

УДК 332.141.4.6

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TECHNOGENESIS AS A FACTOR FEATURE OF TECHNOGENIC- CONDITIONED HEAT SUPPLY SYSTEMS IN WHICH ELECTROMAGNETIC FIELDS ARE USED IN THE PREPARATION OF WATER

Modern civilization in the twenty-first century has entered a new phase of its development, when people have taken on the function of integrating their knowledge to create new nanotechnologies that are highly efficient for the economy and energy production and safe for environmental impact.

The article emphasizes that the main tactical intention to ensure high efficiency of production processes and preventive production activities in construction in the process of non-reagent preparation of water in electromagnetic fields (magnetized water of heat supply systems) is the unification of organizational and management decisions in the process of operation of heat power systems (feasibility studies) in order to achieve reliable analytical information on the results of passive monitoring of material flow status of feasibility studies.

The key tactical intentions of achieving high efficiency of production processes of prophylactic production activities in the process of non-reactive water treatment in electromagnetic fields (magnetized water in heating systems) are the unification of organizational and management decisions in the operation of systems of thermal power facilities (GPO) in order to achieve reliable analytical information about the results of monitoring the passive state of material flow in the systems of GDO. As the results of the studies showed, the sensitivity of the methods used to control the state of material flows of HPO systems allows to determine the dynamics of the components of material flows in time and space.

According to the scientific and technical literature and personal research, the technology of using magnetized water for its preparation in heating systems is relevant and promising due to its implementation (based on experimental testing) and saving energy and material resources, as well as the formation of biological fouling. We have found that the sensitivity of the information-analytical system, which is material flows, arises in complex inorganic systems, which is a major factor in the sequence of operation of water treatment technology in electromagnetic fields (EMF). This is confirmed by the fact that the proposed analytical control system (indicator) is, with the linearity of the calibration functions, a feature of determining the concentration below which it is impossible to determine the presence of this component in the material flows.

Keywords: *technogenesis, economic and energy resources, electromagnetic fields, passive monitoring, self-organization of heat supply systems (thermodynamics and synergetics), indicator control systems.*

Introduction. Modern civilization in the XXI century has entered a new phase of its development, when people assumed the function of integrating their knowledge to create new nanotechnologies that are highly efficient for the economy and energy production and safe for environmental impact.

Analysis of research and publications. During the scientific and technological revolution, a profound transformation of economic, environmental and energy problems of cities and, first

of all, heat and power is carried out. This approach is given in the works of well-known scientists Herasymchuk I.S., Shkarupa O.V., Golubitska T.V., Biehun S.V. and others, on the economics of natural resources and the intensification of heat and power processes (with the exception of the low efficiency of heat) is due, in some cases, to the irrational consumption of energy, material resources (energy) due to the formation of biofouling in the piping systems of heat power objects (HPO), as evidenced by many publications [1, 2, 3, 4]. These scientific publications state the prospects and economic attractiveness of the use of reagent-free water treatment in electromagnetic fields (EMF) of heat supply systems. The works emphasize the fact that the use of magnetized water in the HPO systems guarantees the rational use of natural resources, technological production materials, etc.

Problem statement. Proof of the economic attractiveness of the use of reagent-free water treatment with electromagnetic fields (EMF) of heating systems may be the decline in the volume of biofouling on long-working HPO production systems and the exclusion of their formation when applying for water treatment in the EMF at the new buildings, the use of magnetized water, due to the equivalence and optimality between the parameters of magnetized water obtaining and their specific indicators of material flows in HPO systems. Such approach to the implementation of reagent-free water treatment technology provides a constant state of the assimilation potential of the atmosphere in the location of the HPO systems. At the same time, it is possible to achieve such success only under the condition of a combination of measures in relation to organizational and managerial decisions, as the vector value of Fig. 1, regulation of industrial processes of heat generation (Law of Ukraine, 2019), therefore, the effectiveness of the proposed nanotechnology by determining the forecast of the dynamics of the state of material flows of HPO systems using the results of passive monitoring (priority level).

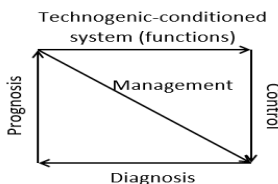


Fig. 1 Diagram of techno-natural system and its vector components

Main part. We, on the basis of the collected, processed data on nanotechnology, developed technological regulations for the practical use of production technology for reagent-free water treatment in electromagnetic fields (EMF) of heat supply systems in the construction industry. That is, adaptation of scientific results in practical terms (ISO standards - International Standard Organization) as the factor indicator sign of control due to man-triggered material flows [5], which in the conditions of economic globalization provide consistency between the effectiveness of the proposed nanotechnology and the exception of negative impacts on the environment (atmosphere).

The scientific basis for solving this problem is the justification of measures of organizational and managerial decisions in the operation of HPO systems in which EMF (positive technogenesis) is used for water treatment. Thus, the consistency of the state of the material flows of the HPO systems with optimally equivalent parameters of magnetized water is highlighted. Due to this, a high level of efficiency of the proposed nanotechnology is achieved, and as a consequence – the preservation of the assimilation potential of the atmosphere. Therefore, the studies were carried out in a complex system (Fig. 1), research: "Human - economy - natural environment." The application of a comprehensive system of research allows to determine the dynamics of changes in the constituent material flows under

the influence of EMF by hydrochemical, electrophysical and thermophysical specific indicators (potentials).

Object of research. HPO systems (term of 5 years).

Purpose of research. Establishment of measures of ecological-production organizational-management decisions at operation of man-triggered (positive artificial technogenesis) material flows owing to application of reagent-free water preparation in EMF [1].

Materials and methods. The work uses statistical and mathematical analysis [6], methods of conceptual mathematical modeling [7, 8, 9, 10, 5]. Methods are divided into the following groups: methods of information collection (passive monitoring); methods of information processing; methods of interpretation of the results; methods of forecasting and mathematical modeling.

Results and discussion. In our works [1, 2, 3, 4, 11] the prospects and relevance of the method of reagent-free water treatment in heat supply systems with the use of electromagnetic fields were shown. At the same time, scientific and technical features of man-triggered material flows of HPO systems in the process of water preparation were not proved earlier and only now (for the last 3 years) received such opportunity. The fundamental conclusion of the research results of HPO systems was the fact that the material flows in them are man-triggered, as a factor feature of technogenesis (the positive feature of the use of EMF). It should be noted that the formation of the chemical and physical composition of the material flows of heat supply systems depend on two main factors:

- first, direct factors that directly affect the technology of water treatment;
- second, indirect factors that recognize the conditions for the implementation of production decisions (organizational and managerial decisions) and ensure high efficiency of production and environmental activities.

This classification creates a set or structure of relations between factors and as a result there is a need for these relations and interaction between the structural components of man-triggered material flows.

The first stage of such studies of engineering heating system is a formalization of this problem, which allows to quantify the natural resources that engineering system uses, the spatial-temporal spread of core components of technologically triggered material flow. The result of the first stage, thanks to mathematical calculations, is a generalized conceptual model of an engineering heat supply system, Fig. 2.

At the second stage of research, the technological regulations of reagent-free water treatment in heat supply systems are developed, when numerical specific indicators of the conceptual model are determined.

At the third stage of research, scientific regularities are established, or rather, the possibility of achieving equivalence and optimality between the parameters of the magnetized water obtained by us and the specific indicators of man-triggered material flows of the HPO systems of the construction industry is concretized [4, 12].

In the end, the optimal thermal optimum of the HPO systems and the effect on the assimilating potential of the atmosphere are determined, these scientific materials received the certificate for intellectual property [13].

Despite the high prevalence of urban engineering structures of heat supply systems, in general, real engineering structures are designed as micro boiler rooms, which simplifies the use of a formal model.

We found that under the influence of EMF the self-organization in the heat supply system becomes possible (simple organizational systems - complex inorganic systems) due to the interaction of thermodynamic and synergetic processes. Under the influence of EMF, the physical purpose of self-organization, simple inorganic systems of material flows are characterized by the absence of chaos of particle motion. According to [14]:

1) "the processes of destruction and creation, degradation and evolution in the Universe are equivalent", and 2) "the processes of creation + increase in orderliness have a single algorithm regardless of the natural system". Thus, a clear example of self-organization from chaos, in our opinion, is the appearance of an ordered structure (the action of EMF) in heat supply systems in the formation of man-triggered material flows.

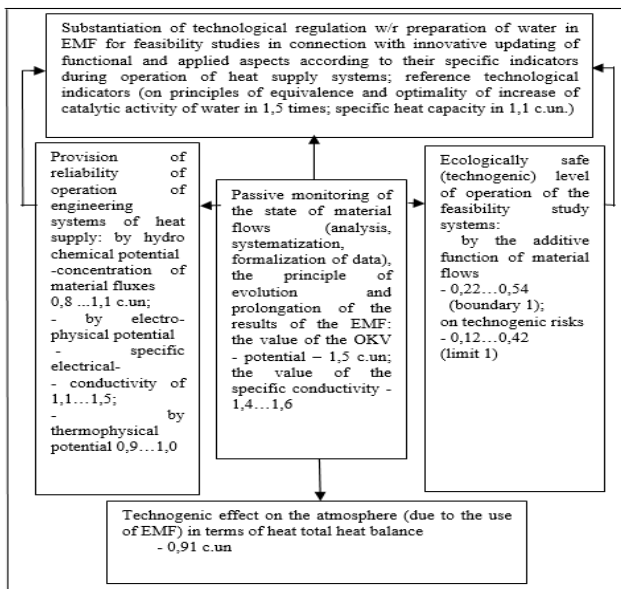


Fig. 2 Structural and graphic conceptual model

Due to the self-organization of heat supply systems, an important factor in the operation of man-triggered material flows is the establishment of scientific regularities of the equivalence of the parameters of the obtained magnetized water with the corresponding specific indicators of material flows of the HPO systems. This need arose from the fact that when we receive magnetized water for heat supply systems, the optimal parameters of its state are determined in advance and therefore these requirements must be observed for heat supply systems.

The purpose of this publication is also to substantiate the need to combine into a single whole the main characteristics of nanotechnology of reagent-free water treatment in EMF (strategic intentions) and organizational and managerial tactical intentions, which are the mandatory component of the creation of innovative technologies (Fig. 3).

At the same time, it can be noted that only such interpretation of the received scientific material gives the chance to estimate interrelations and interactions between the components of the investigated nanotechnology, including, construction branch (technological and organizational and administrative aspects).

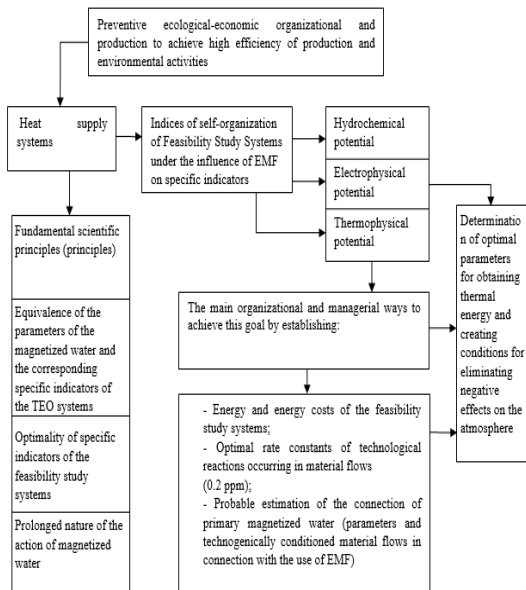


Fig. 3 Modern organizational and management decisions in the operation of heat supply systems in conditions of reagent-free water treatment in electromagnetic fields

It can be stated that such a theoretical basis has an important applied value because it allows to be a guide in the operation of new nanotechnology. Thus, the solution of the problem of reagent-free water treatment in heat supply systems has several ways of its implementation: magnetic, electromagnetic (magnetizing of water). And therefore, the right choice of one of them can determine the further production and environmental situation. In this connection, the reliability of analytical information directly depends on the means of ensuring the quality of the results of physical and chemical analysis (organizational and managerial decisions).

The table shows the main stages of these tactical intentions. The shortened presentation of the material is due to the fact that certain stages of scientific work are reflected in the scientific press [1, 15].

The sensitivity of the information-analytical system, which are the material flows of the HPO system, is the ability of the method to respond to changes in the content of the components of the material flow by the interaction between them, if the response of the instrument (receiving magnetized water and its concentration in the material flows there is an interdependence, so-called calibration function:

$$Y = f(Piy + xi), \quad (1)$$

where Y is the detector signal; Piy - y is the parameter, and the component (self-organization: simple inorganic system - complex inorganic system).

When the calibration function is linear, the sensitivity of the method is determined by its slope:

$$Sx = \Delta y / dx \quad (2)$$

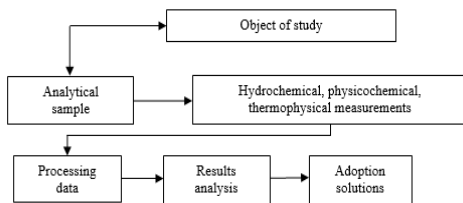


Fig. 4. Information and analytical system

The detection limit is characterized as the concentration below which it is impossible to determine the presence of this component in the sample. Mathematically, this value is characterized by:

$$X_d = X_o + K \cdot \sigma_o, \quad (3)$$

where X_d is the detection limit;

X_o is correction of idle experience (average X_i);

K is the factor, which depends on the spread of measurement error;

σ_o is standard deviation of the results of the idle experiment.

With the response that exceeds X_d , it is believed that a certain substance is found. In the case where X_d is in small concentrations, then the standard deviation σ_o of the response of the idle experiment is usually unknown. Under these conditions, σ_o is replaced by (S - sample standard deviation of the idle experiment, which is calculated through "n" measurements), and the limit of finding is calculated by the formula:

$$X_d = X_o + t_{\alpha} \cdot S/\sqrt{n}, \quad (4)$$

where t_{α} is the critical value of t-propagation for a given probability level at n-1 degrees of freedom.

The calculations on the choice of the analytical control method play a decisive role in the application of the indicator control system as a factor indicator of the efficiency of production processes in the application of nanotechnologies, which are used for reagent-free water treatment in HPO (electromagnetic water treatment with the established optimal parameters).

Summary. Thus, according to our findings, the key tactical intentions to the achievement of high efficiency of production processes of preventive productive activities in the process of reagentless water treatment in electromagnetic fields (magnetized water in heating systems) is the association of organizational and management decisions in the operation of systems of heat power objects (HPO) with the aim of achieving reliable analytical information on the results of the passive condition monitoring of material flow in HPO systems. As shown by the results of the research, the sensitivity of the methods used to control the state of material flows of the HPO systems allows us to determine the dynamics of the constituent material flows in time and space.

According to the scientific and technical literature and personal research of technology of use of magnetized water for its preparation in heating systems is relevant and promising through its implementation (according to the materials of pilot testing) and savings of energy and material resources, and the formation of biofouling is eliminated. We found that the sensitivity of the information and analytical system, which are material flows, occurs in complex inorganic systems, which are the main factor sign of the consistency of the functioning of water treatment technology in electromagnetic fields (EMF). This is confirmed by the fact that the proposed system of analytical control (indicator) is, with the linearity of calibration functions, the feature of determining the concentration below which it is impossible to determine the presence of this component in material flows. This complex

control system is based on previously established scientific regularities of nanotechnology effectiveness, on the basis of which this scientific publication became possible.

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Н.Е. Журавская

Техногенез, как факторный признак техногенно-обусловленных систем теплоснабжения, в которых при подготовке воды используют электромагнитные поля

В статье подчеркивается, что основным тактическим намерением на пути обеспечения высокой эффективности производственных процессов и предупредительной производственной деятельности в строительстве в процессе безреагентной подготовки воды в электромагнитных полях (омагниченная вода систем теплоснабжения) является объединение организационно-управленческих решений в процессе эксплуатации систем теплоэнергетических объектов (ТЭО) с целью достижения надежной аналитической информации по итогам проведения пассивного мониторинга состояния материальных потоком систем ТЭО.

Ключевые слова: *техногенез, экономическое и энергоресурсосберегающее производство, электромагнитные поля, пассивный мониторинг, самоорганизация систем теплоснабжения (термодинамика и синергетика), индикаторные системы контроля.*

Н.Є. Журавська

Техногенез, як факторна ознака техногенно-зумовлених систем тепlopостачання, в яких при підготовці води використовують електромагнітні поля

У статті підкреслюється, що основним тактичним наміром на шляху забезпечення високої ефективності виробничих процесів та попереджувальної виробничої діяльності в будівництві в процесі безреагентної підготовки води в електромагнітних полях (омагнічена вода систем тепlopостачання) є об'єднання організаційно-управлінських рішень в процесі експлуатації систем теплоенергетичних об'єктів (ТЕО) з метою досягнення надійної аналітичної інформації за підсумками проведення пасивного моніторингу стану матеріальних потоків систем ТЕО.

Ключовими тактичними намірами досягнення високої ефективності виробничих процесів профілактичної виробничої діяльності в процесі безреагентної обробки води в електромагнітних полях (омагнічена вода в системах опалення) є об'єднання організаційних та управлінських рішень у експлуатація систем об'єктів теплоенергетики (ГПО) з метою досягнення достовірної аналітичної інформації про результати моніторингу пасивного стану матеріальних потоків в системах ГРО. Як показали результати досліджень, чутливість методів, що застосовуються для контролю стану матеріальних потоків систем НРО, дозволяє визначити динаміку складових матеріальних потоків у часі та просторі.

Відповідно до науково-технічної літератури та особистих досліджень технології використання омагніченої води для її приготування в системах опалення є актуальною та перспективною завдяки її впровадженню (за матеріалами експериментального тестування) та економії енергії та матеріальних ресурсів, а також формуванню біологічного обростання усувається. Ми виявили, що чутливість інформаційно-аналітичної системи, що є матеріальними потоками, виникає у складних неорганічних системах, які є головною факторною ознакою послідовності функціонування технології очищення води в електромагнітних полях (ЕРС). Це підтверджується тим, що запропонована система аналітичного контролю (індикатора) є, при лінійності функцій калібрування, особливістю визначення концентрації, нижче якої неможливо визначити наявність цього компонента в матеріальних потоках.

Ключові слова: *техногенез, економічне та енергоресурсозберігаюче виробництво, електромагнітні поля, пасивний моніторинг, самоорганізація систем тепlopостачання (термодинамика і синергетика), індикаторні системи контролю.*

Посилання на статтю

APA: Zhuravska, N. (2019) Technogenesis as a factor feature of technogenic-conditioned heat supply systems in which electromagnetic fields are used in the preparation of water. *Shliakhy pidvyshchennia efektyvnosti budivnytstva v umovakh formuvannia rynkovykh vidnosyn*, 42, 106–113.

ДСТУ: Журавська Н.Є. Техногенез, як факторна ознака техногенно-зумовлених систем тепlopостачання, в яких при підготовці води використовують електромагнітні поля [Текст] / Н.Є. Журавська // Шляхи підвищення ефективності будівництва в умовах формування ринкових відносин. – 2019. – № 42. – С. 106–113.