

**OPTICAL METHOD AND FIREWARE FACILITY OF THE CHECKING
TO BIOLOGICAL ACTIVITY WATER SOLUTION**

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Abstract

Work is devoted the description of an optical quality monitoring of biological activity of water and water solutions, the description of a hardware-software complex realising the given method also is resulted. Results of experimental researches on an example of solutions of the ionic silver used in pharmacology as antiseptics are resulted. Work is interesting to the persons projecting means for the decision of problems of medicine and ecology.

Key words: *biotechnologies, biosensor control, biogauge, biological activity of water (BAW).*

1. INTRODUCTION

Water represents the major chemical compound defining possibility of existence of a life. All live indissolubly connect with it and entirely depends on it. She participates in the majority physical and chemical interactions and in all biological and biochemical processes in environment. Development and ability to live of all biological objects which the person concerns also directly depend on a condition of water or the water environment. Therefore an actual problem is quality assurance of the water environment for various needs and requirements of the person, especially waters drinking which stocks on a planet are limited.

According to existing standard documents potable water should be safe in the epidemic and radiating relation, is harmless on the chemical compound and to have favorable organoleptic properties [36].

Safety of water in the epidemic relation is defined by its conformity to specifications on microbiological and parasitologic to indicators. As a rule, the result of such pollution is shown almost at once in the form of flashes of illnesses of a considerable part of the population. Potential consequences of microbic pollution are that, that the control over them should be to constants.

Harmlessness of potable water on a chemical compound is defined by its conformity to specifications on:

to the generalised indicators and the maintenance of the harmful chemical substances most often meeting in natural waters in territory of the Russian Federation, and also the substances of the anthropogenous passage which have gained global distribution;

to the maintenance of the harmful chemical substances arriving and formed in water in the course of its processing in system of water supply;

to the maintenance of the harmful chemical substances arriving in sources of water supply as a result of economic activities of the person.

Organoleptic properties of water (a smell, smack, chromaticity, opacity) and radiating safety are defined by its conformity to specifications. GOST R 51232-98 establishes a quality monitoring of quality of potable water on 53 indicators. It is necessary to notice, that these indicators are the general for all rivers of our country so that all chemical substances described in it, are present at each source of water supply is improbable, here it is necessary to consider a number of factors, including geology of region and kinds of activity of the person typical for it, and also products of disinfection of water. Hence, before carrying out of the expanded researches, the organisations carrying out operation of systems of water supply, together with the Gossanepidnadzor centre analyze following materials during not less than three years [36]:

about structure and volume of the sewage arriving in a source of water supply above a place of a water fence;

bodies of wildlife management, hydrometeorological services, water resources management, geology use of bowels;

the centre of Gossanepidnadzor by results of sanitary inspections of the enterprises and the organisations;

controls and the agriculture organisations about assortment and total volume of pesticides and the agrochemicals applied in territory of a reservoir.

Only on the basis of the spent analysis the list of the substances characterising a chemical compound of water of a concrete source of water supply is made. And only after that start source operation, carry out the expanded laboratory researches of water under the made list of chemical substances to which add the general indicators for the rivers of Russia.

What or data on carrying out of similar works from the organisations which are carrying out system of water supply to receive it was not possible. Thus it is improbable, that these works ever were spent basically though the similar should be spent annually as, for example, in channels of the rivers, often enough there are changes (changes of a channel of the rivers, an exit of geological breeds, etc.).

In SanPin in section, hygienic specifications of the maintenance of harmful substances in potable water, is about 703 indicators, each of which has the class of danger, and, hence, and maximum concentration limit. Not knowing a full chemical compound of water, not probably to define degree of its danger as the chemical substances concerning 1 and 2 classes of danger, develop.

It is necessary to pay attention to that fact, that risk for health connected with presence of toxic elements in water though differs from the risk caused microbiological pollutants (microbiological pollutants prove at once strongly and widely), it should not give minor value. As on health toxic elements render adverse effect not at once and gradually (at long influence).

For today of laboratory define quality of potable water till 17-30 indicators, and it is considered norm for systems of drinking water supply. On water sold in shops quality proves to be true 60-100 indicators, that also is not sufficient.

Principal cause on which acceptance of the international quality standards of potable water is not supported, connect with that advantage, which gives carrying out of the analysis "risk-advantage" (quantitatively or qualitatively) at a formulation of national standards and rules. Such approach allows to establish standards which are easy for observing. Acceptance of rigid standards will essentially limit availability of sources of water supply which would answer such standards. Thus, the state priorities and business factors influence at an establishment of standards. Each country itself defines, whether

expenses are justified by those benefits which it receives at acceptance of rigid standards. But unless health of citizens it not benefits of the state?

It is necessary to notice, that till now there are no standard documents in ours and in the majority of foreign countries about necessity of the control of biological properties of water, as the factor influencing development of all live. Thus a basis of influence on live is not the chemical compound in itself, and the information which has been put in pawn in structure of water. About it it is possible to receive direct and indirect acknowledgement in many works Russian and foreign scientists: Rahmanin J.A., Aksenov S.I., Zenin S.V., Emoto M, Beavers A.V., Treasurers of Century P and many other things.

For today there is a concept «biological activity of water» which is understood «as its property raised or lowered (concerning the control sample) influences on processes of ability to live of the biological objects, got as a result of influence of external factors» and in it the essence of influence of water system on other bioobjects [36], in our opinion, is put in pawn. Thus for research of the given indicator methods and control devices in which basis bioobjects or as a sensitive element are directly used, or as the information converter should be used.

Thus constant increase of anthropogenous loading on environment, including in the form of increasing volumes and the nomenclature of polluting substances, causes increase of the requirements shown to methods and control devices of quality of an environment.

Diverse polluting substances, getting to environment, can undergo in it various transformations, strengthening or weakening thus the toxic action which cannot be revealed analytical methods. Thus technical and analytical control devices are not capable to catch action. From here addition of an analytical quality monitoring biological is obvious. The biological control is based on unity of the organic world, that allows to predict on quantitatively measured parametres (test reactions) of laboratory test organisms degree of influence of the operating factor (a field, substance) on representatives of other kinds of the biological world.

Thus, use of bioobjects in technical systems allows to raise level selfdescriptiveness received signals from object of research as any live substance possesses higher sensitivity to the external factor of influence, than a mean. However measurement or control process is better to carry out by means of control and measuring systems which structure includes specialised hardware for reception of the primary information and computers in the form of the personal computer for formation of operating influences and processing of results of measurements.

From the aforesaid it is visible, that synthesis of the biological objects, capable to provide high sensitivity of a quality monitoring, and the electronic means providing high accuracy of measurements and processing of the received measuring information, is modern way of construction of methods and control devices of an environment and substances for the decision of practical scientific problems.

2. THE REVIEW OF PROPERTIES OF THE BIOOBJECTS USED IN MEASURING MONITORING SYSTEMS OF AN ENVIRONMENT AND SUBSTANCES

Application of measuring systems with use of bioobjects in medicine and ecology is possible first of all thanks to that different forms of the live possess unity of a structural structure, a metabolism, life-support systems and the adaptation to environment. Therefore any factor having harmful influence on one form of live substance, can be harmful and for its other forms [1]. It, on the one hand, explains possibility of use of various bioobjects for the forecast of influence of harmful factors for other live systems, with another - induces cautiously to concern application of substances and radiations biocidal actions.

At the heart of processes of an exchange of a cage with Wednesday and an internal metabolism the difficult network organised definitely in time and space of various reactions lays. In biological systems each of components is in constant and indissoluble interaction with each other, as defines basically the nature of dynamic behaviour of the given systems, mechanisms of their self-control and management [2]. Therefore the cage or organism metabolism which is understood as the basic mechanism of a metabolism at various forms live, also is one of the reasons of possibility of use of bioobjects in measuring systems.

One of the basic characteristics of life-support systems - mechanisms of a food and breath which are necessary for considering by working out of measuring systems with use of bioobjects as they directly influence functioning of the bioobject and, accordingly, on size of controllable parametre.

Change of conditions of environment essentially influences process of functioning of bioobjects and generates fundamental property of all live - the variability causing the adaptation to environment. It is expressed that all bioobjects aspire to adapt for changes of own inhabitancy, except cases of harmful (pernicious) influence on them.

Thus, it is visible, that the unity of the organisation of live organisms allows to use one bioobjects for definition of a condition of others.

Characteristic line of all live - irritability, or sensitivity. Certain degree of internal coordination and regulation, and also appropriate interrelation between influence and reaction for maintenance of viability and an organism survival is necessary to all organisms.

The general sequence of processing of influences includes [1]:

- 1) perception of value of the influencing factor;
- 2) primary differentiation (distinction of influences various intensity);
- 3) transformation of the information to any changes of own physical and chemical properties.

The major property of bioobjects, even low level of the organisation, ability to summation or integration of all factors influencing it is.

High organization forms live are rational for applying to research of influence of substances on the higher system levels of functioning of an organism (the central nervous system, a brain and so forth). At the control of processes of a food, breath, revealing of infringements of a metabolism methodologically and metrological replacement of higher organisms the with the lowest is justified.

Thus, the choice of bioobject as the influence analyzer on environment is enough challenge including first of all biological features of this or that object, and also ability to react to various kinds irritant/

The behaviour of bioobjects is influenced by its various internal systems, therefore etiological reactions integrated reflect influence of stimulus of the different nature. It is possible to allocate following reactions of bioobjects:

- 1) locomotions – moving of all organism to space, as reaction to changes in the environment;
- 2) taxis – the directed movement of an organism or population under the influence of a gradient of external stimulus;
- 3) kinesis is not directed impellent reaction at which speed of movement depends on intensity of stimulus;
- 4) attachment reactions;

5) growth - reproduction. From the biochemical point of view growth can be defined as irreversible increase in dry weight of protoplasm and fiber which the set both internal influences, and external factors. Therefore growth is the reaction reflecting quality of environment. In measuring systems the estimation of growth of microorganisms is most widely applied to revealing of effect of influence harmful pollutant or antibiotics of various types;

6) destruction. This process can be both natural, and caused by high concentration of harmful substances. The death, degradation or destruction includes many hardly perceptible stages consecutive destruction separate systems and structures and till the certain moment has reversible character. At the control of death rate of organisms-sensor controls it is possible to fix only evident symptoms of prelethal conditions - immobilization an organism, loss of the major functions.

In more details the given aspect of a question is shined in works [1, 26].

It is necessary to note, what exactly on two last reactions of bioobjects the various kinds of biotesting connected with definition of changes of properties of water solutions are under construction.

Thus, the bioobject, being difficult organize system, possesses uniqueness and unpredictability. Property of uniqueness of difficult system biological variability speaks. Property of unpredictability causes an estimation of biological reactions as events, i.e. phenomena which can occur or not occur.

System properties of bioobjects are the stablest at a variation of biological parametres. For example, in an organism the constancy of structure of the internal environment and stability of its basic physiological functions is supported. Thus, there is reliability of maintenance of functions of bioobject even at its astable parametres because of biological variability. That is from the methodical and metrological point of view the control of system parametres provides reproducibility of results of measurement by means of measuring systems.

By means of measuring systems with use of bioobjects today in hospitals doctors put diagnoses to patients, ecologists in laboratories do the conclusions about harm of the new synthesised chemical substances. Thus it is necessary to consider, that the biogauge essentially differs from the traditional analytical device usually intended for revealing only of a mass fraction of substance or concentration of an element without dependence from influence of other elements. The majority of devices does not allow to divide various chemical forms of one element.

The biogauge changes sensitivity at adaptation or a sensitisation. Its reaction depends on interaction of the whole group of factors, reflecting set of thin and important changes in environment. For the majority of bioobjects nonlinearity of reaction to the influence size, caused by necessity to perceive a wide range of stimulus is characteristic. Therefore for maintenance of linear dependence of reaction of the biogauge from influence size it is required to allocate a working range of concentration of defined substances.

Corresponding conditions are necessary for functioning of bioobject as a part of measuring systems (a nutrient medium, oxygen and so forth). However all these complications of measuring systems with use of bioobjects in comparison with usual technical equipment are compensated to that only the biogauge can find necessary substance in the most complicated mix, allocate the investigated factor among the noise surpassing a signal in millions of time; to estimate integrated harm of various factors; to signal about presence of sources of mutations or the substances suppressing photosynthesis, a metabolism. Therefore construction measuring monitoring systems with use of bioobjects a perspective direction of development of means and a quality monitoring of an environment and substances.

At designing of measuring systems the most various types of physical and chemical converters - optical, electrochemical, gravimetric are used, calorimetric, etc. the Choice of the measuring converter

or a gauge depends on what properties of the bioobject which is representing itself as the primary measuring converter, change at influence on them of substances or physical fields.

In works [1, 26, 32] the basic types of measuring converters are considered, we will present their advantages and lacks to the control of informative parametres of biogauges (table 1).

Table 1. Comparative characteristics of measuring converters

Converter type	Advantages	Lacks
1. Optical	Sensitivity, бесконтактность, small influence of electric hindrances	Necessity of application of high-energy photodetectors, optical hindrances
2. Electrochemical		
– conductometric	Rather cheap, small dimensions	Sensitivity to temperature fluctuations, pH, to ionic structure
– potentiometric: a) ion-selective electrodes б) ion-selective field transistors	Simplicity, reliability	The slow response, necessity of a stable electrode of comparison, sensitivity to electric noise; Sensitivity to temperature fluctuations, radiations, necessity of drawing of a layer of a sensor control on a shutter
– amperometric: a) O ₂ - electrodes б) H ₂ O ₂ - electrodes	Low cost, small dimensions, stability of the response; Selectivity; Sensitivity	Low sensitivity Low selectivity
3. Acoustic	Speed, stability of the response	Low sensitivity in liquids, an error of nonspecific linkage
4. Calorimetric	Independence of optical hindrances	High cost at the expense of difficult system термостатирования, the high expense of a matter

The carried out analysis has shown, that the greatest advantages in comparison with other measuring converters optical gauges, therefore their use methodologically possess and metrological it is more expedient at construction of measuring systems.

3. A CHOICE OF THE PRIMARY MEASURING CONVERTER FOR OPTICAL QUALITY MONITORING OF BIOLOGICAL ACTIVITY OF WATER SOLUTIONS

There are the bioobjects perceiving and changing the physical and chemical properties or behaviour for the account of biochemical processes at influence of chemical substances or radiations of environment that allows to use them in methods and control devices. Primary measuring converters of similar type (biogauges) are created on the basis of biological objects, for example live organisms as vegetative, so fauna or their fabrics, cages, biological membranes, enzymes, organic molecules, antibodies and so forth

Thus the choice of the biogauge for a specific target should be carried out with the account of following requirements [1]:

- a constancy of conditions of carrying out of the analysis;
- repeated repeatability of reaction;
- reproducibility of results in different laboratories.

Today workings out of means and a quality monitoring it is possible to consider as a perspective direction use as multidimensional biogauges of seeds of the plants possessing high sensitivity to various harmful factors of environment. Seeds of plants in development react to insignificant changes of intensity of a light stream, possess high sensitivity to chemical substances and the other influences influencing an environment.

There is quality monitoring in which seeds of oats are used as the primary measuring converter, wheat, sunflower, barley, beans, carrots, colours. Thus it is possible to notice, that use of grains of wheat for indication of changes in the water environment is shown in works [4-7].

Experimental and theoretical researches have shown, that grain is better than other cultures reacts to change of a chemical compound of the water environment. The huge role of water in grain depends on two reasons: water in grain not only a component fiziko-chemically connected with substance, but also the active agent who is taking part in biochemical processes, constantly made in grain [8].

The huge experimental material [8] testifies to crucial importance for germination of grains of the maintenance and water migration in it. The essence of germination of grain consists in transition of a seed of a based condition to active ability to live. Germination comes only at sufficient access of water and oxygen, and also under certain temperature conditions. The water absorbed by grain, creates the conditions favorable for active action hydrolytic of enzymes under which influence transformation of high-molecular spare nutrients in more simple and capable to pass in a water solution mobile connections [8] begins. The formed simple substances with a water solution are displaced to a germ here again continuously consumed on synthesis of new fabrics. From here it is obvious, that all development of grain depends on structure, structure and moving of the water activating growth.

Besides, in molecular structure of grain there are unceasing chemical processes. Any display of ability to live of grain - the certain complex of biochemical transformations almost always connected with use of water [8]. Thus different sources of water, change of its quantity and communication forms in grain cause change of intensity of breath and its character that testifies to direct reaction of the water environment to development of grains of wheat and confirms possibility of the control of change of parametres of the water environment on biogauge reaction.

The water which is a part of grain, is environment in which there are vital processes, it also takes part in incessant biochemical transformations. Water at different stages of these transformations possesses unequal reactionary ability. Various degree of readiness of a moisture to enter biochemical reactions

there is a consequence of different size of its durability physical and a chemical bond with grain fabrics.

Thus, water brings basic changes in physical and chemical and mechanical features of development of grain. Thus the biological moisture formed in grain as a result of biological processes, and brought from out of differently influence grain development. And this fact allows to use wheat grains as the biogauge for the control of changes of the water environment on change of parametres of bioobject. Therefore for working out of an optical quality monitoring of biological activity of water solutions as the primary measuring converter we will use wheat grains. Speed of germination of the grains, defined as number of the sprouted grains in unit of time will be thus controllable indicator.

For stabilisation of target characteristics of the biogauge research of influence of temperature, humidity and light exposure on wheat grains has been carried out.

Research of influence of temperature on change of properties of the biogauge.

As is known, the temperature depends on many factors (change of day and night, a season etc.) under which action it periodically and changes. Therefore to exclude influence of constantly changing temperature probably only by means of the thermostat. However, use of thermostats for sprouting wheat seeds connect with a number of inconveniences. First, it power consumption. Secondly, the thermostat supporting temperatures in a range from 20-27 °C, should be equipped not only a heating element, but also the refrigerating unit, and it not only increases cost of such thermostat, and also its overall dimensions. Thirdly, during thermostat work powerful enough electromagnetic fields influencing biological object are formed.

All these lacks can be excluded, using the passive thermostat. It will allow to exclude spasmodic changes of temperature (as the thermostat possesses a huge thermal capacity), to make their smoother. And to consider influence of external changing temperature the control sample of party of grains of wheat is enough to place in the thermostat together with the examinee the sample. As a result, two samples the examinee and exemplary will be in identical temperature conditions.

Experimental researches have shown, that if in a homogeneous temperature field to spend simultaneously measurement of temperature at two parties of wheat subjected to influence of the external factor and control, by greatest temperature it will appear there where has sprouted more seeds of wheat or sprouts have the big length.

It has appeared, that wheat seeds at germination allocate heat (Fig. 1), and the quantity of warmth allocated with them is proportional (on a certain piece) to length of sprouts of wheat that it is possible to use as the additional information on change controllable objects. Thus, for the first time it is received, that on size of temperature of a surrounding field it is possible to judge quantity of the sprouted seeds of wheat and about length of sprouts parties.

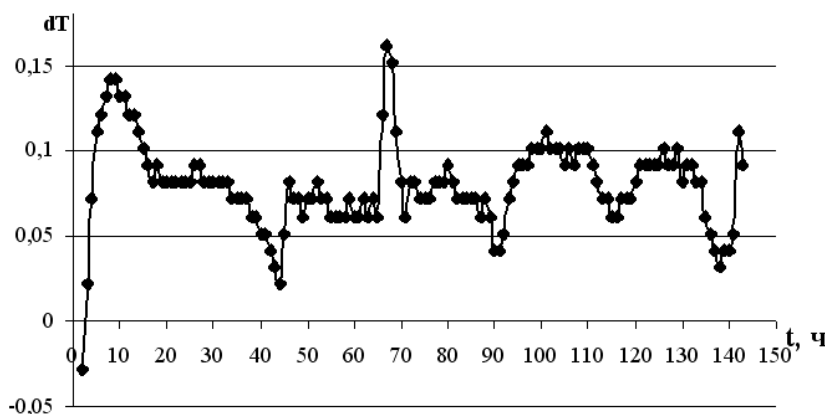


Fig. 1. Dependence of change of temperature between samples from time

The similar scheme of the control allows not only to exclude influence of periodically changing temperature, but also to fix the slightest changes of temperature of samples.

Research of influence of humidity on change of properties of the biogauge.

At any temperature the quantity of the water steam containing in unit of volume of air, cannot surpass some limiting size. Air containing this maximum quantity of water steam, is called as sated. Thus partial pressure of water steam (p_n) reaches pressure of saturation (p_n), air corresponding to temperature (at temperatures more low 100°C), that is water steam in air is sated.

What should be humidity at germination of seeds of wheat for today precisely not it is known, but seeds of wheat for germination should be provided not only water, but also air for breath.

At small humidity of 30-60 % there is an intensive evaporation of water and as show results of experiments, there is a drying of seeds of wheat long before its germination.

To exclude it the influencing factor it is possible only by means of special installations, however they are very bulky also roads, besides they are not deprived lacks which have been listed for thermostats.

It is known that, in densely closed small capacities with some maintenance of water, always there comes such condition, when the further evaporation of water not so probably (there comes saturation). Humidity in such capacity remains invariable, as does not depend on influence of external influencing factors (temperature etc.), therefore, let sprout wheat seeds in the closed volume, it is possible to provide a sensitive element of the biogauge not only certain structure of air (air or gas test), but also constant humidity.

This method allows to exclude completely casual component which are brought by changing humidity as wheat seeds (it is not dependent on time) will be under the influence of identical humidity.

Research of influence of light exposure on change of properties of the biogauge.

For research of influence of light exposure on germination of seeds of wheat, many experiences, in which course a part of seeds let sprout have been spent at sunlight influence, other part of seeds in full darkness (at zero light exposure). As have shown results of these experiments wheat seeds at germination in light exposure do not require (if this light exposure does not cause thermal ionisation), on the contrary, let sprout at zero light exposure seeds sprout faster. Hence, if to isolate a sensitive element of the biogauge from illumination influence it is possible to exclude the casual error caused by this factor.

Thus, research of the factors influencing accuracy and repeatability of measurements of parameters of biogauges (on an example of grains of wheat), has allowed to raise metrological level of a developed quality monitoring, and as consequence to expand its scope.

4. A CHOICE OF A GAUGE FOR AN OPTICAL QUALITY MONITORING BIOLOGICAL ACTIVITY OF WATER SOLUTIONS

The choice of the measuring converter or gauge depends on controllable informative parameter of bioobject. In our case a source of a useful signal are wheat grains, thus as physical parameter of the control at influence of the external factor the grain sprout, and a controllable indicator - speed of germination of party of biogauges in unit of time, defined as number of the sprouted grains by the certain moment of time acts.

As it is required to count only number of sprouts of grains, not making any transformations with the biogauge it is necessary to choose a gauge (the optical device), capable to receive the image of the necessary quality and thus not to render collateral influences on bioobject.

There is a set of various means of reception of the image: film and digital cameras, a videocamera, the Web-chamber, the scanner, a microscope, etc.

Let's consider the basic sources of reception of images for the decision of a problem of the given work, having allocated merits and demerits:

1) manual scanners:

□□ disadvantages: one speed of input of the information is required; at scanning laser radiation which creates a high tension field in the field of scanning that will affect properties of bioobject is used, and it is unacceptable for a quality monitoring;

□□ advantages: reception of images with the high permission;

2) colour tablet scanners of an intermediate and high class:

□□ disadvantages: at scanning laser radiation which creates a high tension field in the field of scanning that will affect properties of bioobject is used, and it is unacceptable for a quality monitoring;

□□ advantages: reception good on quality of the scanned material (images), the accurate image with high quality of scanning;

3) drum-type scanners of a high class:

□□ disadvantages: placing is required is exemplary directly on scanning drum, that considerably reduces automation of a quality monitoring because of small quantity of holding samples; influence of laser radiation on bioobject;

□□ advantage: high quality of scanning, in some cases above, than at tablet scanners;

4) digital chambers:

□□ disadvantages: it is difficult to operate the device from the personal computer, and, hence, it is impossible to create quality monitoring automation; the high price;

□□ advantage: the received images have the high permission;

5) videocameras:

□□ disadvantages: the expensive equipment; the big overall dimensions, that at use automatically increases the sizes of installation (the over-expenditure of materials); change of options through the personal computer is complicated, they can be changed is hardware;

□□ advantage: data transmission occurs a stream that allows to do some pictures through a small interval of time;

6) the Web-chamber:

□□ disadvantages: the low permission of the received images;

□□ advantages: rather inexpensive equipment; the small sizes that allows to adapt without special problems to it for measuring installation; data transmission occurs through interface USB that chamber options allow programm to change.

Thus, for working out of an optical method and a hardware-software control device of biological activity of water solutions expediently use of the Web-chamber [9-11]. Thus it is necessary to notice, that it is possible to compensate the general low permission of received images a Web-chamber arrangement on small distance from a working surface.

5. REALISATION OF THE HARDWARE OF AN OPTICAL QUALITY MONITORING BIOLOGICAL ACTIVITY OF WATER SOLUTIONS

All bioobjects possess property of biological variability, hence, essentially depend on environment conditions, therefore the account of influence of various factors causes necessity of comparison of results of investigated action with result at its absence (control). In detail principle of work of the given scheme is described in works [24] On working capacity of biotechnical system the whole complex of biological, chemical, technical and other factors which can be considered and eliminated at corresponding stages of reception of the measuring information influences.

The general scheme of hardware-software means of an optical quality monitoring of biological activity of water solutions is presented on Fig. 2 [9, 12, 13, 15, 16, 18, 26].

Experimental installation of an optical quality monitoring of biological activity of water solutions consists of an optical bench with which help reception of the primary information is carried out, and the personal computer which is processing measurements and giving out total result to the user. Traffic control of optical system is made by the user through the personal computer software, by means of giving on a payment of management of commands through parallel interface LPT.

The Web-chamber carries out shooting of images of a working surface where are located on measuring trays of a matrix with grains. A Web-chamber food is made through interface USB, through it the user by means of the personal computer software exercises administration of shooting and receives ready images for the further processing.

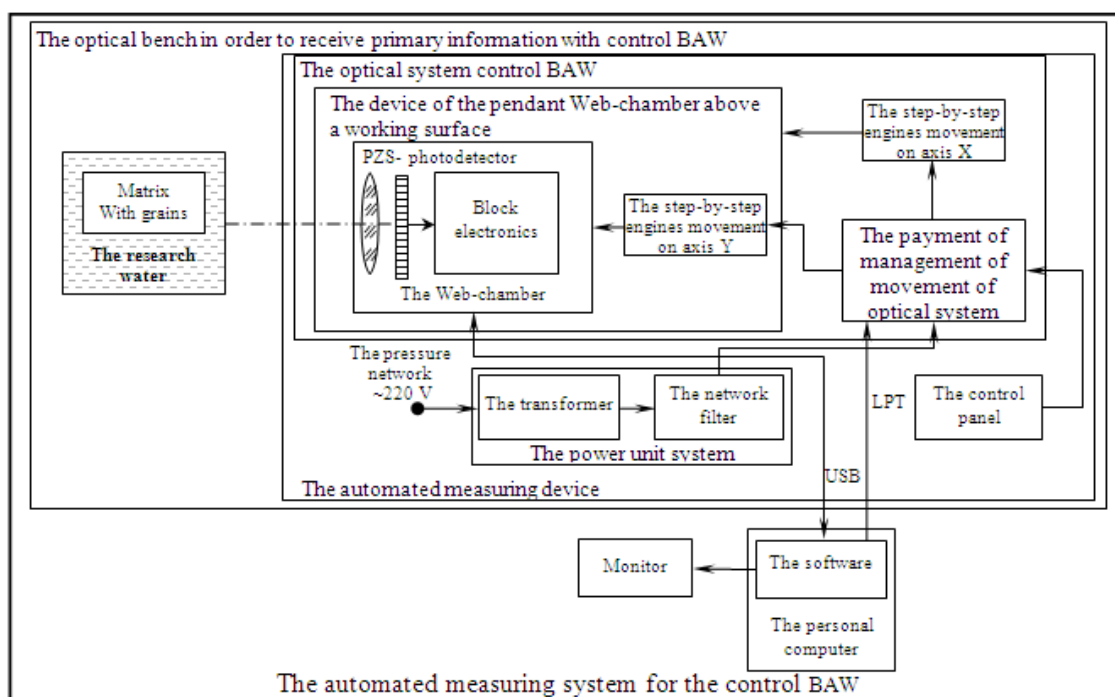
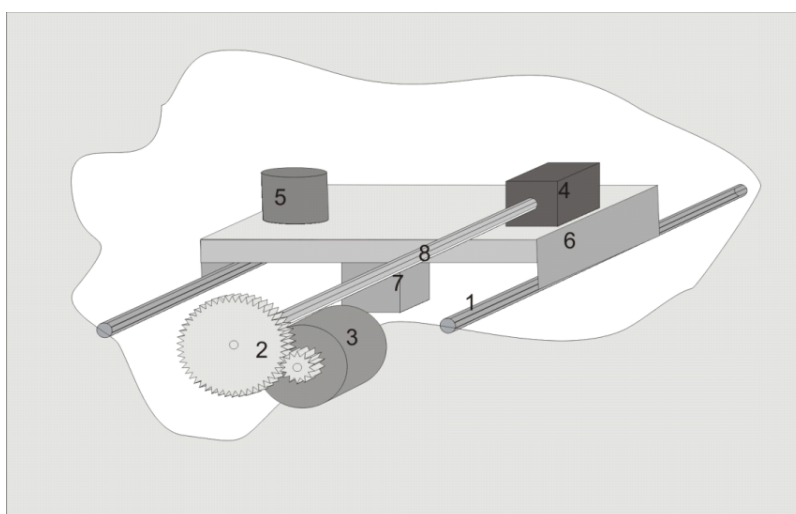


Fig. 2. The block diagramme of hardware-software means optical quality monitoring of biological activity of water solutions

For reception of the qualitative image the system of positioning of the Web-chamber over a working surface is important. For exact movement of a measuring platform to the right and to the left along a working surface the screw gear set in motion by the step-by-step engine by means of a tooth gearing is used. It is necessary to notice, that the platform is rigidly fixed in relation to the screw that excludes its movement without rotation of the step-by-step engine. The general view of system of positioning is presented on Fig. 3.



Symbols:

- 1 - directing;
- 2 - a tooth gearing;
- 3 - the engine moving installation along a working surface;
- 4, 8 - worm pair;
- 5 - the engine moving the Web-chamber on positions;
- 6 - a measuring platform;
- 7 - the Web-chamber.

Fig. 3. System of positioning of the Web-chamber

Definition of an indicator of biological activity of a water solution is based on definition of number of the sprouted grains of wheat in unit of time. Automation of process of the account is concluded in reception of the qualitative image of a matrix with grains and its program analysis. Reception of the image both the whole matrix, and its separate segment is possible. So at an arrangement of an objective of the chamber at height of 20 sm from a working surface reception of the image of the whole matrix (Fig is possible. 4.). However because of insufficient quality of the image there are difficulties of faultless definition of number of sprouts.

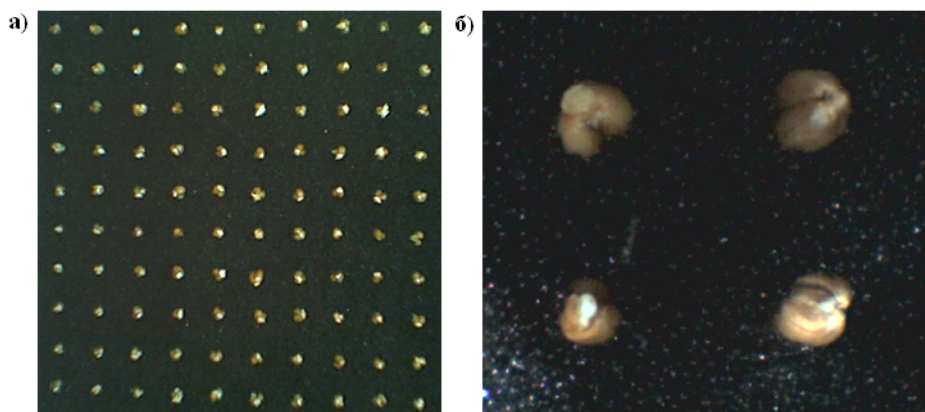


Fig. 4. The image of the whole matrix (a) and a matrix segment (b) at shooting

For increase in accuracy of definition the distance between an objective of the chamber and a surface of a matrix 3,2 has empirically been chosen the image of one matrix containing hundred grains simultaneously see As a result, has been replaced with a matrix segment to which gets four grains. It allows to receive the image of higher permission with a considerable quantity of points on one object of measurement that raises probability of exact definition of a sprout. The image received at shooting of a segment of a matrix from 4 grains, is presented on Fig. 4.

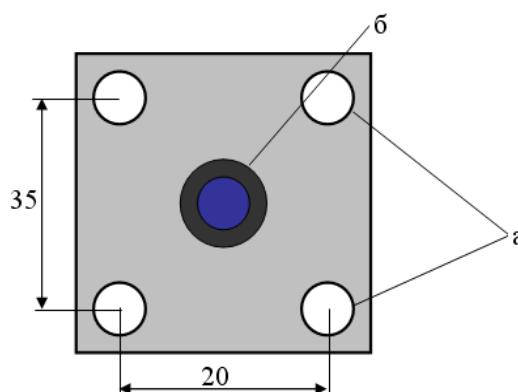
For reception of the qualitative image illumination of certain intensity is necessary. If illumination is too weak the image will turn out dark and the program will not define sprouts. If illumination is bright occurrence of reflexions on glossy surfaces of grain is possible and the program will count these

reflexions as sprouts because of their high brightness. For maintenance of illumination of a working surface various variants were tried. With one stationary source (luminescent lamp LPB 2004A, capacity 6 Wt) for illumination all the width long a working surface. However the arrangement only on the one hand a light source did not allow to receive uniform illumination on all site of measurement that led to a measurement error (about 5 %).

Experiments with fixed on the device suspension «a lighting matrix» were made - 20 supertiny incandescent lamp (SMN 6,3-20) average intensity took places in regular intervals over a surface of a measuring matrix in chessboard order between 4 cells with grains. The similar scheme of illumination was more comprehensible, but programm was difficult faultless to count number of sprouts because of the insufficient permission of the image at bright illumination, the error made 3 %.

Only after transition to the account of sprouts on matrix segments, it was possible to achieve faultless recognition of sprouts. Thus for maintenance of illumination of a working surface the light-emitting diodes of high brightness located on perimetre of the Web-chamber are used. They move together with the chamber to each position that provides identical conditions of shooting.

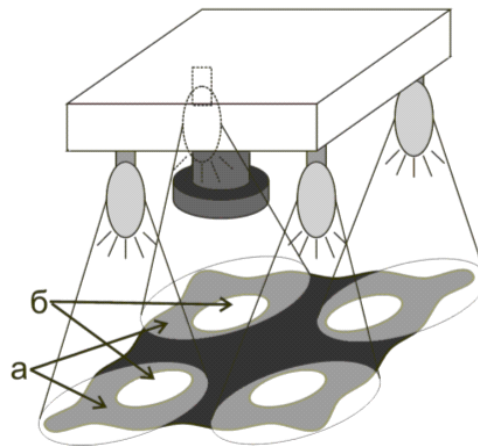
By the experimental it is by defined, that if light gets under a right angle on a surface of grains there are reflexions. For an exception of a similar situation, diodes have arranged, being guided for the sizes of removed area so that grains did not get to area of direct illumination, the scheme of an arrangement of diodes is presented on Fig. 5. The General view of illumination of a working segment of a matrix is presented on Fig. 6.



Symbols:

- a) diodes, 4 pieces;
- b) chamber objective.

Fig. 5. The scheme of an arrangement of diodes on the chamber (bottom view)



Symbols:

a) Illumination area;

b) Object of measurement.

Fig. 6. A general view of illumination of a working segment of a matrix

The general view of hardware-software means of an optical quality monitoring of biological activity of water solutions [31-34] is presented on Fig. 7 also includes:

- 1 - a power unit of a measuring platform;
- 2 - the management block;
- 3 - a control panel a measuring platform;
- 4 - the step-by-step engine moving a measuring platform on directing;
- 5 - the personal computer forming operating influences and processing results of measurements;
- 6 - a measuring platform with fixed on the device suspension the Web-chamber;
- 7 - the Web-chamber making shooting, reception of images of a working surface and transfer to the user program of the personal computer;
- 8 - directing for moving of a measuring platform;
- 9 - the step-by-step engine moving the Web-chamber on positions;
- 10 - a tray with the matrixes located on it with grains;
- 11 - a working surface.

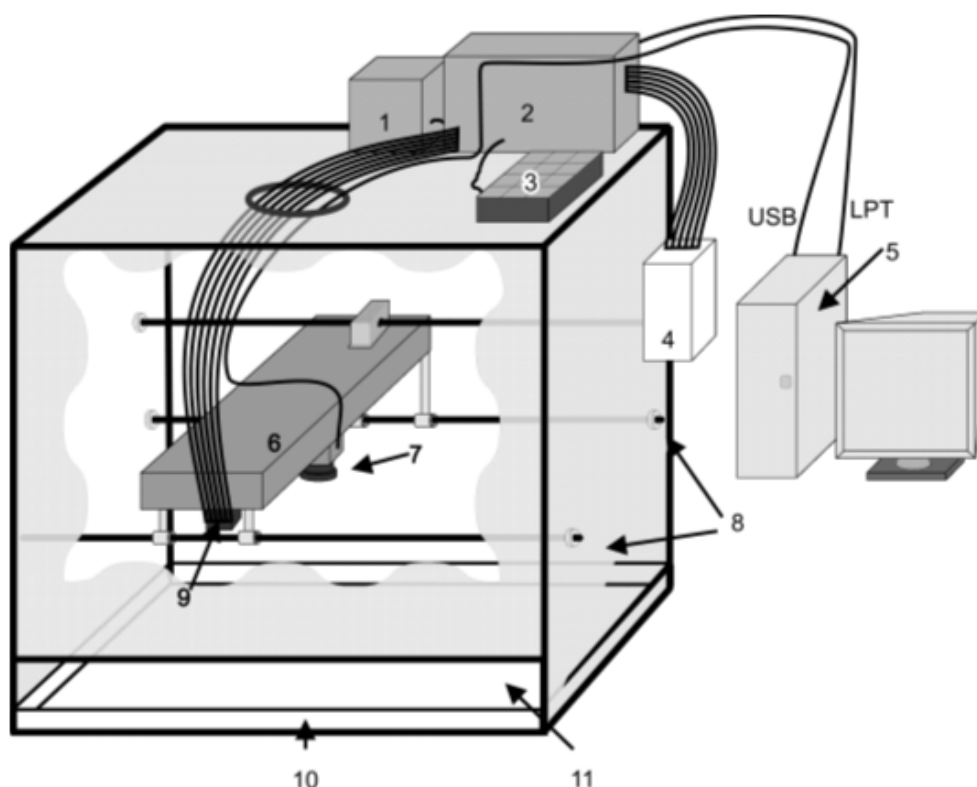


Fig. 7. A general view of hardware-software means of an optical quality monitoring biological activity of water solutions

Thus, hardware-software means of an optical quality monitoring of biological activity of water solutions has been developed with the account of the declared requirements minimising probability of an error and a factor cost.

6. THE DESCRIPTION OF THE SOFTWARE OF AN OPTICAL METHOD THE CONTROL OF BIOLOGICAL ACTIVITY OF WATER SOLUTIONS

The quality monitoring software is intended for processing of images of a working surface and consists of following subsystems (Fig. 8): managements of moving of the optical device on a working surface, capture of images, processing of images, visualisation of results of processing and communication with a database.

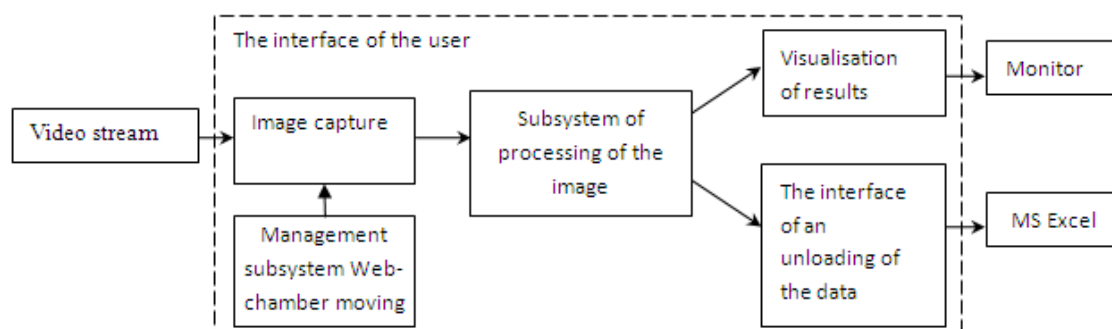


Fig. 8. Architecture of program system

All components are realised in programming language Delphi. The program has been developed for OS Windows 98/2000/XP. The subsystem of the interface of the user allows to operate work of system by means of standard means of OS Windows: windows, the menu, dialogues, management elements.

The subsystem of management over a working surface is intended by moving of the optical device for consecutive movement on positions of measurement with a certain time interval.

The subsystem of capture of the image is intended for capture of separate shots from a target video stream for the purpose of their further processing. For installation of the optical device and image capture one of modules of processing of video streams Delphi VideoGrabber is used.

The subsystem of processing of the image is responsible for processing of images in real time. The grasped shots are transferred to an input of the given subsystem which processes them according to the set algorithms.

The visualisation subsystem allows to display results of processing of images both final, and intermediate.

The subsystem of an unloading of data is used for preservation of results of processing of images for their subsequent viewing and the analysis. In the given subsystem it is used means MS Excel.

The general algorithm of the program [17, 26] is presented on Fig. 9.

The developed software [43, 44] is used as the analyzer of the image of biological objects (wheat grains). The program allows to process images of a working surface of each of investigated matrixes with grains, to distinguish small images (sprouts of grains). To define quantity of the sprouted grains of wheat in unit of time with the subsequent calculation of relative indicators of change of biological activity of water solutions and changes of disorder of indications, and also factor of influence of the investigated factor on biological activity. A result of work of the program is construction of empirical dependences of the found indicators from concrete parametre of the investigated factor. On the basis of the received data the user can do conclusions about degree of influence of the investigated factor on biological activity of water solutions.

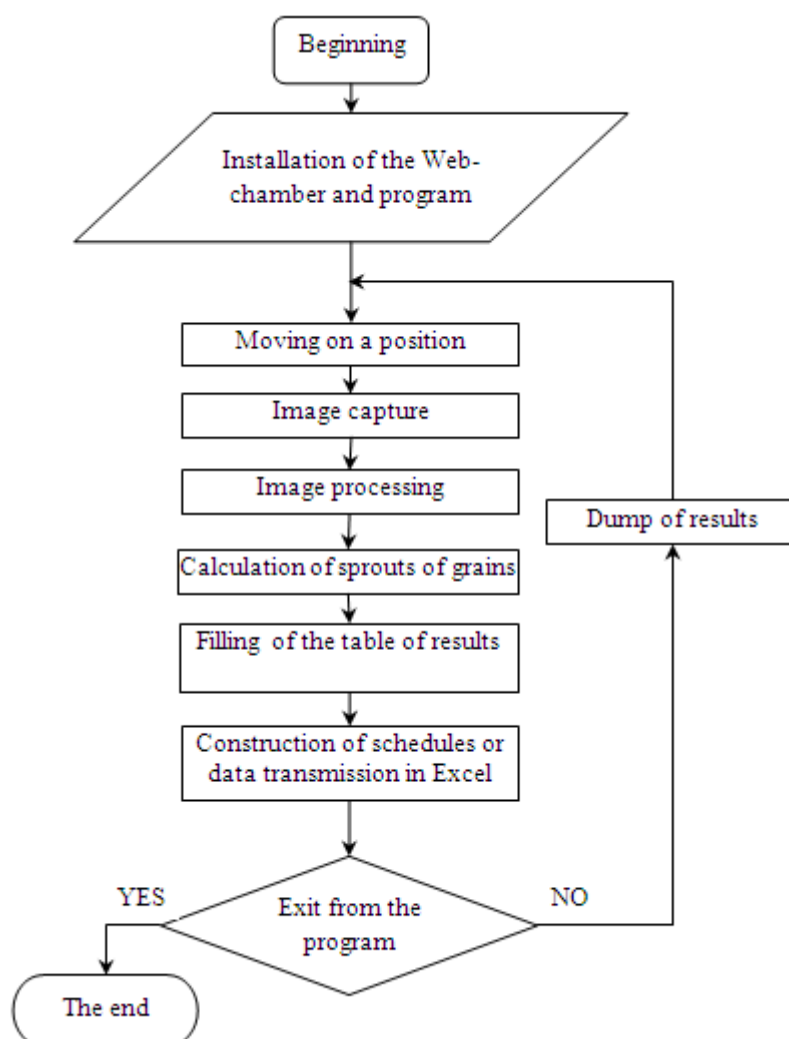


Fig. 9. The general algorithm of the program

Let's describe the general scheme of work of the program:

1) installation of the optical device is carried out by means of module VideoGrabber, capture of the image and shooting by means of one of modules of processing of video of streams Delphi;

2) loading of parameters of the program. The given procedure carries out adjustment of the necessary configuration of options, therefore the program it is easy to adapt under any model of the Web-chamber. Necessary parameters undertake from a file of a configuration of the program config.txt, namely, delays of movement of the chamber and a measuring platform, quantity of steps of moving, parameters scraps of the working image, sensitivity of brightness on channels RED and BLUE, threshold values of number of pixels on grain and a sprout.

3) moving of the Web-chamber to the necessary position by means of performance of executed files which comprise commands of measuring installation;

4) procedure of processing of the image includes:

- 4.1) consecutive loading of images;
- 4.2) change of the sizes of the received images having the rectangular form according to the chosen permission, under the form of working area (a segment of a square matrix with 4 grains of wheat);
- 4.3) clearing of a matrix of the processed pixels of a picture;
- 4.4) search of areas of adjacent pixels with brightness on the channel of red colour (RED) more than a threshold (SensR);
- 4.5) elimination of hindrances and noise on the image, i.e. is less than areas of containing bright pixels, than threshold value of the minimum size of grains (SensZ);
- 4.6) definition of quantity of areas in which contains pixels more than threshold value of pixels for a sprout (SensP), with brightness on the channel of dark blue colour (BLUE) bigger, than threshold value (SensB);
- 4.7) calculation of quantity of grains and sprouts on a separate segment of a matrix;
- 5) definition of quantity of grains and sprouts on each measuring matrix according to a dot accessory;
- 6) the received values for each matrix are brought in the table. As some matrixes data processing is made by calculation of statistics concern one experimental point: average value, SKO, confidential intervals in a concrete point;
- 7) for increase of accuracy and an exception of casual influencing factors it is used the differential scheme with the control in each point, therefore is made calculation of relative indicators of an estimation of biological activity of water solutions;
- 8) last stage of processing is construction of empirical dependences of indicators from parametre of a source of influence or export of data to program MS Excel environment.

The algorithm of the program is based on empirical supervision at processing. The image of a segment received by the chamber with grains has been considered separately on RED and BLUE to channels. It has been noticed, that by consideration on RED to the channel all grains which sprouted and have not sprouted, look more contrastly in comparison with a background (Fig. 10). And by consideration on BLUE to the channel the surface of grains is much more dark than sprouts (Fig. 10).

From here there was an idea at first to process the image on RED to the channel and to define areas of pixels belonging to grains, whether and then to consider these areas on BLUE to the channel and to define contain these areas the light pixels defining presence of a sprout.

Processing of images is made by a finding of areas of the adjacent pixels which brightness exceeds the set threshold of brightness on RED to the channel then from these areas those which size exceeds the set minimum size of grains are selected, hindrances from internal noise of the chamber and fulguration matrixes thereby are eliminated. After an area filtration are considered about presence in them of the pixels which brightness exceeds the set threshold of brightness on BLUE to the channel, in the presence of those, they are counted up in each area and, if the quantity exceeds the set minimum threshold of pixels for a sprout, grain it is considered overgrown (Fig. 11).

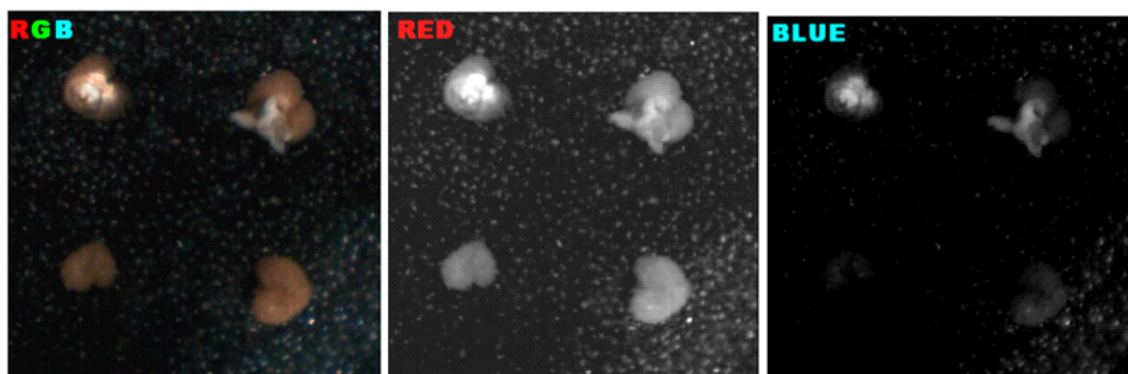


Fig. 10. Images of a segment with grains in colour and on RED to the channel

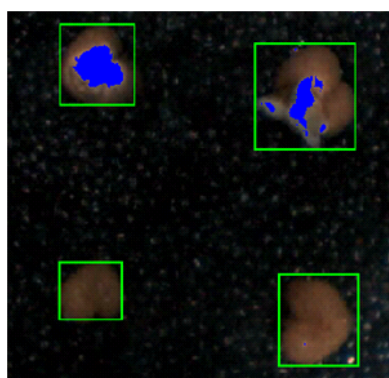


Fig. 11. The image of a segment of a matrix with the distinguished sprouts

Thus, application of the described analysis algorithm of the image of biological objects (wheat grains) allows to define authentically sprout presence during the certain moment of time and to make an estimation of change of biological activity of water solutions at influence of the investigated factor. Automation of procedures of the account and processing of empirical data has essentially reduced labour input of a quality monitoring in comparison with existing earlier.

7. THE DESCRIPTION OF AN OPTICAL QUALITY MONITORING OF BIOLOGICAL ACTIVITY OF WATER SOLUTIONS

Water changeable environment that is connected with high sensitivity to influence of external factors, therefore it is necessary to create a differential quality monitoring with the greatest possible minimisation of influence of random factors. As the variant of the decision of the given problem can be realisation of a dot differential quality monitoring [21].

The essence of the developed optical quality monitoring of biological activity of water solutions consists that the Web-chamber forms the optical image of the matrix including 100 grains then allocate by the established criteria of the image of separate grains, and further images of the separate sprouts which total in a matrix characterises biological activity of a water solution.

The theoretical analysis and experimental researches have led to the following full scheme of an optical quality monitoring of biological activity of water solutions:

- 1) researches are spent in laboratory conditions at constant temperature indoors nearby 21°C , with a minimum quantity of sources of external electrophysical and magnetic radiations;
- 2) in researches for solution preparation the water satisfying with GOST R51232-98 «Water drinking», having constant temperature nearby $19\text{--}20^{\circ}\text{C}$ and not exposed to any influences before experiment carrying out is used;
- 3) in researches it is used wheat grains corresponding GOST [45, 46].
- 4) water solutions with various properties depending on character and an experiment essence, for example various concentration prepare;
- 5) before experiment prepares $(2 \cdot N \cdot M)$ the measuring matrixes filled with grains of wheat, where N - the number of matrixes for one experimental point can individually be defined (recommended value for experiment carrying out - 5), and M - number of investigated points, for example number of investigated concentration;
- 6) each party of grains (N matrixes) investigated and control parts of i -th experimental point are filled in with a water solution of i -th concentration and a water basis (control) accordingly for 2 minutes then consistently give all the best on a measuring tray: the top number investigated samples, bottom - control;
- 7) M measuring trays with matrixes of grains maintain in a current of 18 hours then consistently place on a working surface optical monitoring systems strictly on certain labels and make measurements;
- 8) control process is made automatically by means of the optical monitoring system under control of the user program:
 - 8.1) Web-chamber positioning over the set segment of a matrix is carried out, and to be made shooting for image reception;
 - 8.2) the received image is processed and the number of the sprouted grains in an investigated segment of a matrix is defined;
 - 8.3) repetition of points 8 for all subsequent segments of one experimental matrix and all matrixes of one experimental point;
 - 8.4) definition of total number of the sprouted grains in each measuring matrix;
- 9) the received values are brought in the user table in which statistics in each experimental point automatically pay off: average value of the sprouted grains of wheat (indicator BAV), relative indicators of biological activity of water solutions, changes of disorder of indications and influence factor, and also SKO and confidential intervals;
- 10) the conclusion of experimental dependences in the user appendix of the calculated indicators from parametre of external influence is made;
- 11) the analysis of the received results.

At carrying out of experimental researches always the primary goals are processing of the received results and their true interpretation as much as possible explaining an essence of process or the phenomenon.

The offered model of an estimation of biological activity of water solutions [23] consists that on indicators will be estimated two key moments: degree of influence of the influencing factor on change of amplitude of a controllable indicator (a parity of average values of the sprouted grains in investigated and control parts) and the stability of parameter caused both internal processes, and external conditions, by an estimation of disorder of an indicator after measurement at influence and without it. We will notice, that introduction of the second component in an estimation of an indicator of biological activity of water solutions, it is offered for the first time as possibility of more exact interpretation of received results for problems of medicine and pharmacology at creation and practical use of medical products on their basis.

Thus, for quality standard of change of an indicator of biological activity of water solutions for the first time it is offered to count parities:

$$K_{\text{influence}} = \frac{D_{\bar{N}}}{D_{\sigma}} \text{ Or } K_{\text{influence}} = \left(\frac{D_{\bar{N}}}{D_{\sigma}} - 1 \right) \cdot 100\%,$$

Where $K_{\text{influence}}$ - factor of influence of the investigated factor on biological activity of water solutions or its change,

$D_{\bar{N}}$ - A relative indicator of biological activity of water solutions,

D_{σ} - Relative disorder of indications at research of biological activity of water solutions.

The relative indicator of biological activity of water solutions or its change pay off from parities:

$$D_{\bar{N}} = \frac{\overline{N_{\text{investigated}}}}{\overline{N_{\text{control}}}} \text{ Or } D_{\bar{N}} = \left(\frac{\overline{N_{\text{investigated}}}}{\overline{N_{\text{control}}}} - 1 \right) \cdot 100\%,$$

Where $\overline{N_{\text{investigated}}}$ - average quantity of the sprouted grains in unit of time in an investigated part, piece,

$\overline{N_{\text{control}}}$ - Average quantity of the sprouted grains in unit of time in a control part (a water basis), piece

Relative disorder of indications at the control of biological activity of water solutions or its change pay off from parities:

$$D_{\sigma} = \frac{\sigma_{\text{investigated}}}{\sigma_{\text{control}}} \text{ Or } D_{\sigma} = \left(\frac{\sigma_{\text{investigated}}}{\sigma_{\text{control}}} - 1 \right) \cdot 100\%,$$

Where $\sigma_{\text{investigated}}$ - an average quadratic deviation of quantity of the sprouted grains in unit of time in an investigated solution, piece;

σ_{control} - An average quadratic deviation of quantity of the sprouted grains in unit of time in a control part (a water basis), piece

Thus the factor of influence of more unit means increase of biological activity, the factor of influence of less unit means its fall, and equality of factor of influence to unit means an invariance of biological activity of a water solution.

As developed the method and a hardware-software control device are intended first of all for problems of medicine and pharmacology at creation and practical use of medical products we will explain necessity of use of such model, on an example of already investigated water solutions of ionic silver.

In a graphic kind the model of an estimation looks like (Fig. 12) where each area characterises a certain condition of system: the individual condition (fat lines) shows absence of influence of the external factor; dashed lines - borders of confidential intervals, hit in internal area testifies to change of an indicator within an error.

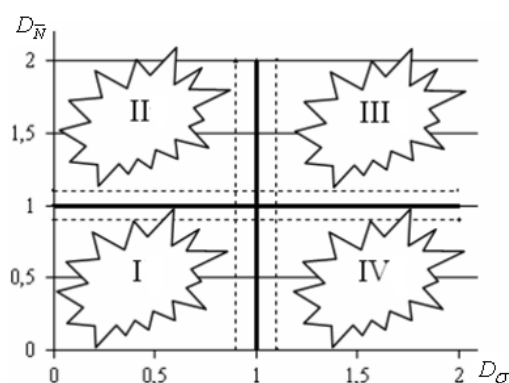


Fig. 12. Graphic model of an estimation of biological activity of water solutions [23]

The area I is characterised by decrease in an indicator of biological activity and stabilisation of properties of environment at change of the investigated factor. Solutions of ionic silver with similar properties can be used as means of biochemical processes of biological system slowing down activity, for example in treatment of HIV-infections, cosmetology, etc.

The area II is characterised by growth of an indicator of biological activity and stabilisation of properties of environment at change of the investigated factor. Solutions of ionic silver with similar properties should be used for working out of the preparations stimulating activity of biochemical processes of biological system, for example, in ophthalmology as eye drops, in the general therapy for the general strengthening of an organism and immunity increase, in treatment of burn wounds, etc.

The area III is characterised by growth of an indicator of biological activity and instability of properties of solutions of ionic silver at change of the investigated factor. Solutions of ionic silver with similar properties should be used for working out of medical products when time action of a preparation is required, for example, at treatment of LOR-pathologies, etc.

The area IV is characterised by decrease in an indicator of biological activity and growth of instability of properties of environment at change of the investigated factor. Solutions of ionic silver with similar properties are extremely seldom applied in medicine, therefore entrance parametres of data acquisition of solutions should be excluded from compoundings of preparation of medical products.

From here it is visible, that each area definitely characterises properties of biological system (a solution of ionic silver). As in medicine solutions with various display of properties are required, for example the fast short-term effect or slowly current process with long-term display of the necessary properties the offered model quite adequately reflects an essence of investigated processes and to suit practical application, that undoubtedly is scientific novelty of the given work.

8. EXPERIMENTAL RESEARCHES

Working capacity of an optical method and hardware-software control device of biological activity of the water environment we will show on the experimental researches of water solutions of ionic silver connected with wide use in medicine and pharmacology at creation and practical use of medical products on their basis. The basic problem was shortage of knowledge of degree and character of influence of this or that concentration on biological system, biological activity of solutions of ionic silver depending on concentration in a range from 1 to 50 mg/l therefore has been investigated.

Change of a relative indicator of biological activity of solutions of ionic silver depending on concentration of a solution is presented on Fig. 13.

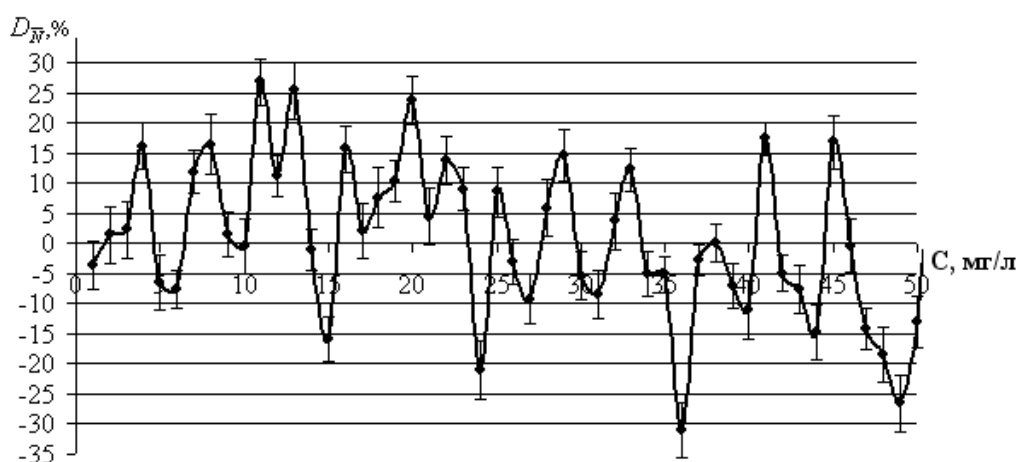


Fig. 13. Relative change of an indicator of biological activity of solutions of ionic silver depending on concentration of silver in a range from 1 to 50 mg/l

The given indicator characterises a parity of average peak values germinating power wheat grains in control and investigated parties of each experimental point, therefore is the core for the analysis of change of biological activity.

From schedules it is visible, that change of biological activity of solutions of ionic silver has difficult oscillatory character and changes in a range from -32,2 % to 26,8 % that complicates a conclusion of certain dependence of change of biological activity from intensity of the influencing factor.

It is possible to allocate following concentration of solutions where the considerable gain of grains of wheat in unit of time in comparison with the control sample not less than 15 % is observed is 4, 8, 11, 13, 20, 41 and 45 mg/l. Concentration of solutions where decrease in biological activity of a gain of grains of wheat is observed not less than on 15 % is 15, 24, 36, 48 and 49 mg/l etc.

Therefore the analysis of these points demands special attention that is better to do, using a relative indicator of disorder of the indications, characterising stability of parametre (Fig. 14).

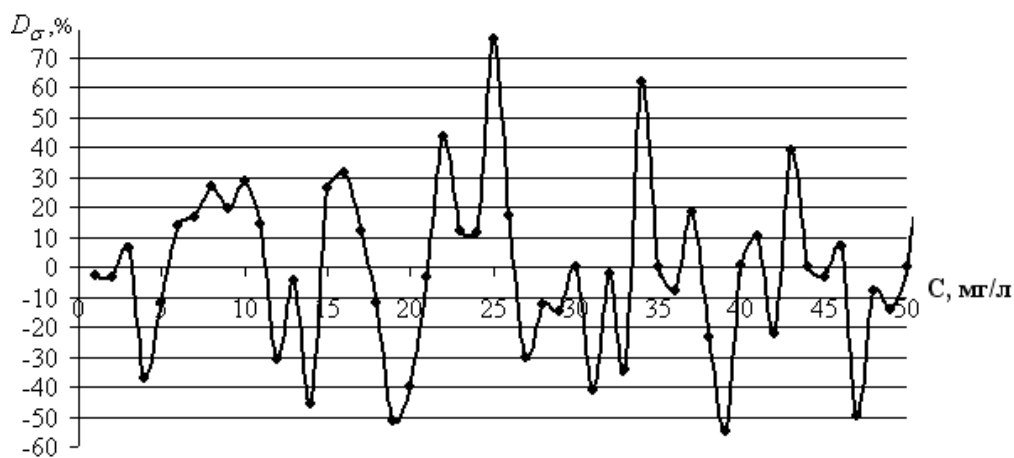


Fig. 14. Relative change of disorder of indications at research of biological activity of solutions of ionic silver from concentration of silver in a range from 1 to 50 mg/l

From drawings it is visible, that considerable change of disorder of indications (over 40 %) is observed at concentration 14, 19, 22, 25, 34, 39 and 47 mg/l, that is in these points there is a significant stabilisation of indications, or on the contrary growth of chaos owing to "reorganisation" of structure of a solution as a result of ionisation by silver ions.

Integrated estimation of biological activity of solutions of ionic silver is the analysis of change of factor of the influence characterising a total estimation of degree of influence of ionisation by ions of silver of a water solution. Results of researches are presented on Fig. 15.

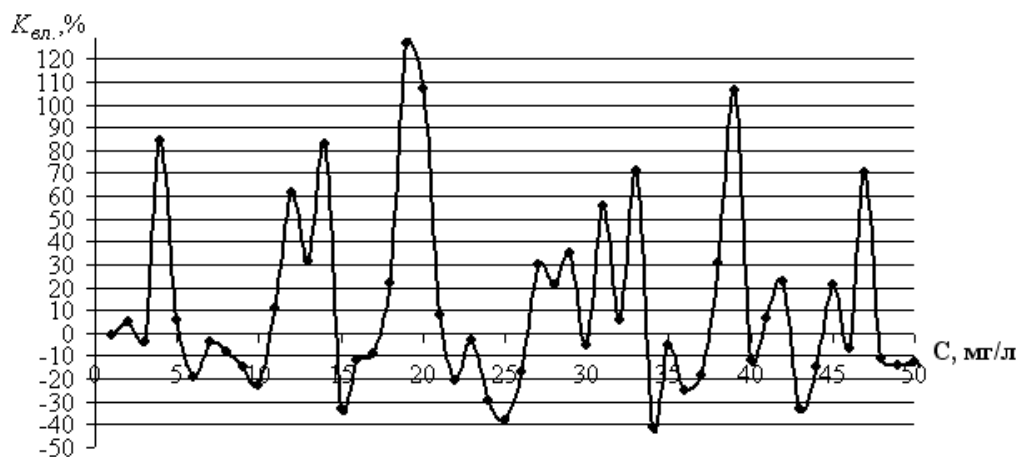


Fig. 15. Change of factor of influence from concentration of ions of silver in a solution
In a range from 1 to 50 mg/l

Analyzing earlier allocated concentration, it is possible to tell, that for biological system concentration of 4 and 20 mg/l so at value data it is observed as acceleration germinating power wheat grains, that is growth of an indicator of biological activity, and display of stability of properties that is expressed in a

constancy of measurements (aspiration of separate measurements to average value) are optimum. From here it is visible, that from 7 before the allocated concentration on change relative to an indicator of biological activity of a water solution of ionic silver only 2 remained in a category optimum.

Besides, it is possible to allocate some more the concentration which earlier have been not allocated because of insignificant (10-15 %) changes of a relative indicator of biological activity, but on set of signs concerning to optimum. These are concentration 12, 19, 33 mg/l, that is introduction of additional parametre of an estimation has allowed to reveal without additional expenses concentration perspective for the further researches.

Thus, for creation of medical preparations it is expedient to carry out additional researches, including on biological systems of higher level of the organisation, on the basis of solutions of ionic silver of following concentration 4, 12, 19, 20, 33 mg/l characterised by stable display of properties and causing growth of biological activity.

Analyzing concentration in a range from 1 to 50 mg/l reducing biological activity of solutions of ionic silver, it is possible to note absence of the concentration which use is not expedient because of instability of shown properties.

It is necessary to allocate concentration at which there is a decrease in biological activity, but display of properties remains stable in time, these are concentration 14, 31, 39, 47 mg/l. Similar concentration of solutions of ionic silver, probably to use at creation of the medical products which are slowing down exchange processes like demulcents.

Besides, separately it is necessary to note concentration 8, 11 (15, 24) the mg/l at which considerable growth (decrease) in a relative indicator of biological activity of solutions of ionic silver was observed, but at the same time was observed growth of disorder of indications. Therefore at a choice of the necessary concentration, leaning only on results of changes of indicator D_N , it was possible to choose concentration not approaching for practical use.

The analysis of experimental data also has shown, that there are concentration, for example, 13, 45 (36, 48, 49) mg/l leading to insignificant growth (decrease) in biological activity of a solution of ionic silver, but this change has stable irreversible character. Use of properties of solutions with the given concentration also can be useful in the practical purposes.

Thus, as a result of experimental researches of biological activity of solutions of ionic silver, the set of the concentration giving to a solution certain properties which use is possible in medical practice at creation of medicinal forms is allocated.

9. THE CONCLUSION

The developed optical method and hardware-software control device of biological activity of water solutions is actively applied in GOU VPO RusHealth «Altay state medical university» on chair «Bases of hygiene and ecology of the person» to research of influence of concentration of ions of silver on the water solutions used in the therapeutic purposes. Within the limits of performance of complex program NIR«Application of ionic silver in practical public health services» RK 227-70 on chair researches on manufacturing and approbation of solutions of ionic silver for the therapeutic purposes, for example for treatment of a sharp antritis [47] are carried out. So after an establishment of some concentration with necessary properties by means of an optical method and a hardware-software control device of biological activity of solutions of ionic silver, therapeutic tests for 90 patients with maxillary a sinusitis have been conducted. Preliminary each patient has passed inspection under

specially developed questionnaire [47] including a passport part, rhinologic the anamnesis, results tool, laboratory, radiological, bacteriological, immunologic researches.

Thus, use of the developed optical quality monitoring of biological activity of water solutions has allowed to receive at a preliminary stage the information on degree of influence of solutions of ionic silver of various concentration and properties shown by them without considerable expenses, and approbation of the received results in the therapeutic purposes has shown utility of the received knowledge and success of their application.

Also within the limits of the given program on chair «Bases of hygiene and ecology of the person» researches on working out of medical products on the basis of silver for treatment are conducted:

- ☐ ☐ diseases of LOR-BODIES at a flu, ORZ (rhinitis, pharyngitises of the infectious nature), quinsy;
- ☐ ☐ oral cavity diseases at: paradontosis, ulitis, stomatitises;
- ☐ ☐ diseases of a gastroenteric path at: a chronic gastritis, a stomach ulcer of a stomach and a duodenal gut, chronic prick, acalculous a cholecystitis.

Means are developed for treatment of purulent wounds, burns also, etc., for their use as disinfecting means for cleaning of baths, bowls etc., as means of disinfection of water researches of solutions of ionic silver are carried out in swimming pools. By efficiency of destruction of bacteria silver is much more active some chlorine, does not give toxic connections with impurity of water and has no specific smell.

Thus, it is visible, that developed the optical method and a hardware-software control device of biological activity of solutions of ionic silver are directed for the decision of many actual problems in public health services and ecology of the person.

Besides, received results of research are used on chair of information technologies GOU VPO «Altay state technical university» within the limits of program realisation «Priority directions of development of a science, technologies and technics in the Russian Federation», performance of Federal target programs and creation bursting the technologies directed on creation of fundamental bases of essentially new materials, services and technologies, namely in manufacture nano (bio) sensor controls and nano (bio) gauges for the decision of problems of separate branches of a national economy. The offered method and hardware-software means are a prototype of measuring system with use of bioobjects, and the received knowledge during their creation lays down in a basis at designing of new measuring systems, for example, for definition of an indicator of toxicity of separate chemical compounds in the water environment. There are besides, begun works [40-41] on research of properties of weak fields and radiations from biological objects with use of the developed means and a quality monitoring, allowing to fix small target changes at the small entrance. Also there are begun workings out on adaptation of the developed method for monitoring of pollution of potable water.

Work occurrence is caused by the practical necessity connected with studying of properties of water environments. The basic conclusions of work discussed and published in works of various scientific and technical conferences and forums [9-38], allow to pass to the scientifically-proved application of the developed quality monitoring in scientific researches and separate branches of a national economy: in pharmacology at creation of dosages of medical products, in ecology at monitoring of pollution of water resources and so forth

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