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**DEVELOPMENT OF DECISION SUPPORT IN THE
STRUCTURE OF THE INFORMATIONANALYTICAL
SYSTEM OF ATMOSPHERIC AIR ENVIRONMENTAL
MONITORING (p. 6-12)**

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The main problem that determines the efficiency of environmental monitoring systems is the lack of validity of management decisions on correction of environmental situations. In such conditions, a formal versatile basis that describes the information-analytical system (IAS) of environmental monitoring is required.

For the development and description of the IAS composition and structure, elements of the theory of fuzzy logic and fuzzy sets and methods of system analysis are used. Thus, the theoretical basis for the development of a versatile IAS structure of environmental monitoring is formed. The set-theoretical model of the information-analytical system of environmental monitoring of atmospheric air at the municipal level, which includes subsystems of the urban system parameter monitoring, decision support, the information system "parameter database – situation knowledge base" is proposed.

The decision support subsystem is presented as the decision model that determines the allowable transformations of situations and a set of strategies for applying these transformations to solve the problem of eliminating an adverse situation. The adaptive fuzzy model of situation recognition in the process of environmental monitoring, which allows producing diagnostic conclusions is developed. The diagnostic process is represented by a sequence of actions, which involves three steps: determining the criticality for each situation feature; determining the degree of criticality; providing linguistic features. The advantage of the proposed IAS architecture is the possibility of fast scaling of the decision support system. This is achieved by simply expanding the feature and situation dictionary and the knowledge base, as well as the flexible configuration of the knowledge base by correction of weight ratios of elementary premises of the rules. The general description of the information technology of monitoring and support of operational decision-making on correction of environmentally hazardous situations is formed. The results of setting the fuzzy model of situation recognition by means of experimental learning of the system on the

examples – specific results of observations of atmospheric air quality are obtained. The self-learning ability of the system is found, which ultimately will allow limiting the involvement of real individuals as experts in the assessment of environmental situations by automating the diagnostic process.

Keywords: environmental monitoring, information-analytical system, model, situation recognition, decision support, information technology.

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STUDYING THE EFFECT OF MULTIFUNCTIONAL PARTITIONS ON TEMPERATURE INDICATORS AT OFFICES OF THE OPEN SPACE TYPE (p. 13-21)

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Existing partitions used in offices and at enterprises were considered, an analysis of use of partitions to ensure comfortable working conditions was performed and supplements to the classification system were systematized and introduced. Attention was drawn to the fact that the existing classification systems consider partitions based on the convenience of their use, material and design missing their influence on meteorological factors.

As a rule, partitions are made from one or two layers of materials having different properties. They separate rooms or a working space at various heights from the floor. It was shown in the work that incorrectly arranged partitions made of expensive building materials can bring to naught the planned objectives of improvement of working conditions. In premises with high ceilings, conditions of irrational heating are likely to be created, both in the premises in general and concrete working zones. The studies have shown that this is solved by installation of partitions that direct and retain heat.

It was found in the course of the study that temperature indicators in separated rooms are not significantly affected by the partition material type but the degree of room separation with partition by height is of paramount importance.

As a result of temperature studies in premises of open space type where various partitions (glass pipes in a metal frame, ceramic panels, expanded polystyrene) were installed, it was established that

partitions can significantly influence the temperature indicators but only if the room is completely separated in height. It was established that the material of partition does not affect the temperature indicators if separation is not complete (less than 100 %).

The studies have proved the prospects of the scientific substantiation of the use of partitions and definition of connection between room separation and the factors affecting worker's performance capability.

Keywords: office of open space type, localization of working space, temperature distribution, building partitions.

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DEFINITION OF A COMPOSITE INDEX OF GLAZING ROOMS (p. 22-28)

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The effect of geometrical parameters of rooms and window openings on the value of the daylight factor (DF) in the reference point on the work surface is considered in the article. This is important, as while using a light factor (LF) and a window-to-wall ratio (WWR), there is a significant error. Therefore, there are objective difficulties with the unification of the results of studies on the effectiveness of natural sidelight, which are due to the influence of the size of the room on the DF value in the reference point on the work surface.

The use of the above-mentioned coefficients to evaluate the efficiency of lateral natural light results in the fact that, at constant

value of the coefficient, the value of the DF may differ several times. This is because the area of the window opening does not correspond to the area of glazing through which daylight passes into the room. The area of the room does not correspond to the area of the work surface on which it is necessary to provide normalized illumination, and the dimensions of both the room and the work surface are not taken into account in the LF or in the WWR at all.

It is proposed to use a composite room glazing index (CRGI). It takes into account not only the glazing area of the window opening but also the dimensions and area of the work surface. This makes it possible to use the results of studies on the effectiveness of natural light without binding them to the dimensions of a room. Using the Relux program, the DF value in the reference point for rooms of different sizes with different glazing areas of the window openings is calculated and the dependence of the DF on the CRGI has been obtained. As a result of the approximation of this dependence, an equation describing the relationship between these quantities has been developed.

An algorithm that takes into account both the width of the opaque portion of the window opening and its proportion has been developed to determine the area of the window opening at which the required value of the DF in the reference point is provided. The obtained scientific result in the forms of the CRGI and algorithm of calculating the area of the window opening is interesting from the theoretical point of view. From a practical point of view, the results help calculate the minimum glazing area of the window opening to provide a normalized DF value with a standard deviation of 0.894, based solely on the dimensions of the room. This is a prerequisite for using the obtained results in the development of normative documents for construction sites.

Keywords: window opening, daylight/natural light, daylight factor, a composite room glazing index.

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STUDYING THE EMISSIONS FROM ENTERPRISES IN THE BREADMAKING INDUSTRY IN ORDER TO USE THEM AS ADDITIVES TO ANIMAL FEED PRODUCTS (p. 29-35)

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We have investigated the concentration, physical properties and chemical composition of dust formed in the equipment at enterprises in the bread-making industry, depending on the character of production and a place of its formation.

It was established that the dust concentration varies from 130 to 640 g/m³. The physical properties of dust are as follows: bulk density – 350–570 kg/m³, mineral substance – 0.6–7.8 %; variance at

$d=50\ \mu\text{m}$ is from 3.8 to 18, and at $d=5\ \mu\text{m}$, from 1.7 to 6.3. The chemical composition of dust, % per dry matter, is: starch – (17–75), protein – (0.2–18), pentosanes – (2.0–6.2), fat – (0.2–3.6), sugar – (1.7–58), cellulose – (0.8–48).

The results obtained indicate that the maximum values of dust concentrations are reached in the units of grain preparation for processing (equipment for treating grain surface at a preparatory unit of the mill, 640 g/m³). Minimal values are reached at the silo-bottom conveyors of grain elevator, 130 g/m³. Ash content varies from 0.6 % (flour dust in the mill's grinding unit rollers) to 7.8 % (grain dust in the silo-bottom conveyors of grain elevator).

Bulk density varies from 350 kg/m³ in the mixer at a feed plant to 570 kg/m³ in the silo-bottom conveyors of grain elevator.

The most disperse particles form in the mill's grinding unit rollers, and the least disperse ones are in the grain elevator's equipment.

The chemical composition of dust, % per dry matter, is: starch – (17–75), protein – (0.2–18), pentosanes – (2.0–6.2), fat – (0.2–3.6), sugar – (1.7–58), cellulose – (0.8–48).

Chemical composition represented by carbohydrates, proteins, fats, mineral substances, allows us to resolve the task on processing grain and flour dust.

The data obtained might prove useful when solving the issue of processing grain and flour dust. The grain and flour dust is a valuable secondary resource, easily reproduced, a cheap and readily available source of raw materials for animal feed additives after appropriate treatment.

Given the volume, physical properties and chemical composition of dust generated at enterprises of the bread-making industry, we have developed the scheme for processing it, as well as the liquid waste when applying the wet method of grain preparation for processing, into carbohydrate-protein feed additives in the form of a biomass for animal feed.

The scheme for processing waste, bran, and grain dust into feed granules is developed, in order to store them better and utilize during feed production.

The efficiency of processing and utilization of waste at an enterprise in the bread-making industry is represented by a set of integral criteria that characterize the quantitative and qualitative aspects of this process. The comprehensive integral technological process efficiency criterion makes it possible to identify reserves for improvement at particular enterprise. The integral criterion of the effectiveness of the technological process $K_{\text{efficiency}}$ should approach its maximum value ($K_{\text{efficiency}} \rightarrow 1$). The lower its values for a given enterprise, the larger the reserves to improve the process.

Keywords: bread-making industry, equipment, grain dust, physical properties of dust, chemical composition, recycling, scheme, feed additives, animal feed granules, criteria of efficiency.

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STUDYING AND SUBSTANTIATION OF THE METHOD FOR NORMALIZATION OF AIRIONIC REGIME AT INDUSTRIAL PREMISES AT THE ULTRASONIC IONIZATION OF AIR (p. 36-45)

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We report results of investigations on normalization of the air-ionic mode at premises with ultrasonic ionization of humidified air. We substantiated an increase in the concentration of negative air-ions with complex influence of the balloelectric effect and ultrasonic cavitation. We established that the concentration of negative air-ions increases almost in six times at the use of distilled water as a source of air-ions under the action of an ultrasonic generator with a power of 10 W at a distance of 0.5 m. At the same time, there is no generation of ozone and nitrogen oxides due to the combined influence of ultrasonic cavitation in a surface layer of water and the balloelectric effect. We proved that the concentrations of negative and positive air-ions increase due to changes in physical-and-chemical properties of water and the emerging mechanical-and-chemical phenomena with a decrease in the degree of water mineralization of water.

We proposed a mechanism for formation of air-ions in the humidified air of industrial premises under the combined action of the balloelectric effect and ultrasound. We substantiated that improvement in the quality of the air-ionic composition of air in industrial premises takes place at a temperature of demineralized water of 20–25 °C and a directed airflow of 6 m/s towards a working zone, with the combined action of the balloelectric effect and ultrasound, which improves sanitary and hygienic working conditions. We proposed a structure of an automated control system for the air-ionic mode of a working area of industrial premises under artificial air-ionization with a use of an air-ions generator and a ventilation system. It will make possible monitoring and processing of information on technological, electrical and microclimatic parameters, adjusting, coordination of work and joint managing of devices of a ventilation system and an ultrasonic generator of air-ions.

Keywords: air-ionic mode, balloelectric effect, ultrasonic cavitation, working zone, production premises.

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The given research is devoted to the development of the technology of utilization of lime-softening sludge to obtain calcium nitrate.

Water treatment waste by chemical composition differs from natural raw materials such as limestone, which is traditionally used to obtain calcium nitrate. Sludge obtained at the stage of lime-softening contains about 70 % calcium carbonate, a fairly large amount of iron, which enters the precipitate with solutions of coagulants, as well as organic impurities. Organic impurities come from river water and precipitate as a result of coagulation.

The process of extracting calcium by the acid solution is stable. The results are well reproduced on two kinds of waste from different enterprises. This is explained both by the high dissolution rate of calcium carbonate in nitric acid, and the similar chemical composition of the waste.

Not only calcium compounds, but also iron ones together with the organic component of liming sludge fall into the solution. A process scheme is proposed for cleaning the solution, which should include the stages of oxidation of the solution and subsequent precipitation of iron.

The concentration of iron in the experimental solutions was up to 6 g/l. With the help of the calculations of the precipitate-solution equilibrium, it has been stated that iron in the area of low concentrations of nitric acid precipitates in the solution, and calcium stays

in it. The decrease of the acid concentration was carried out by the addition of pure calcium carbonate.

Kinetic studies of the process of iron precipitation on model solutions of iron (III) nitrate have been carried out. The second-order kinetic equation is obtained. The calculation of the process activation energy is available in the paper. The value of the energy is ~37 kJ/ mole, which is the evidence of the precipitation process in the transition area. The undissolved residue contains about 40 % iron and can be used to obtain coagulants.

Thus, the application of the proposed method will allow the best use of water treatment waste.

Keywords: water treatment, lime softening, sludge, calcium nitrate, coagulants, dissolution, nitric acid, purification, deposition.

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ASSESSMENT OF THE STABILITY OF AQUATIC ECOSYSTEMS DEVELOPMENT ON THE BASIS OF INDICATORS OF THE MACROPHYTES FLUCTUATING ASYMMETRY (p. 54-61)

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In order to implement the provisions of the EU Water Framework Directive 2000/60/EU, the theoretical and methodological principles of applying the method of instantaneous biomonitoring of the stability of aquatic ecosystems development on the basis of evaluation of macrophyte fluctuating asymmetry indicators were proposed. The research found that the violation of the stable development of ecosystems, including the influence of anthropogenic factors, causes deviation in the morphological parameters of higher aquatic plants. Violations of the symmetry of individual parts, namely morphogenetic changes in macrophytes, are closely related to the coefficients of ecological stabilization of landscapes and the water quality categories. The qualitative assessment of the environment in terms of fluctuating asymmetry of indicator plants is justified in relation to salt composition, trophoscopic and toxicity indices. The particular sensitivity of this method has been found in relation to the content of heavy metals in the mules and coastal soils at concentrations below the established maximum permissible concentrations (MPC). The regularities of the distribution of the integral fluctuating asymmetry indices are determined and a three-dimensional model of the asymmetry formation in a leaf of *Potamogeton perfoliatus* is established, depending on the stability of the landscapes and water quality. They represent the basic short-term component of the integrated system of biomonitoring of sustainable development of aquatic ecosystems and allow clarifying, correcting and generalizing the existing methods for environmental assessment of water quality. The proposed technique allows strengthening the role of the biological component in conducting an environmental assessment of the quality of surface water and ensures the implementation of the EU Water Framework Directive 2000/60/EU on the territory of Eastern Europe.

Keywords: biomonitoring, macrophytes, water quality, surface waters, biodiversity, fluctuating asymmetry.

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ESTABLISHMENT OF FIRE PROTECTIVE EFFECTIVENESS OF REED TREATED WITH AN IMPREGNATING SOLUTION AND COATINGS (p. 62-68)

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An analysis of techniques for determining the fire protective effectiveness of reed was performed; the need to develop reliable methods for studying the process of ignition and flame propagation around the surface of the building structure, required to create new types of fireproof materials, was established. Estimation of ignition time and time of passing the surface area by the flame front revealed the unreliability of the actual values of the flammability index. The method for determining the process of ignition and propagation of flame of fire protected materials was substantiated and, taking into account the permanent conditions of heat and mass exchange in the course of testing, the setup was developed. Determining the flammability index implies the impact on sample of the heat flux of the electric radiation plane and the sample ignition by the burner. In also involves determining the thermal coefficient of the plant, measurement of the maximum temperature of combustion products and the time of its achievement, ignition time and the time of passing the surface sections by the flame front, the length of the burnt part of the sample and calculation of flammability index.

The conducted research into the process of ignition and flame propagation along the reed surface using a given technique

showed that the raw sample under thermal influence ignited at second 52, the flame propagated across the whole sample over 100 s. The fire protected sample, treated with the impregnating solution based on the mixture of inorganic and organic substances, specifically the mixture of urea and phosphoric acids and natural polymer in the amount of 47.1 g/m², ignited at second 595, flame propagation along the surface occurred only at the first section, the maximum temperature of flue gases was 114 °C, flammability index decreased to 0.42.

The results of determining the flammability index showed that under the influence of high temperature flow on the coating in the amount of 46.2 g/m², ignition and flame propagation did not occur, flammability index was 0. Due to intense swelling, there occurred a slight increase in temperature in the vent pipe. A decrease in the flame retardant in the composition by two times at the same consumption resulted in an increase in flammability index for the roofing impregnating solution up to 5.8, and for the swelling coating up to 0.96, respectively. The above results make it possible to establish the ratio of flame retardants and polymers in these compositions and their required quantity.

Keywords: fire protection of reed, impregnating solutions, coatings, surface treatment, time of ignition, flame propagation.

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