Central Asian Journal of Medicine

RESULTS OF STUDYING THE INFLUENCE OF BIO-FERTILIZER “YER MALHAMI” ON THE QUALITY OF WATER BODIES

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ABSTRACT

The biofertilizer is intended for pre-sowing treatment of seeds and seedlings of vegetables, industrial crops, potatoes, roots of young seedlings of fruit trees, forest crops in order to accelerate plant growth, increase yield, improve its quality, and suppress phytopathogenic microflora. The "Yer malkhami" has been shown to be effective in agricultural trials, which requires the development of maximum permissible concentrations.

Key words: biological fertilizers, reservoir water, organoleptic properties, sanitary regime, concentration, microbiological industry, environment, biodiversity, toxicity, norm, pollution, health, maximum permissible concentration, ecosystem, drinking water, biological product, nitrogen fertilizers, azotobacteria.

INTRODUCTION

The relevance of research: Forecasting the consequences of environmental contamination with microbiological synthesis products is a pressing problem of modern society. Despite significant advances in hygienic regulation of chemical environmental factors, these issues for biological factors in the context of the development of the microbiological industry in the Republic of Uzbekistan often remain unresolved. Pollution of water bodies leads to the destruction of the natural environment under the influence of external toxic substances that come from

natural or anthropogenic sources. Long-term exposure of a reservoir to sources of severe pollution leads to an increase in the concentration of harmful impurities in it above the maximum permissible concentration, which poses a threat both to the ecosystem and to the health of people who use water for drinking and domestic needs [18.20.22]. Destruction of biodiversity, increased disease and mortality among people and animals, disruption of natural habitats, damage to water, soil and air quality. Industry produces a huge (more than 90%) amount of waste [4.5.7.11.21]. Most of them contain toxic chemicals and pollutants. They can cause environmental pollution. They contain substances dangerous to living organisms such as lead, mercury, sulfur, asbestos, nitrates and many other harmful chemicals. Aquatic pathogens in the form of pathogenic bacteria and viruses resulting from human and animal activity are the main cause of illness due to contaminated drinking water [3.8.10.20.21]. Many industries do not have a proper waste management system and dump waste into fresh water, which flows into rivers, canals and then into the sea. Toxic chemicals can change the color of the water, increase the amount of minerals also known as esterification, change the temperature of the water and pose a serious threat to aquatic life. All this can become negative consequences of water pollution if this process is not controlled and timely measures are not taken to reduce the volume of harmful wastewater and garbage entering our rivers and lakes [1.6.12.14.19.21].

Biological products used in agriculture either provide a protective effect for plants against pests and diseases, or act as fertilizers. The main positive property of biological products compared to chemicals is their specificity and low toxicity for humans and warm-blooded animals. The increase in crop yields due to the use primarily of fertilizers is undoubtedly [2.9.13.15.16.17.22.]. The most important role in this belongs to nitrogen fertilizers, since it is with them that nitrogen is introduced into the soil, which is transformed by plants into protein compounds. Nitrogen fertilizers have a beneficial effect on the plant: they improve their chemical composition, protein content, and carotene. It has been established that when using nitrogen mineral fertilizers in the conditions of the Republic of Uzbekistan, significant soil contamination with ammonium and sodium nitrate occurs. Preventing pollution and protecting the environment requires the application of sustainable development principles. Effective combating the negative consequences of water pollution must be based on correct environmental norms and standards. Continuous and full-fledged work of government departments in terms of environmental protection is necessary. In connection with this important stage in hygienic regulation and the influence of compounds regulated in water, the organoleptic properties of water.

Purpose of the study. The purpose of this research was the development of hygienic standards and scientific substantiation of a system of health measures that ensure environmental protection during the production and use of the new biological fertilizer “Yer Malhami” in agriculture.

Research methods. The object of our research was the biological fertilizer “Yer Malhami”. The study of the toxicity and nature of the biological effect of the biofertilizer was carried out in accordance with the requirements of the methodological instructions “To conduct research to justify the maximum permissible concentration (MAC) of environmental bioinsecticides” and the Methodological instructions for determining the biological plant protection product “Er Malkhami” in water bodies of reservoirs. The principle of the method is based on growing colonies of nitrogen bacteria on a nitrogen-free agar medium.

Azotobacteria are large, round, convex, shiny, mucous, opaque, non-pigmented, with smooth edges. Determining the number of cells of foreign microorganisms is based on obtaining a series of serial tenfold dilutions of the drug, growing bacteria under certain conditions and comparing the number of grown colonies with the number of colonies of azotobacteria. It is known that many biological products have an adverse effect on the organoleptic properties of water (smell, taste, color, transparency, foaming). In addition, when they get into water bodies, they violate their sanitary regime.

The organoleptic properties of water in the presence of “Yer Malhami” were studied by its effect on smell and taste at temperatures of 90°C and 60°C, transparency, color, and foaming. By the cylinder method of G. Stunnel, modernized by V.T. Monaev determined threshold concentrations based on the effect of “Yer Malkhami” on foam formation. Coloring of water containing different concentrations of the drug on the processes of natural self-purification of water from organic pollution. Determination of dissolved oxygen was carried out by the Winkler method, based on the fact that divalent manganese hydroxide absorbs free oxygen, forming manganese dioxide. The research results were processed using the generally accepted method of variation statistics with an assessment of the reliability of differences in empirical samples using the Student's test.

Research results. Microorganisms are important drivers of a functional agroecosystem. Their diversity significantly stimulates the growth of crops because they produce antibiotics and phytohormones (for example, they secrete phosphatases). These compounds protect plants from soil-borne pathogens and increase their ability to absorb nutrients Biological fertilizer "Yer Malkhami" is developed on the basis of soil microorganisms capable of nitrogen fixation and

production waste. Biofertilizer "Yer Malkhami" is produced in liquid, dry and peat form. Characteristics of various forms of biofertilizer release are presented in Table 1.

Table No. 1

Characteristics and standards of biofertilizer “Er Malhami”

Name of indicators	Release form		
	Liquid	Dry	peat
1	2	3	4
Appearance and color	Viscous liquid (gel) from cream to dark brown color	Homogeneous cream to brown powder	Brown to black friable or semi-friable mass
Moisture content, %	97.0±1.0	4.0±1.0	50.0±5.0
Mass fraction of residue after sifting on a sieve with NO56 mesh, % not more than	__	5.0	__
Number of viable Azotobacter cells, billion/g, at least	1.0	1.0	0.5
By the end of the guaranteed storage period, billion/year, at least	0.5	0.5	0.2
Number of cells of foreign microorganisms, billion/g, no more	0.05	0.05	0.1
By the end of the guaranteed storage period, billion/year, not more than	0.05	0.05	0.2

By the end of the guaranteed storage period of peat azotovit, the mass fraction of moisture may be reduced to 35%. Biological fertilizer “Yer Malkhami” is packaged in 50, 100, 200, 400, 1000 g, peat fertilizer in 200, 400, 800, 1000 g, and liquid fertilizer in 5 dm3, 50 dm3 packages with the application of manipulation signs “Afraid of dampness”, “Afraid of heat."

The biofertilizer is intended for pre-sowing treatment of seeds and seedlings of vegetables, industrial crops, potatoes, roots of young seedlings of fruit trees, forest crops in order to accelerate growth, increase yield and improve its quality, and suppress phytopathogenic microflora.

An important step in hygienic regulationis to study the influence of compounds regulated in water on the organoleptic properties of water. The presence of "Yer Malhami" gives the water a faint aromatic smell of apple juice. The determination of threshold concentrations of the biological product based on the sense of smell was carried out with different initial concentrations in 2 series of experiments at different temperatures -20 and 60°C. Based on the experimental results, summary tables of the distribution of odor intensity indicators (in points) were compiled depending on the concentration of the drug in water. The threshold for the sensation of the smell of “Yer Malhami” at 20 °C is determined in the range of 1.5-50 g/l. The practical limit corresponding to an odor intensity of 2 points is set at 6-100 g/l. The threshold for the sensation of odor according to the majority of odorants corresponds to a concentration of 12.5 g/l, the practical limit is 50 g/l (Table 2). When the temperature increased to 60 °0, the odor threshold was determined at the level of 0.097-3.125 g/l, the practical limit was at the level of 0.78-12.5 g/l. According to the results of the sensations of most odorants, the odor thresholds and the practical limit correspond to concentrations of 1.56 and 6.25 g/l. Taking into account fluctuations in threshold values due to the individual sensitivity of odorants, the results obtained were processed by the Student-Fisher statistical method, taking into account outliers.

Table No. 2

Distribution of odor intensity indicators depending on the concentration of “Yer malhami” in water at a temperature of 20°C

Concentration, g/l	Logarithm concentration	Odor intensity in points						Average value	Equalization values
		0	1	2	3	4	5		
100	2			33	38	9		2.7	-
50	1,699		11	55	14			2.03	2.03
25	1,398	3	45	31	1			1.37	1.44

12.5	1,097	12	61	7				0.94	0.90
6.25	0.796	49	30	1				0.4	0.49
3.125	0.494	68	12					0.15	0.20
1,562	0.193	74	6					0.073	-

The lower confidence limits of the arithmetic mean value of the odor threshold concentration were obtained. According to the results of statistical processing, the threshold for the sensation of the smell of “Yer Malhami” was set at the level of 16.1 g/l, the practical limit was at the level of 54.4 g/l (Table 3). At a temperature of 60°C, the odor threshold and practical limit correspond to biofertilizer concentrations of 1.2 and 4.7 g/l, respectively. The experimental error in all cases was no more than 6%, which indicates the reliability of the results obtained. Checking the accuracy and correctness of the research carried out using a graphical method for assessing organoleptic data revealed a proportional relationship between the intensity of the odor and the logarithms of biofertilizer concentrations and the consistency of the results Weber-Fechner law. The lower confidence limits of threshold concentrations on the influence of odor intensity, determined using the graphical method, do not differ significantly from the values obtained from the readings of most odorants.

Table No. 3

Statistical parameters of the influence of "Yer Malhami" on the organoleptic properties of water by smell at temperatures of 20°C and 60°C

Odor intensity in points	Temperature°C	Statistical parameters				
		M	±	±m	R	Mmm
1 point	20	16.1	20	0.9	5.5	14.3
2 points	20	54.4	23.7	2.6	4.7	49.2
1 point	60	1.2	0.34	0.07	5.0	1.06
2 points	60	4.7	3.0	0.2	4.2	4.30

Since the methodology for studying the influence of harmful substances on the organoleptic properties of water determines a certain degree of objectivity in assessing odor, the need arose to conduct an additional test, the so-called “closed experiment”.

The experiment was carried out at 60°C in the range of found threshold concentrations with 7 concentrations of the substance, differing from each other by 2 times. Each experimental sample corresponding to one of the concentrations was grouped with 4 control samples. Odorizers, familiar with the nature of the smell of "Yer Malhami," had to indicate a test sample. The obtained results were processed using the least squares method for probit analysis. Analysis of the data shows that the threshold for smelling the drug corresponds to a concentration of 0.85±0.05 g/l. Comparison of indicators of the effect of the drug on the intensity of odor according to various research methods made it possible to identify the correspondence of threshold concentrations to the same level and the reliability of the studies (Table 4).

Table No. 4

The influence of "Yer Malhami" on the intensity of odor according to the data of most odorants (I), graphical results (2) and statistical (3) methods

Intensive smell in points	Tempera-tour°C	Method for analyzing the obtained data		
		1	2	3
		substance concentration in g/l		
I point	20	12.5	14.4	14.3
2 points	20	50.0	50.1	49.2
I point	60	0.78	0.94	1.06
2 points	60	6.25	3.54	4.30

A study of the effect of "Yer Malhami" on the nature of the taste showed that concentrations at the odor threshold level do not affect the taste of water.

Studies of water transparency in the presence of "Yer Malhami" were carried out with concentrations of 0.19-3.0 r/l. It turned out to be a threshold concentration 0.39 g/l (Table 5).

Table No. 5

The influence of "Yer Malhami" on water transparency

Concentration of "Yer Malhami" g/l	Height of water column in cylinder (cm)
Control	30.0
0.195	30.0
0.39	23.5
0.78	15.2
1.56	8.8
3.125	5.3

Studies to determine the color of a water column 10 and 20 cm high in the presence of "Yer Malhami" revealed threshold concentrations of 0.78 and 0.20 g/l, respectively (Table 6).

Table No. 6

The influence of "Yer Malhami" on the color of water

Concentration, g/l	Color of the water column			
	experience 1		experience 2	
	10 cm	20 cm	10 cm	20 cm
6.25	+	+	+	+
3.125	+	+	+	+
1.56	+	+	+	+
0.78	-	+	+	+
0.39	-	+	-	+
0.195	-	-	-	-
0.097	-	-	-	-

The effect of "Yer Malhami" on the chlorine content in water has been studied. Achieving a sufficient bactericidal effect and maintaining the consumer qualities of water requires the addition of an excess amount of chlorine, but residual chlorine should not be contained in an amount exceeding 0.5 mg/l. We conducted studies of chlorine demand with various concentrations of the drug, for which the optimal doses of chlorine were established by trial chlorination. The minimum dose of chlorine corresponded to a concentration of 1.5 g/l of the drug (Table 7).

Table No. 7

The influence of "Yer Malhami" on the chlorine content (according to chlorine demand) in water

Concentrations (g/l)	Dose of active chlorine (mg/l)	Residual asset. chlorine after contact with sample (mg/l)	Chlorine absorption (mg/l)
Control	2.18	0.36	1.82
1.5	2.18	0.36	1.82
15.0	2.91	0.36	2.55
50.0	3.64	0.5	3.14

A significant increase in chlorine demand - 1.4 times compared to the control - was observed at a water content of 15.0 g/l of the drug, which allowed us to consider this dose as the threshold dose for this indicator of harmfulness. The drug had virtually no effect on foaming (Table 8).

Table No. 8

The influence of "Yer Malhami" on pricing

Concentration tradition	20°		60°	
	Episode 1	Episode 2	Episode 1	Episode 2
Foam layer stability in sec.				
Control	60	60	55	58
15.0	65	60	58	65
1.5	58	55	55	56
0.15	61	60	54	57

Thus, the limiting concentration for the effect of “Yer Malhami” on the organoleptic properties of water should be considered 0.2 g/l, which corresponds to the threshold concentration for the effect of the drug on color.

Discussion: Forecasting the consequences of environmental contamination with microbiological synthesis products is a pressing problem of modern society. Despite significant advances in hygienic regulation of chemical environmental factors, these issues for biological factors in the context of the development of the microbiological industry in the Republic of Uzbekistan often remain unresolved. We have established concentrations of biofertilizer that do not affect the organoleptic properties of water, smell and taste, since deterioration of the organoleptic properties of water can lead to restrictions on water use. Based on the studies conducted, it was found that the threshold for smelling the drug corresponds to a concentration of 0.85±0.05 g/l. A study of the effect of “Yer Malhami” on the nature of the taste showed that concentrations at the odor threshold level do not affect the taste of water. Studies of water transparency in the presence of “Yer Malhami” were carried out with concentrations of 0.19-3.0 g/l. The threshold concentration was determined to be 0.39 g/l. Studies on the specific color of a water column with a height of 10 and 20 cm have established drug concentrations of 0.78 g/l and 0.20 g/l, respectively. The drug does not affect foaming. The chlorine requirement of water in the presence of the drug was studied. We have established a drug concentration of 15 g/l as the threshold for this indicator.

Conclusion: The research results allowed us to formulate the following conclusions:

1. We have established concentrations of biofertilizer that do not affect the organoleptic properties of water, smell and taste, since deterioration of the organoleptic properties of water can lead to restrictions on water use.
2. Based on the studies conducted, it was found that the threshold for smelling the drug corresponds to a concentration of 0.85±0.05 g/l.
3. A study of the effect of "Yer Malhami" on the nature of the taste showed that concentrations at the odor threshold level do not affect the taste of water.
4. Studies of water transparency in the presence of "Yer Malhami" were carried out with concentrations of 0.19-3.0 g/l. The threshold concentration was determined to be 0.39 g/l. 5. Studies on the specific color of a water column with a height of 10 and 20 cm have established drug concentrations of 0.78 g/l and 0.20 g/l, respectively.
5. The drug does not affect foaming.
6. We have established a drug concentration of 15 g/l as the threshold for this MPC indicator in the water of reservoirs - 16.10 mt/l
7. "Yer Malhami" can be recommended as a biofertilizer in agricultural production, subject to measures aimed at preserving the health of workers and preventing pollution of the environment and production environment.

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