ABSTRACT AND REFERENCES

ECOLOGY. TECHNOLOGY AND EQUIPMENT OF FOOD PRODUCTION

SYNTHESIS OF COMPOSITE SORBENT FOR REMOVING HEAVY METAL IONS FROM WASTEWATER (p. 4-8)

Iulia Avetisian, Oleksandr Khokhotva

Sedimentation of heavy metal ions, low, but environmentally relevant concentrations of heavy metals in water bodies has become one of the most dangerous problems worldwide. One of the known sources of this type of pollution is wastewater from nuclear and thermal power plants. According to national and international environmental standards, the composition of such water no longer allows the use of traditional purification methods. This dictates the need to develop a composite sorbent for modern purification systems.

A method for the synthesis and modification of the composite sorbent based on the KU-2-8 ionite was developed. The synthesis was carried out by deposition of synthetic magnetite Fe_3O_4 in pure form on its surface and in the presence of thiocarbamide. Sorption properties of materials were studied in dynamic conditions when extracting Cu (II) ions from water. Thomas model, linking the amount of the solution passed with a concentration of the substance sorbed on the column outlet was built. Under the terms of the Thomas model, the correspondence of experimental data to the calculated values confirms mainly physical sorption in the monolayer (Langmuir model), and the extraction of copper ions is described by the pseudo-second-order kinetic equation.

Difrogrammetric analysis of the relative distribution of copper, iron and sulfur in the sorbent structure has shown that copper ions are extracted from the solution by the entire amount of grain of the composite material.

Keywords: sorption in column, KU-2-8, thiocarbamide, heavy metal ions, modification, difrogrammetric analysis.

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ESTABLISHING THE OPTIMAL CONDITIONS OF THE PROCESS OF WATER TREATMENT BY ULTRASOUND (p. 8-12)

Nataliya Bernatska

The efficiency of water treatment from chemical and biological contamination using ultrasound in the presence of oxygen was investigated in the paper. It was found that the necessary water quality parameters are obtained already after an hour of acoustic cavitation action in the presence of oxygen. Oxidation of water-soluble organic compounds during sonication is the first-order reaction. Dispersion of microorganisms is heterogeneous system and oxidation is the pseudo-second-order reaction. High COD decrease efficiency during sonication of oxygen in the atmosphere is caused by the fact that peroxy radicals, peroxides and oxoradicals, participating in the radical-chain oxidation of organic compounds are generated under cavitation and provide high process speed.

In aerobic conditions of storing dispersions, not treated with ultrasound, the COD value increases slowly, reaching a maximum for 6–10 days and remains constant. During storage of solutions with an excess of organic matter under aerobic conditions, the COD value decreased from 7181 mg/dm^3 to 6504 mg/dm^3 for 2 weeks. During storage of water, treated with ultrasound, the COD value remained constant for 2 weeks.

After ultrasonic treatment of contaminated water, post-effect of acoustic cavitation, which lies in reducing the number of microorganisms per unit volume and COD occurs. In the US-treated water, growth of microorganisms starts only after 24 hours. The results allow to choose optimal conditions for the water treatment process and use ultrasonic units to treat sewage of the food industry enterprises or use mobile ultrasonic units for household purposes, such as cleaning private pools.

Keywords: acoustic cavitation, water treatment, reaction kinetics, biological contamination, chemical oxygen demand.

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PURIFICATION OF AQEOUS MEDIA BY MAGNETICALLY OPERATED SAPONITE SORBENTS (p. 13-20)

Nataliia Mykhailenko, Oksana Makarchuk, Tetyana Dontsova, Svitlana Gorobets, Igor Astrelin

Composite magnetically operated sorbents based on saponite and magnetite (containing from 3 to 10 % wt.) were synthesized, and their phase and chemical composition was revealed. Their adsorption properties with respect to the dyes were investigated and it is shown that magnetically operated sorbents have a high sorption capacity (maximum sorption capacity qt by malachite green reaches 324,50 mg/g), which is significantly higher than in their separate phases – native saponite (105.71 mg/g) and magnetite (36.71 mg/g). The calculated parameters of the equation of the Langmuir adsorption isotherm indicate that sorbent shows greater selectivity with respect to the cationic type dyes. It was found that sorption of dyes on magnetically operated sorbents proceeded at a higher rate compared to saponin. When removing spent sorbents from water by magnetic separation, it was revealed that effective removal of magnetically operated sorbents from the working medium is possible with nozzles in the form of nickel-plated steel grids. It is shown that using magnetically operated sorbents and high-gradient magnetic separators allows to purify working media from dyes with high efficiency, up to 90–96 %, therefore, using magnetic separators with high-gradient magnetic nozzles in the form of nickel-plated grids with desired technological parameters of magnetic separation process that take into account the magnetic properties of a particular sorbent type is recommended.

Keywords: saponite, magnetically operated sorbent, adsorption, dyes, magnetic separation.

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GEOSTATISTICAL MODELLING OF AIR POLLUTION ANALYSIS (p. 21-26)

Viktor Putrenko, Volodymir Tihohod

The problem of statistics-based monitoring of air pollutionis topical for modelling aided bythe tools of spatial analysis. We have suggested that the monitoring problems can be solved by means of geostatistical analysis methods that used to be applied in constructing continuum models of spatial distribution. We transferred from discrete statistical data to the geostatistical model through the gravity model that allows obtaining estimates on pollutants interaction.

Geostatistical calculations were based on the module created by the technology of the ESRI ArcGis companywith the use of the kriging method for calculating emission expansion. Comparison of the two kinds of geostatistical models shows that the method using the gravity model has identified large areas of Donetsk Region (Ukraine) with high levels of air pollution. Therefore, the methodology based on the geostatistical model with the use of the gravity model for the data transformation can be applied for identifying areas with high air pollution.

Keywords: intellectual analysis, geostatistics, gravity model, atmospheric pollution, geographical information systems.

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ENVIRONMENTAL AND SOCIAL ASSESSMENT OF ROAD RECONSTRUCTION PROJECTS (p. 26-34)

Viktoriia Khrutba, Ganna Weigang, Vadim Ziuziun

We have analysed the legislative framework of Ukraine on regulating impacts of the roads construction and reconstruction projects upon the environment and human health––and revealed its discrepancy with international requirements.

Ukraine's road networks can be saved by credit funds of international financial organizations, which requires an environmental and social assessment of the projects. The paper reveals the peculiarities and a mechanism for determining the environmental impact of the range of construction and reconstruction of roads according to modern technological processes and international requirements.

We have made an ecological and social assessment of the project of reconstructing highway M-03 Kyiv-Kharkiv-Dovzhanskyiat the road segment from Boryspil to Lubny and identified direct and indirect impacts of the project on people, flora, fauna, soil, water, air, climate, landscape, material assets and cultural heritage as well as on the interaction between these elements.As a result, we have determined that the project improvesthe conveyance and the engineering protection of the ecosystem as well as increases the bandwidth and reduces the road congestion, which improvesthe environmental and social situation in the area.

The current methods of assessing the environmental and social impacts of the project by the requirements of the IBRD can be effectively applied to other projects of reconstruction and improvement of roads.

Keywords: international bank, road/highway, environment, environmental impact, social impact, emissions of harmful substances.

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NOMOGRAM DEVELOPMENT FOR OPERATIVE WASTEWATER CONTROL (p. 35-39)

Julia Shatokhina

It was found that some wastewater treatment stages are provided with accurate, but too long control methods of specific indicators. Operative determination of suspended solids concentration allows to define the required coagulant amount at reagent wastewater treatment and prevent further surface water body pollution.

The correlation between wastewater indicators such as the suspended solids concentration and transparency, which is used in the paper to construct nomograms was found. The option of the nomogram depends on the selected parameters and auxiliary functions.

Two variants of the correlation between wastewater transparency and suspended solids concentration, which provides two versions of the construction algorithm were considered.

The construction algorithm of the first nomogram - determination of the suspended solids concentration from wastewater transparency through the inverse transparency function.

The construction algorithm of the second nomogram - determination of the suspended solids concentration from wastewater transparency through the intermediate function.

Resulted nomogram construction algorithms can be applied to wastewater with a significant correlation between the indicators.

Keywords: operational quality control, transparency, suspended solids concentration, nomogram, wastewater.

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INCREASE OF FERMENTATIVE ACTIVITY OF BREWING YEAST USING ZINC NANOAQUACHELATE (p. 40-44)

Valentyna Koshova, Valentyna Yazhlo, Volodymyr Kaplunenko, Yulia Ogorodnyk

The results of investigating the metal nanoaquachelate effect on the fermentative energy of brewing bottom yeast Saccharomyces-cerevisiae race - 11 were presented.

To improve the fermentative activity of yeast mentioned above, zinc nanoaquachelate in an amount of 0.10–0.30 mg/dm^3, in increments of 0.10 was used during the main fermentation of beer wort.

As a result of the research using brewing yeast S. cerevisiae race – 11, it was found that adding zinc nanoaquachelate in an amount of 0.10 mg/dm^3 in beer wort improves the fermentative activity, and the amount of the released carbon dioxide was 16. 7 % higher than in the fermentation of pure malt wort. The content of visible extract in the young beer on the seventh day of fermentation was 15.1 % higher compared with the control, pure malt wort.

Keywords: wort, brewing yeast, fermentative activity, fermented extract, zinc nanoaquachelate.

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USAGE OF NATURAL SPICY AROMATIC RAW MATERIALS FOR AVOIDING OF MICROBIOLOGICAL DETERIORATION OF DAIRY PRODUCTS (p. 45-49)

Svetlana Teterina, Natalya Yuschenko, Ulyana Kuzmik

In terms of obtaining high-quality, safe and storage-stable milk and dairy products, growth inhibition of microorganisms is topical. The research objective is to study the impact of previously developed spicy-aromatic compositions on test cultures of microorganisms (contaminating microflora representatives), namely Enterobactercloaceae, Micrococcusalbus, Bacillussubtilis, Endomyceslactis. The spice compositions include ginger, cinnamon, cloves, turmeric, sumac, aniseed, black pepper and allspice, cardamom, fenugreek, nutmeg, star-anise.

It was found that all spice compositions showed pronounced antimicrobial properties in relation to the test cultures. Consequently, using spice compositions in dairy product technologies will provide a bacteriostatic effect, which, while adding the aforementioned spices contributes to inhibition of foreign microbiotas, which allows to extend the shelf life of milk products obtained.

Keywords: antimicrobial properties, spices, spicy-aromatic compositions, bacteria, microorganisms, dairy products, stability, bacteriostatic effect.

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QUALITY ASSESSMENT OF EXTRACTS FROM UNCONVENTIONAL PLANT RAW MATERIALS (p. 49-54)

Ksenia Naumenko, Oksana Petrusha, Natalia Frolova, Olya Fedorenko

The results of the quality assessment of hydro-alcoholic extracts from black currant and mountain ash sprigs, which are unconventional raw materials for the food industry are given. According to the research, organoleptic, physicochemical and safety indicators of the extracts obtained comply with the requirements of current regulatory documents. This allows their use in technologies of soft and alcoholic beverages, wines, confectionery and canned food as cheap natural flavoring ingredients.

The content of phenolic and aromatic substances in the aqueous-alcoholic extracts of sprigs was investigated. The high content of phenolic compounds allows to use extracts in technologies of wellness foods, improve their storage stability. Extracts from sprigs of black currant and mountain ash are the source of valuable aromatic substances with fruit and almond flavor, so can be used for processing into natural flavors.

During the research, data about extracting up to 70...90% of toxic elements, contained in raw materials from sprigs were obtained. Therefore, normalization of their concentration in the extracts depends on their content in raw materials, as well as the input control.

Keywords: extracts, quality, quality indicators, black currant, mountain ash, food industry.

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FORMATION OF THE TASTE OF PLUM FRUITS UNDER THE INFLUENCE OF ABIOTIC FACTORS (p. 55-60)

Marina Serdyuk, Dmitrij Stepanenko

The research deals with scientific substantiation of the impact of stressful weather factors on the formation of the taste of plum fruits in conditions of the southern steppe subzone of Ukraine and the development of mathematical models to forecast them. For this, fruits of three varieties of plums: Voloshka, Uhorka Italiis'ka, Stanley were selected. The fruits were gathered from trees, typical of the variety and of the same age. Agricultural background at the experimental site satisfied the requirements of the farming equipment. As a result of the studies, it was found that the average content of total sugars in the fruits of the studied plum varieties was 11.4 %, free acids – 0.65 % and was characterized by strong volatility for years of research, as evidenced by the high coefficients of variation. The main stressful abiotic factor that has the most significant influence on the formation of a mass fraction of sugars and organic acids in plum fruits are weather conditions of the last month of fruit formation, i.e., absolute maximum temperature and precipitation during this period respectively. Using the methods of variation statistics, regression models were developed to predict the content of sugars and free acids, depending on abiotic factors, which are as follows: $У=0{,}00222X_1 – 0{,}064460X_2+0{,}75256X_3+0{,}81939X_4–7{,}20252$ – for sugars and $У=0{,}425513+0{,}005985\ X_1$ – for acids. As the regression model to predict the taste of the plum fruits from abiotic factors, the model to predict the content of free acids should be used.

Keywords: weather conditions, sugars, organic acids, fruits, plum, sugar-acid index.

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