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**MATH MODELING AND ANALYSIS OF THE IMPACT OF MUNICIPAL SOLID WASTE LANDFILL LEACHATE ON THE ENVIRONMENT (p. 4-10)****Yuriy Podchashinskiy**

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The hydrochemical composition of waste percolating water (leachate) generated in MSW landfills was investigated and analyzed. On the example of the MSW landfill in the city of Zhytomyr (Ukraine), the component percentage in the leachate was determined. The initial data for the research were hydrochemical indicators of leachate samples from dumps of the landfill for the period 2009–2016. The analysis of the leachate revealed the component percentage. It was found that chemicals such as phosphates, iron, cobalt, cadmium, lead, chemical and biochemical oxygen demand, alkalinity and hardness indicators of leachate in Zhytomyr MSW landfill exceed the maximum permissible concentrations.

The experimental data were obtained, and their features, summarized in the form of regression equations and corresponding approximating curves, which give information on the dynamics of quantitative composition of chemical components in leachate samples from the landfill sumps were identified. The reliability coefficients of these equations were found. The resulting regression equations are the basis for forecasting the pollution processes of percolating water of Zhytomyr MSW landfill. These models will also contribute to the development and implementation of practical measures for decontamination of leachate from MSW landfill sumps, minimization of harmful effects on the hydrosphere in the final stages of the landfill life cycle.

**Keywords:** municipal solid waste, percolating wastewater, seasonal dynamics, mathematical model.

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**THE USE OF SPECTRUM-ZONAL IMAGES BY LANDSAT 7 ETM+ FOR DIAGNOSING SOIL CHARACTERISTICS OF UKRAINIAN POLISSYA (p. 11-19)****Petro Trofimenko**

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A dependence of characteristics of the spectrum-zonal raster images by Landsat 7 ETM+ was examined, in particular, albedo of reflectivity  $\rho$  and certain vegetation indexes, on the soil properties in the transition zone of Central Polissya in Ukraine. In present paper we applied an algorithm for constructing agrochemical schematic maps using Quantum GIS.

An importance was established of the selection of approaches to diagnosing the magnitudes of soil and agrochemical indicators of soil properties with attributes of hydromorphicity, particularly during the formation of statistical sampling to conduct a correlation-regression analysis.

It is demonstrated that the possibility of identification and the quality of diagnosing certain individual indicators of soil properties, as well as informativeness of certain channels, depends on putting an accent (priority) in the form of compiling uniform statistical sample. It was found that combining a sample by the uniformity of the type of soil and granulometric composition of soils allows a more pronounced identification of dynamic magnitude of the nutrient content – movable phosphorus and exchangeable potassium.

It is established that given the multi-component screening of the Earth surface with vegetation, a degree of correlation connection between characteristics of spectrum-zonal images and the indicators of soil properties beyond the vegetation period is significantly reduced.

**Keywords:** sensing, soil properties, screening,  $\rho$  albedo, hydromorphicity, correlation connection, vegetation index.

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### STUDY OF THE STRENGTH OF FLOCCULATED STRUCTURES OF POLYDISPERSED COAL SUSPENSIONS (p. 20-26)

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The influence of concentration, dispersed composition and degree of thickening of the flocculated slime on the strength of flocules was studied. It was revealed that for the formation of durable aggregates of polydispersed coal slime it is recommended to apply the combination of the non-ionogenic and anionogenic flocculant in the ratio of 20:80 % respectively. It was established that the residual sedimentation rate of flocules after mechanical influence at the constant consumption of the flocculant has the greatest value at the concentration of solid phase in slime of 10–30 g/dm<sup>3</sup>. With an increase in the content of the portion of solid phase with coarseness of more than 40 μm, the strength of flocules increases to the larger degree than the influence of the initial concentration. This makes it possible to recommend the correction of the slime composition not only by the concentration, but also by the content of medium grade of more than 15–20 %. It was shown that with an increase in the degree of thickening of more than 140–150 g/l the resistance of aggregates to mechanical influence substantially decreases due to an increase in pseudo-plastic properties of flocculated slime.

**Keywords:** flocculation, polydispersed slimes, aggregate formation, strength of flocules, residual sedimentation rate, degree of slime thickening.

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**ANALYSIS OF THE WAYS TO PROVIDE  
ECOLOGICAL SAFETY FOR THE PRODUCTS OF  
NANOTECHNOLOGIES THROUGHOUT THEIR  
LIFE CYCLE (p. 27-36)**

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Recommendations for conducting ecological evaluation of nanomaterials are prepared. It is necessary to exercise control in order to establish effect of nanoproducts on the environment and human health for safe and productive use of nanotechnology. A general procedure for the system of nanosafety and certification of nanoindustry product should be based on creating standardizing, legislative and methodological support of safety system in the process of production, handling and disposal of nanomaterials. It was found that in order to perform assessment, nanoproducts should be examined at all stages of the life cycle. A scheme of the life cycle of nanomaterials was developed, which should be considered as a multi-stage process from the preparation of the source material to the reclamation. According to the methods proposed and recommendations developed, ecological assessment of porous indium phosphide and the device based on it, indium nitride, was performed. Nanostructures are investigated using the methods of scanning electronic microscopy, chemical analysis, the method of average projected diameter, gravimetric method, etc. It was found that porous indium phosphide may be health hazardous. Porous indium phosphide is formed by the method of electrochemical etching in the solutions of acids. Such methods of synthesis of nanostructures pose an ecological threat. Understanding these threats will optimize the processes of formation and operation of nanomaterials for ecological safety and will highlight the key moments of safe usage and disposal of products of nanotechnology.

**Keywords:** ecological safety, nanomaterials, porous indium phosphide, life cycle.

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## EROSION STUDY OF LIMESTONE ON THE Cat Ba ISLANDS IN NORTH EAST VIETNAM BY TRANSVERSE MICRO-EROSION METER (p. 36-44)

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Erosion rate at the Cat Ba island stations ranged from 0.196 to 0.282 mm/year shows that the average value in comparison with previous study results ranges from  $\pm 0.2$  to  $\pm 0.5$  mm with strong eroded level. Relative erosion rate value is the lowest at measuring stations X2 on April 8th, 2015 and the highest is at measuring stations Z7 on November 9th 2015, the average value in comparison with previous study results, ranges from  $\pm 0.05$  to  $\pm 0.2$  mm with average eroded level and from  $\pm 0.2$  to  $\pm 0.5$  mm with strong eroded level.

The results of relative erosion rate on April 8th, 2015 are lower than on November 9th, 2015. Total rainfall values counted from the beginning of the study to the first measuring date (April 8th, 2015) and the second measuring date (November 9th, 2015) are 980.2 mm and 2280 mm, respectively. Therefore, the erosion rate of limestone is strongly affected by changes of total rainfall on the Cat Ba Island.

Average relative erosion rates in this study are quite high at some submerged zone stations (about over 0.2 mm/year, on average) and quite low with some stations on land in comparison with some previous studies all over the world. Therefore, it needs more assessment in longer period to study more accurately some other impacts on weathering and erosion processes.

**Keywords:** Karst landscapes, Cat Ba, erosion, TMEM, limestone.

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**EXAMINING FEATURES OF THE PROCESS OF HEAVY METALS DISTRIBUTION IN TECHNOGENIC PLACERS AT HYDRAULIC MINING**  
(p. 45-51)

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Effectiveness of the use of technogenic tuff placers for the extraction of heavy metals, which are accumulated on the objects of process-

ing mineral raw material, was shown. It was experimentally proved that the distribution of metals in a technogenic placer is uneven both by the height and lengthwise in a placer. The bulk of metal with the hydraulic mix is concentrated in the central section of a placer and forms the heavy metals zone in the form of the core with percentage from 59.46 % to 85.35 %.

Pulp consistency (P:T) in the studies was accepted in ratio 80 % to 20 %; 85 % to 15 %; 90 % to 10 % with percentage of native copper 0.5 %, 0.75 %, 1 % with respect to the tuff weight. Under conditions of placers formation on a plane, we substantiated the regularities of heavy metals distribution, which makes it possible to determine their position and to design parameters of the zones of increased metal concentration in the body of a technogenic placer.

It is proven that the height and the length of the base of a technogenic cone-shaped placers depend on the density of hydraulic mix. The height of a placer increases at an increase in ratio P:T, and the width of its base decreases. A formula for determining parameters of the zones of heavy metals concentration in the body of a technogenic placer was obtained. Parameters of the zones of increased content of heavy metals in a technogenic placer change by a dependence, described by polynomial of third degree. Polynomial coefficients characterize the dynamics of formation of the core of a placer, where from 59.46 % to 85.35 % of heavy metals are concentrated.

Obtained results of the studies indicate the need for processing technogenic waste, which include precious metals, by searching for the zones of their maximum concentration by the established regularity for the purpose of their extraction and further processing.

Results of the studies make it possible to develop initial requirements for conducting commercial tests and creating an area for processing technogenic tuff placers for the purpose of extraction of copper and other metals.

**Keywords:** mineral resources, heavy metals, hydraulic borehole mining, technogenic placer, technological cycle.

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## RESEARCH INTO TECHNOLOGIES OF OBTAINING GRAPE MUST IN THE PRODUCTION OF SPARKLING BASE WINES (p. 52-62)

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Base wines from grape of the Sukholimansky white and Pinot Noir varieties were received by the traditional national and innovative technologies. Innovative technology implied the fractionation of must and its clarification using commercially available oenological preparations. It was established that, depending on the technology of obtaining must, chemical composition of base wine is formed: carbohydrates dominate (1300.0–2850.0 mg/dm<sup>3</sup>), with less amount of phenolic compounds (115.4–266.6 mg/dm<sup>3</sup>), and an insignificant amount of protein substances (10.2–68.5 mg/dm<sup>3</sup>). The magnitudes for indicators of the root mean square error, calculated by devised regression models, indicate a close relationship between chemical composition of the surface active substances in base wine and the techniques for must separation. As a result of examining the surface active substances by the method of gel chromatography, we obtained their low- and highmolecular fractions. It was found that in the fraction with molecular weight of 50–60 kDa, protein substances, phenolic compounds and polysaccharides are in the form of the complex. Mass fraction of biopolymeric complexes in base wine does not exceed 6.7 %. In the base wines from white grape, the composition of biopolymeric complexes is dominated by the protein-polysaccharide component; in the base wine from red grape, it is dominated by phenolic-polysaccharide component. In order to stabilize biopolymeric surface active substances, we

applied a must clarification method using the combinations of commercially available oenological preparations.

The most effective technique for clarification the must is a combination of halotanin with enzyme and complex preparations. Foaming properties of base wine – parameters of maximum foam height and stability time – were determined using the Mosalux device. It was established that foaming properties depend mainly on the component composition of biopolymeric complexes in base wines.

**Keywords:** technology of must, sparkling base wines, surface active substances, foaming properties.

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**IMPROVED METHOD TO DETERMINE STRUCTURAL-MECHANICAL PROPERTIES OF TURKEY MEAT AT AXIAL DEFORMATION (p. 63-69)**

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We proposed an improved express-method to examine structural-mechanical properties of turkey meat, based on determining the relaxation effort and penetration. Changes in elasticity and relaxation effort of chilled turkey fillet at different storage periods are characterized.

The designed installation makes it possible to explore and analyze the structural and mechanical properties by the method of axial deformation in 20...30 min. with a sensitivity that allows detecting changes in the structure that are undetectable organoleptically.

We described changes in elasticity and relaxation effort of chilled turkey fillet with different shelf life. It was established that organoleptically pronounced changes in the structural-mechanical properties of turkey fillet occur in 46 hours of storage. First, the relaxation slows down, the limit of elasticity is reduced, which, in the combination with the lower tensile strength of the fibers, allows us to recommend it for the formation of natural culinary products with a required shape.

The proposed technique to analyze the results of relaxation and axial penetration makes it possible to draw conclusions about the structural-mechanical properties of turkey meat, the term of its storage, as well as to recommend the examined samples for a certain type of culinary treatment.

The method we developed might be implemented under conditions of small-scale production or laboratories at the wholesale trade enterprises to determine quality of raw materials.

**Keywords:** penetration, structural-mechanical properties, axial deformation, deformation diagram, turkey fillet.

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#### THE USE OF GAS CHROMATOGRAPHY IN DETERMINING THE SORPTION CAPACITY OF THE ADSORBENT (p. 70-74)

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The study specifies the characteristics of adsorbents for their subsequent use in adsorbents that are intended to trap aromatics from the juice vapour at the temperature and vacuum concentration of juices and extracts of plant materials. The paper presents our findings on the specific sorption capacities for aromatics of activated carbon BAC-A and porous polymers, such as polisorb-1, polisorb-10 and tenax GC. The experimental studies employed the dynamic method of gas chromatography with the use of the flame ionization detector. The trace curve of the adsorbate substance in the chromatogram allowed plotting adsorption isotherms and, consequently, calculating the specific capacities of adsorbents for camphor and isoamylol, as well as revealing that polysorb-1 is selective to isoamylol, whereas tenax and BAC-A – to camphor.

The experiment findings have proved the applicability of this method for different adsorbents intended for adsorption of substances in the gas phase. The obtained data on the sorption capacities of the selected adsorbents are essential to calculate adsorption systems for trapping aromatics during the concentration of juices and extracts.

**Keywords:** gas chromatography, adsorption isotherm, adsorption capacity, adsorbent, aromatic/aromatic compound/AC.

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