

## **Application of Biological Preparation "UF-1" for Treatment and Restoration of Polluted Natural Water Bodies**

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### **Abstract**

In this paper, the studies show high anthropogenic load on the Shemordan lake ecosystem. Also, in vitro drug use «UF -1», contributed to the improvement of water quality in many hydrochemical parameters (color, turbidity, concentration of ammonium ions) and biological and characterized as moderately polluted. Received positive laboratory results «UF -1» indicates the possibility of future use of the drug to restore freshwater.

### **Keywords**

monitoring of freshwater; pollution load reduction; microbiological recovery of freshwater lakes; water resources management.

## **INTRODUCTION**

Currently security issue of the most important life-saving resource such as water is one of the world's major problems. Negative human impact on the surrounding world is expressed in the global contamination of aquatic ecosystems by heavy metals and persistent organic toxicants, leading to a decreased ability of the natural self-purification of water bodies[2]. This requires expanding the network of monitoring, evaluation of water resources quality and the search for new tools and technologies of rehabilitation (restoration) of disturbed and degraded water bodies. Slow flow water bodies (lakes, etc.), a greater number of which are most susceptible to anthropogenic stress are of particular interest [3].

## **THE AIM**

Of this work is an water quality investigation of anthropogenically loaded Shemordan Lake on the territory of the Republic of Tatarstan (RT, Russia) and performance evaluation of potential of reservoir clearing and restoration using biological preparation "UF-1."

## **MATERIAL AND METHODS**

During systematic monitoring of Shemordan lake water, turbidity, color, nitrates, nitrites, ammonium ions, fluorides, phosphates, and total iron were determined by the photometric method. pH, total alkalinity, bicarbonates were established by potentiometric method and the water hardness was determined using complexometric method. Calcium, magnesium, chlorides, residual chlorine, sulphates, solid residue were measured by gravimetric method. The content of organic compounds in water was characterized through a permanganate oxidation and biochemical oxygen demand

(BOD), which were determined by titrimetry[1]. The obtained hydrochemical indicators were compared to the standards. For the sanitary and hygienic specifications of the reservoir status the total bacterial count (TBC) in the test samples of water was determined.

*Test microbiological preparation.* Under conditions of laboratory modeling, the influence of "UF-1" (developed by the microorganism consortium of bacteria and micromycetes) on the quality of the lake water was investigated.

## RESULTS AND DISCUSSION

Monitoring studies conducted pond water lake water Shemordan hydrochemical and bacteriological parameters are presented in Table 1.

Table 1 - hydrochemical and bacteriological monitoring studies of the lake water Shemordan.

Indicator	Unit	Emission limits	The results of studies
Odor 20 <sup>0</sup> C	points	2	2
Odor 60 <sup>0</sup> C	points	2	1
Flavor	points	2	2
Chromaticity	Col.deg.	20-35	250.0
Turbidity	FNU	2.6-3.0	13.0
Hydrogenous	pH	6.5-8.5	5.8
Alkalinity	mEq/L	0.5-6.5	7.2
Bicarbonates	mg/L	30-400	367.1
Stiffness	mg/L	7-10	4.90
The dry residue	mg/L	1000	920
Calcium	mg/L	180	76.0
Magnesium	mg/L	40.0	62.35
Nitrates	mg/L	40.0	0
Nitrites	mg/L	0.08	0.02
Ammonium ions	mg/L	0.5	0.70
Fluorides	mg/L	1.5	1.5

Phosphates	mg/L	0.2	2.31
Iron	mg/L	0.1	0.20
Sulfates	mg/L	100	52.0
Chlorides	mg/L	300	21.0
Residual chlorine	mg/L	0	0
Permanganate oxidation	mg O <sub>2</sub> /L	5-7	170
Dissolved oxygen	mg O <sub>2</sub> /L	Not less than 6.0	1.23
Biochemical oxygen demand	mg O <sub>2</sub> /L	2.0	80.2
Total number of bacteria	10 <sup>6</sup> cel/ml	0.5-1.0	5.3

Table 1 show that the results of monitoring studies by hydrochemical and bacteriological parameters the lake water is characterized as "contaminated" with stable high level of contamination over time. There was a significant excess of water quality standards: for color, turbidity, alkalinity by 12%, and for content of ammonium ions – by 40%. The detected excess of BOD values in reservoir water samples by more than thirty times indicates its severe contamination. The TBC magnitude of the investigated water samples corresponded to "strongly contaminated" water quality grade.

Studies conducted using a biological preparation "UF-1" for the purification of water reservoir shown in Table 2.

Table 2 - Studies on the use of biological drugs "UF-1" for the water treatment pond.

Indicator	Unit	The results of studies of lake water Shemordan	research results after drug treatment UF-1
Odor 20 <sup>0</sup> C	points	2	1
Odor 60 <sup>0</sup> C	points	1	1
Flavor	points	2	1
Chromaticity	Col.deg.	250.0	110.0
Turbidity	FNU	13.0	12.0
Hydrogenous	pH	5.8	5.1
Alkalinity	mEq/L	7.2	6.7
Bicarbonates	mg/L	367.1	367.1

Stiffness	mg/L	4.90	4.90
The dry residue	mg/L	920	840
Calcium	mg/L	76.0	76.0
Magnesium	mg/L	62.35	62.35
Nitrates	mg/L	0	0
Nitrites	mg/L	0.02	0.02
Ammonium ions	mg/L	0.70	0.61
Fluorides	mg/L	1.5	1.5
Phosphates	mg/L	2.31	1.87
Iron	mg/L	0.20	0.20
Sulfates	mg/L	52.0	52.0
Chlorides	mg/L	21.0	20.0
Residual chlorine	mg/L	0	0
Permanganate oxidation	mg O <sub>2</sub> /L	170	94
Dissolved oxygen	mg O <sub>2</sub> /L	1.23	5.14
Biochemical oxygen demand	mg O <sub>2</sub> /L	80.2	52.7
Total number of bacteria	10 <sup>6</sup> cel/ml	5.3	2.9

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According to studies table 2 shows that the use of biological preparation "UF-1" for reservoir water clearing under conditions of laboratory modeling significantly improved the hydrochemical indicators of water quality. The magnitude of BOD dropped by almost half. After treatment using biologic agent "UF-1" the water by hydrochemical and bacteriological parameters characterized as "moderately contaminated".

### Conclusion

The studies show high anthropogenic load on the Shemordan lake ecosystem. Application of «UF-1" under the laboratory modeling contributed to the improvement of the reservoir water quality. Thus the artificial construction of adapted microorganism consortia of bacteria and micromycetes is one of the perspective directions for the rehabilitation of water bodies.

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