracking catalysts remains relevant and highly demanded. Low-cost catalysts based on natural clinoptilolite from a Ukrainian deposit were obtained, with a significant increase in surface area following acid activation. However, this activation had no significant impact on the liquid-phase yield or styrene selectivity. Thus, natural clinoptilolite itself exhibited catalytic activity comparable to that of its acid-activated form. Further modification of the catalyst samples with metal oxides (NiO, CoO, TiO_2) significantly enhanced their catalytic activity, as confirmed by gas chromatography analysis. The results indicate a liquid-phase yield ranging from 40 % to 80 %, with high styrene selectivity exceeding 80 % in some cases. This effect is attributed to specific features of the proposed catalyst synthesis method. Acid activation facilitates the removal of natural impurities and increases the surface area for reactant-phase contact, which is crucial in heterogeneous catalysis. Additionally, metal oxide modification introduces additional catalytic centers. Due to the reduced cost of the synthesized catalysts, achieved by utilizing inexpensive natural Ukrainian zeolites, and the significant decrease in the cracking temperature, the proposed polystyrene recycling method appears promising and economically viable for industrial implementation. Furthermore, the high styrene selectivity enables substantial reductions in energy and material costs compared to traditional technologies. In contrast to existing polymer recycling technologies, the use of natural clinoptilolite as a catalyst support offers an efficient and environmentally friendly approach to plastic waste utilization.

Keywords: polystyrene, catalytic cracking, catalytic pyrolysis, clinoptilolite, acid activation, metal oxides.

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FOOD PRODUCTION TECHNOLOGY

DOI: 10.15587/2706-5448.2025.323631

ESTABLISHMENT OF REGULARITIES OF BIOCHEMICAL TRANSFORMATIONS IN GRAPE BERRIES DURING REFRIGERATED STORAGE WITH PRELIMINARY THERMAL TREATMENT

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The paper is devoted to the study of biochemical transformations in grapes during refrigeration storage with preliminary heat treatment. The object of the study was nine table grape varieties. Of these, white – Ganja Table, Karaburnu, Chasselas White, Agadai; pink – Nimrang, Marandi Shamakhi, Taifi Pink; red – Kyzyl Izyum and Muscat Hamburg. For better preservation of table grapes and reduction of nutrient losses before placing them in the refrigeration chamber, they were preliminarily subjected to heat treatment for 5 minutes at a temperature of 65–70 °C in a drying cabinet. Then the grapes were stored in refrigeration chambers for 6–8 months, at a temperature of 0–1 °C and air humidity of 85–95 %. Biochemical studies of the grapes were conducted before placing them and every 30–40 days until the end of storage, as well as before and after heat treatment. After heat treatment, all grape varieties show a gradual restoration of the activity of the studied enzymes during the storage period, but this activity does not reach the initial level. Studies have shown that after heating the products, reactivation is possible if at least a weak enzyme activity is preserved, and it is more intense during the first day of storage. During long-term refrigeration of grapes in a refrigeration chamber, a decrease in the catalytic activity of enzyme systems leads to a decrease in the rate of catalytic processes, that is, biochemical transformations of carbohydrates, phenolic substances, vitamins, organic acids, pectin substances and other components, and thereby contributes to the preservation of the nutritional value of grapes. However, storing grapes with preliminary heat treatment contributes to a greater decrease in the catalytic activity of enzymes, and thereby inhibition of biochemical transformations of grape nutrients. This, ultimately, contributes to better preservation of grapes, their aroma, taste, appearance and their chemical components. Marandi Shamakhi, Nimrang, Ganja Table and Karaburnu are distinguished by a smaller change in the content of vital components.

Keywords: table grape varieties, heat treatment of grapes, refrigerated storage of grapes, biochemical parameters of grapes.

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DOI: 10.15587/2706-5448.2025.323829

USING REHEATING OF BAKED PRODUCTS TO PROLONG THEIR FRESHNESS

pages 39–44

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The object of research is the technological process of reheating bakery products after cooling. The study is devoted to the development of technological methods for extending the freshness of bakery products to reduce bread waste into the environment. Traditional methods for extending the freshness of bakery products require the use of high-quality raw materials, packaging materials, food additives, non-traditional raw materials, and the use of rational methods of storing finished products which in turn leads to an increase in the cost of products.

This work considers the possibility of using reheating of bakery products after a certain storage period, which may allow them to be produced with an extended shelf life without the use of additional ingredients, food additives, and technological equipment. It was established that to slow down the staling process, the optimal temperature for reheating of bakery products weighing 0.060 kg is heating the finished products to 75 °C. It was established that reheating reduces the friability of products compared to the control by 27.0 % under the condition of storage for 48 hours. Along with this, it was found that the water binding of the crumb of products after reheating also decreases during storage, but this decrease after 48 h of storage compared to the control is 15.5 % greater, which indicates a slowdown in the aging of the hydrocolloids of the products. It was found that the lightness (color L*) of the bakery product after reheating significantly decreased from 66.81 to 59.38, which indicates darkening due to the Maillard reaction. Due to reheating, the formation of the subcrust layer of bakery products occurs more slowly and the crust to crumb ratio is 57.5 % less compared to the control. Thus, the use of reheating is an effective technological measure for extending the freshness of bakery products.

Keywords: bakery product, reheating, staling, crumb hardness, subcrust layer.

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DOI: 10.15587/2706-5448.2025.323966

DETERMINATION OF THE DEPENDENCE OF THE FATTY ACID COMPOSITION OF BOILED-SMOKED SAUSAGES WITH THE ADDITION OF VEGETABLE RAW MATERIALS

pages 45–50

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The object of research is boiled-smoked sausages with the addition of vegetable raw materials, which can ensure the production of high-quality products with low cost and maximum yield.

One of the ways to solve this problem is to combine traditional and non-traditional resources, with preference given to additives of vegetable origin. When developing technologies for the production of new types of boiled-smoked sausages, part of the main raw material of animal origin is replaced by vegetable raw materials, thus obtaining a composite product. The authors used brewer's grain flour as a vegetable raw material. Brewer's grain is a valuable by-product in brewing, which is obtained after filtering the wort in the process of brewing beer.

Due to the need for a balanced diet, the study of fat is reduced not only to determining its mass content, but also to analyzing the fatty acid composition, nutritional, biological value and other indicators. Products containing plant raw materials have an improved fatty acid composition, which characterizes the nutritional and biological value of fats. In order to study the fatty acid composition, samples of boiled-smoked sausages were made from beef, pork, nitrite salt, sugar, black and allspice pepper, nutmeg and brewer's grain flour. Partial replacement of meat with brewer's grain flour in an amount of 2–6 % increases the biological value of the product by increasing essential fatty acids. Compared with the control sample, the following results were obtained: the amount of monounsaturated fatty acids increased by 6.8 % (sample 1), polyunsaturated fatty acids – by 39.3 % (sample 3). Regarding the amount of omega-3 fatty acids, the indicator increased in the 1st and 2nd samples, respectively, by 35.6 % and 8 %, while omega-6 increased in the 3rd sample by 45.2 %. and expand the range of high-quality and lower-cost sausage products.

The created sausage products, with the addition of brewer's grain flour, allow solving the issue of recycling brewery waste. This is due to the fact that the rational use of resources and the principles of zero waste are the basis for increasing production efficiency, which allows for a comprehensive solution to the problem of resource supply of the economy and environmental protection.

Keywords: boiled-smoked sausages, brewer's grain, saturated fatty acids, mono- and polyunsaturated fatty acids.

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ECOLOGY AND ENVIRONMENTAL TECHNOLOGY

DOI: 10.15587/2706-5448.2025.323971

DETERMINATION OF THE EFFECTIVENESS OF FUNGICIDE PROTECTION SYSTEMS AS A RESERVE FOR SUSTAINABLE SUNFLOWER PRODUCTION IN SOUTH OF UKRAINE

pages 51–57

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Sunflower is a strategic crop in the agricultural sector of Ukraine, but its yield and seed quality are significantly reduced due to damage from phytopathogens. One of the main methods for their control is the use of fungicides. A study conducted in the southern regions of Ukraine established the impact of fungicide application schemes based on active substances from the classes of benzimidazoles, strobilurins, and triazoles on the spread and severity of dominant diseases and sunflower yield. The main diseases of the crop included white mold, downy mildew, black stem, and stem canker. In the absence of fungicidal protection, disease development at BBCH growth stage 91 was significant, reaching 17.5 % (white mold), 28.9 % (downy mildew), 15.3 %, and 14.5 % for black stem and stem canker, respectively. The best biological efficacy for controlling Sclerotinia sclerotiorum and Phoma macdonaldii at BBCH growth stage 16 was shown by Amistar Gold, 250 SC (1.0 l/ha) – 78.0 % and 84.3 %, respectively. Against Diaporthe helianthi and Plasmopara halstedii, the highest efficacy at the same growth stage was demonstrated by Thanos, 50 WG – 86.6 % and 92.7 %, respectively. The use of Amistar Gold, 250 SC and Acanto Plus SC at BBCH growth stage 51 showed high biological efficacy against black stem and stem canker, ranging from 88.8 % to 90.3 %. Against downy mildew, the efficacy of Acanto Plus SC was higher by 4.5 % compared to Amistar Gold, 250 SC, reaching 88.9 %. For white mold, the efficacy of these products ranged from 80.0 % to 85.7 %, with Acanto Plus SC being more effective. Alpha-standard SC did not affect the development of downy mildew and showed low efficacy against white mold – 17.1 %. For black stem and stem canker, it had average efficacy rates of 74.5 % and 77.2 %, respectively. The use of fungicide application schemes: Amistar Gold, 250 SC (BBCH 16; 51) and Thanos, 50 WG (BBCH 16) along with Acanto Plus SC (BBCH 51) provided maximum yields of 3.24 and 3.31 t/ha, exceeding the control by 1.63 and 1.99 t/ha, respectively. The recommended protection schemes using Amistar Gold, 250 SC (1.0 l/ha), Thanos,

50 WG (0.6 kg/ha), and Acanto Plus SC (1.0 l ha) can be implemented in farms in southern Ukraine and adapted to other sunflower growing zones.

Keywords: white mold, black stem, stem canker, downy mildew, disease development, fungicidal protection, sunflower, productivity.

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DOI: 10.15587/2706-5448.2025.323866

DEVELOPMENT OF A PRACTICAL MECHANISM FOR THE ENVIRONMENTAL DIRECTION OF THE "GREEN OFFICE" PROGRAMME WHEN WATERING INDOOR PLANTS IN ACCORDANCE WITH SUSTAINABLE DEVELOPMENT

pages 58–62

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The object of research is a continuous action device with an alarm for rationalizing the irrigation system, which will help support the sustainable development program and improve the environmental situation in the country.

The problem solved in this study is related to the need to optimize the consumption of resources during plant care at enterprises of various forms of ownership that have begun to introduce environmental management. This is also one of the problematic aspects associated with the landscaping of industrial centers, offices and premises where a significant number of people work and live. The development of mechanisms for solving the problem should contribute to increasing the decorative properties of plants and optimizing work related to care, watering and maintaining a given soil moisture.

In order to solve the problem, a simple-to-use device for maintaining optimal soil moisture in pots (containers) with indoor plants has been developed, which occurs by visual registration (when the LED lights up).

This is due to the fact that the order of mounting and arrangement of needle electrodes in the design of the plant container with the placement of the LED on the soil surface has been changed. The proposed design features have made it possible to constantly monitor soil moisture – if the humidity reaches a value less than the required value, the LED turns on and records the need for watering.

Thanks to the conducted research, an increase in the qualitative component of moisture intake is ensured, the decorativeness of plants increases and the risk of their death is reduced, which will allow enterprises to actively move towards supporting the "green" economy. Compared with known analogues, the device gives confidence in the reliability of soil moisture control in containers with plants, and in case of its deviation from the optimal indicator, the sensor gives an instant light signal.

The proposed development also allows to improve the qualitative composition of the moisture supply, optimize the use of water resources, reduce death and increase the efficiency of plant care while ensuring their healthy growth.

Keywords: soil moisture monitoring, irrigation control, automatic soil moisture recording device, LED indicator.

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ISSN-L 2664-9969; E-ISSN 2706-5448

DOI: 10.15587/2706-5448.2025.323812

INVESTIGATION OF EXTRACTION AND DEHYDRATION EFFICIENCY OF GRANULAR COAL SLUDGES

pages 63–68

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The object of research is the process of extracting the solid phase and dewatering carbon-containing products of a coal enrichment plant in the technological chain of devices "drum screen – centrifuge". One of the most problematic areas of coal enrichment technology is the sludge waters of coal enrichment plants, which require high-quality cleaning and are promising for obtaining a fine coal fraction. This allows to reduce the load on radial thickeners, prevent coal losses and environmental pollution.

During the study, an industrial experiment was used to determine the efficiency of the module, which consisted of an Ecomash DS 511A-113 drum screen and an Ecomash SHS 511A-113 centrifuge. It was established that classes larger than 1.5 mm are advisable to capture and dewater by filtering on the developed drum screen to a moisture content of 15–22 % by filtration methods. Polydisperse sludge after removal of classes larger than 1.5 mm is effectively dehydrated in a centrifuge to a residual moisture of 19.7–33 %. The degree of sludge dehydration in a centrifuge is affected by the fraction of the class content larger than 0.4 mm and the centrifuge feed capacity, which determine the formation time, compression and compactness of particle packing in the sludge. It has been established that when dewatering fine-dispersed sludge of fine classes with a particle size of less than 0.4 mm, the moisture content of the centrifuge sludge increases with increasing solid phase retention efficiency. An increase in the fraction of fine-dispersed classes in the sludge, represented mainly by wet clay, leads to an increase in moisture content to 33 % and an increase in ash content to 83–85 %. An increase in the content of granular classes 0.4–1.5 mm to 30 % and above contributes to a decrease in sludge moisture content, other things being equal, due to the squeezing of moisture from the surface of fine particles that are squeezed by larger particles. The technological chain of the module, tested in industrial conditions, consisting of a filter screen and a centrifuge, allows for the effective extraction of the granular fraction of the sludge, capturing up to 87.4 % of the solid phase, leaving only finely dispersed high-ash clay with a particle size of less than 40 microns in the centrate.

Keywords: polydisperse sludge, solid phase retention efficiency, sludge dewatering, settling centrifuge, filtration, coal sludge purification.

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DOI: 10.15587/2706-5448.2025.323953

DIVERSIFICATION OF OIL CROPS IN THE SOUTHERN STEPPE OF UKRAINE: ADAPTATION TO CLIMATE CHANGES AND ENVIRONMENTAL CONDITIONS

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The leading role in the economy of Ukraine's agro-industrial complex belongs to the production of oilseed crops, which not only provide stable profits for producers but also positively impact the state's food security as a whole. Oilseed plants, particularly sunflowers, are highly liquid and enjoy stable demand in both domestic and foreign markets, increasing the area cultivated with these crops. However, in recent decades, the most significant growth has been observed in sunflower cultivation, which has led to a deterioration in the phytosanitary condition of fields, water regime issues, soil compaction, drying out, weed infestation, reduced yields of subsequent crops, climate change, and so on. The article analyzes the dynamics of oilseed crop cultivation in the Mykolaiv region from 2013 to 2023. State statistics indicate an increase in the area allocated for oilseed crops from 407.3 thousand hectares in 2013 to 476.2 thousand hectares in 2023. Most sown areas are occupied by sunflowers, whose share fluctuates between 70.1 % and 90.1 %. At the same time, the area under soybeans has decreased; however, a recovery was observed in 2023. Rapeseed, the second most important crop, shows fluctuations in area, reaching 117.6 thousand hectares in 2023. The yield of oilseed crops varies depending on climatic conditions and cultivation technologies; rapeseed demonstrates stable results (1.77–2.36 tons per hectare). The article also discusses the results of cultivating flaxseed, safflower, and brown mustard. In particular, despite its low yield, flax has growth potential due to its drought resistance and export opportunities to EU countries. The purchase prices for flax indicate high demand for this niche crop. The article emphasizes the importance of adapting technologies and varieties to ensure stable yields and increase the profitability of oilseed crop production in the region. Thanks to modern cultivation technologies, the yield of oilseed crops has increased from 23.6–28.8 % to 51.6 %. Introducing new elements will contribute to further yield increases without expanding cultivated areas. This will allow for the redistribution of oilseed crop sowing areas and partially diversify them, ensuring the adaptation of agroecosystems to climate change and the preservation of soil fertility. Additionally, the range of quality oils will increase. Research in this direction should continue as new varieties, substances, and fertilizers emerge.

Keywords: plants of the oil group, winter rape, oil flax, sunflower, structure of sown areas, elements of technology, varieties and hybrids, productivity.

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