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# WATER QUALITY ASSESSMENT OF THE TETERIV RIVER

Zhytomyr oblast is entirely located in the ambit of the basin of the Dniper River. The total quantity of rivers in the region is 2818 with the total length of more than 13.7 thousand km. According to the classification structure of hydrographic system, there are eight medium-sized and no big rivers in the region. The largest part of the region belongs to the basin of the right tributary of the Dniper; 38% of the region's territory is situated in the basin of the Teteriv River. The length of the river is 385 km, the basin area is of 15300 square kilometers. The river flows within Chudniv, Romaniv, Zhytomyr, Korostyshiv and Radomyshl' rayons of Zhytomyr oblast, as well as Ivankiv rayon in Kyiv oblast; and then it flows into Kiev water-storage reservoir. The riverheads are not far from the borders of Zhytomyr and Vinnytsia oblasts, southward from the village Nosivka at the altitude of 299 meters. Because the head of the Teteriv is located on Podillia upland sometimes it has the features of a mountain river. The river has mixed water sources with a predominance of a snow inflow. More than 50% of the river flow consists of snow melt water. River ice formation begins usually in late November - early December and the release from ice is in mid-March. An average freeze time is about 3- 4 months with an average thickness of ice - 0.2-0.5 m. The spring flood increases the river level to 5.2 meters. In some places water spreads in wide to several kilometers and floods low-lying shores. The Teteriv River has a fairly long period of high water - up to the 1st June.

To determine the influence of the city on the river system, this water body was being examined at two observation sites during the period from 2012 to 2014 year. The choice of sampling sites was performed as following: range number 1 - sampling area which is located higher up the town (4.5 km) at the reservoir "Vidsichne". This sampling site allows drawing conclusions about the water quality in the river. The second range - sampling site located lower down the city Zhytomyr (2.5 km). This sampling site allows the quality of water flowing through the city to be evaluated. Such arrangement of sampling sites allows evaluating correctly the water quality of the river at different areas.

The characteristic of water quality of the Teteriv river is evaluated according to the environment quality classification of surface water. It includes a wide range of hydrobiological, hydrochemical and hydrophysical indicators that reflect the features of abiotic and biotic components of aquatic ecosystems [1].

Generalization of water quality assessment by individual indicators with the definition of integral values of classes and categories of water quality is done by analyzing the indicators within scopes of the relevant units: A - indicators of salt content; B – tropho-saprobiochemical (ecological and sanitary) indicators; C - specific indicators of toxic and radiation exposure.

Sampling was conducted according to the current regulations [3, 4, 5]. Clean cups with the volume of 1 $dm^3$ and dark glass cups with frayed lid were used for storage and

transportation of water samples. Water samples were not conserved. The results of hydrochemical measurements and the normative documents on the carried out investigation are given in the table №1.

Table 1

The results of hydrochemical measurements of water samples from the Teteriv River (the average value for the period of investigation)

| № | Name, units of measurement | Results of measurement | | SanPin 4630-88* MAV | Techniques for measurement** |
|---|---|---|---|---|---|
| | | Range №1 | Range №2 | | |
| *1* | *2* | *3* | *4* | *5* | *6* |
| 2 | Temperature, °C | 12,6 | 12,8 | Not rated | MVV 081/12-0311-06 |
| 3 | Hydrogen indicator, pH | 7,5 | 7,7 | 6,5-8,5 | MVV 081/12-0317-06 |
| 4 | Dry sediment, mg / dm3 | 180 | 144 | 1000 | KND 211.1.4.042-95 |
| 5 | Suspended solids, mg / dm3 | 3,20 | 3,50 | 0,75 | KND 211.1.4.039-95 |
| 6 | Permanganate oxidation mg O/dm3 | 1,80 | 2,00 | Not rated | MVV 081/12-0016-01 |
| 7 | Chem. consumption of Oxygen (COD) mg O2/dm3 | 3,20 | 3,30 | 15,00 | KND 211.1.4.021-95 |
| 8 | Biochemical consumption of Oxygen (BOC5) mg O2/dm3 | 2,60 | 4,00 | 4,00 | KND 211.1.4.024-95 |
| 9 | Dissolved oxygen, mg/dm3 | 15,70 | 16,70 | More then 4,00 | MVV 081/12-0008-01 |
| 10 | Ammonium salt, mg/dm3 | 0,08 | 0,19 | 1000 | MVV 081/12-0106-03 |
| 11 | Nitrite mg/dm3 | 0,02 | 0,06 | 3,30 | KND 211.1.4.023-95 |
| 12 | Nitrates mg/dm3 | 20,02 | 20,40 | 45,00 | MVV 081/12-0651-09 |
| 13 | Phosphates mg/dm3 | 0,18 | 1,75 | 3,50 | MVV 081/12-0005-01 |
| 14 | Surfactants, mg/dm3 | 0,02 | 0,05 | Not rated | KND 211.1.4.017-95 |
| 15 | Iron, mg/dm3 | 0,30 | 0,30 | 0,30 | KND 211.1.4.034-95 |
| 16 | Sulfates, mg/dm3 | 13,2 | 13,45 | 500 | MVV 081/12-0007-01 |
| 17 | Chlorides mg/dm3 | 6,30 | 7,20 | 350 | MVV 081/12-0653-09 |
| 18 | Hardness, mg/dm3 | 1,80 | 2,90 | Not rated | MVV 081/12-0006-01 |
| 19 | Calcium, mg/dm3 | 60,9 | 65,8 | Not rated | MVV 081/12-0006-01 |
| 20 | Magnesium, mg/dm3 | 9,83 | 9,60 | Not rated | MVV 081/12-0006-01 |
| 21 | Manganese, mg/dm3 | 0,05 | 0,05 | 0,10 | MVV 081/12-0416-07 |
| 22 | Copper, mg/dm3 | 0,003 | 0,003 | 1,00 | MVV 081/12-0648-09 |
| 23 | Zinc, mg/dm3 | 0,002 | 0,003 | 1,00 | MVV 081/12-0413-07 |
| 24 | Lead, mg/dm3 | 0,006 | 0,006 | 0,03 | MVV 081/12-0414-07 |
| 25 | Nickel, mg/dm3 | 0,005 | 0,005 | 0,10 | MVV 081/12-0649-09 |

* 4630-8804.07.1988 SanPiN "Sanitary rules and protection norms of surface waters against pollution." ** GOST rules and techniques for water measurement.

The biggest contribution to the deterioration of water quality both down and upstream belongs to nitrogen compounds and heavy metals. Having analyzed the values of surfactants (from 0.02 to 0.05 mg / dm3), nitrates (from 20.02 to 20.40 mg / dm3), phosphates (0, 18 to 1.75 mg / dm3) and sulfates (from 13.2 to 13.45) it can be denoted that beyond the city (range№ 2) water quality deteriorates. According to these indicators, water quality in the Teteriv river reduces by 1-2 category.

Water quality assessment in terms of its salt composition indicators shows that according to pollution criteria, the river water is of the I quality class of the lowest indicators and it occupies a transitive position from the I to the II class of the worst indicators.

General environmental index (GEI) was calculated according to the recommendations. [2]. Minimum values of GEI for water samples at the range **№**1fluctuated from 2.8 to 3. GEI values of water samples from range № 2 were the worst: from 3.3 to 3.5. Average values of this indicator for all study period ranged from 3.1 to 3.3; such values characterize the water as clean enough. The values of certain block parameters in water samples higher up and lower down Zhytomyr were, respectively, the following: I(s) = 1,8 and 2,0; I(ts) = 3,1 and 4,2; I(t) = 3,6 and 3,9.

Hydrochemical state of the river Teteriv hadn't extremely altered during the survey period. The content of dissolved oxygen was satisfactory: within 15,70-16,70 mg O2/dm3 (at the rate of at least 4.0 mg/dm3).

Compared to the previous years, inconsiderable deterioration of the following indicators was seen: COC - 3.20 - 3.30 against of 3.00 mg O2/dm³ and BOC - 2.60 - 4.00 against of 3.30 mg O2/dm³. Other indicators did not significantly alter; the general state of the river remains stable.

The results of the surface water radiological analyzes on 137Cs and 90Sr [6] contamination show that the content of the controlled radionuclides in drinking water samples during the indicated period was lower than the established criteria for drinking water. Thus, 137Cs concentration was 0.001 Bk/m3, and 90Sr concentration - 0,008 Bk/m3 compared to the controlled pollution levels - 2,000 Bq/m3.

The three-year monitoring of water quality in the river Teteriv revealed the following: in general, the quality of the river water meets the MAC norms for community water use; according to defined environmental index, indicator values show that water is clean enough; water quality in terms of its salt composition indicators is considered to be transitive (from the I to the II class); and the indicators of tropho-saprobiological block transit from – the III to the IV quality class; according to the indicators of substances from the specific block of components which can cause radioactive and toxic contamination, river water belongs to the I-st water quality class. Generally, the river Teteriv water corresponds to the II class of water quality.

But it is worth noting that over the past three years, the water pollution of the Teteriv has increased slightly. This is mainly due to insufficient cleaning and even non-

cleaning of wastewater of municipal and industrial companies in the region. This problem needs for regular monitoring of water quality in the river Teteriv.

## REFERENCES


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