

DYNAMICS OF SOME WATER QUALITY INDICATORS ON ȘOMUZU MARE RIVER DURING 2008

CRISTINA MAXIM^{*2}, DUMITRU COJOCARU¹

Keywords: Pollution, water quality indicators

Abstract: The experimental data analyzed in this paper are part of a larger study concerning the evaluation of the degree of pollution of the waters in the superior basin of Siret River and refers to the dynamics of some chemical and biological parameters of Șomuzu Mare River, tributary to Siret River in Suceava County.

INTRODUCTION

One of the major issues of the contemporary society is the increasing pollution of the soil, waters, air and therefore of the aliments we consume. It is of utmost importance that the implementation of the ecological, pollution-free technologies is accompanied by a permanent monitoring of the surrounding environment in order to adopt the necessary measures to stop pollution. Since Suceava County has plenty of industrial firms, mining plants and animal farms presenting pollution potential, we have decided to present in the present paper some of the chemical and biochemical indicators by evaluating the chemical and biochemical Oxygen consumption (CBO₅, CCO-Mn and respectively CCO-Cr) in the degree of pollution of the waters of a river tributary to Siret River in this county.

MATERIALS AND METHODS

In order to evaluate the dynamics of the pollution degree of the water in Șomuzu Mare River water samples have been collected from two different areas – the Vorniceni section, upstream, a place about 56 km up the flowing point; and the Dolhești section, downstream, about 13 km from the flowing point - all along 2008, at a regular two months interval. There have been considered for the study the main quality indicators referring to the aerating character according to the present legislation: the concentration value of the dissolved oxygen which has been evaluated using the electrochemical method implying the use of a borehole, the biochemical oxygen consumption (CBO₅) after five days and the chemical oxygen consumption (using the potassium permanganate (CCO-Mn) method and the bichrome (CCO-Cr) method).

RESULTS AND DISCUSSIONS

In order to perform a correct interpretation of the values we have obtained after determining the concentration of the dissolved oxygen, the biochemical oxygen consumption after five days (CBO₅) and the chemical oxygen consumption (CCO-Mn and CCO-Cr), we have analyzed the results we have obtained by comparing them with the maximum limits admitted for the five water quality classes of the surface waters, according to the Regulation No. 161/2006 concerning the approval of the Normativ on the reference objectives of surface waters classification (table I)

Table I: The maximum limits admitted for some of the surface water quality indicators according to the Regulation 161/2006 concerning the approval of the Normative on the reference objectives of surface waters classification

Nr. crt.	Quality indicator	U/M	Quality class				
			I	II	III	IV	V
1	Dissolved oxygen	mg O ₂ /l	9	7	5	4	<4
2	BOC ₅	mg O ₂ /l	3	5	7	20	>20
3	CCO-Mn	mg O ₂ /l	5	10	20	50	>50
4	COD-Cr	mg O ₂ /l	10	25	50	125	>125

Given the fact that oxygen is a chemical element absolutely necessary to all aerobe organisms, including the aquatic ones, one of the water quality indicators measured is the concentration of the dissolved oxygen.

In our experiments we have determined the concentration of the dissolved oxygen in the water of the Şomuzu Mare River in the two above-mentioned locations at a two months regular interval all along 2008 (fig. 1).

Just as the data presented reveals, in February 2008 the concentration of the dissolved oxygen was 12.00 mg/l and respectively 12.85 mg/l in the two locations mentioned above; thus, the waters of this river fell at the time in the first class water quality. In spite of the fact that in April the concentration of the dissolved oxygen slightly dropped, especially at Vorniceni, the waters of this river are still situated in the first class water quality (9.59 mg/l and respectively 10.47 mg/l).

The rising temperatures of the environment during the summer months trigger a progressive dropping of the oxygen concentration in the two locations, more significant at Dolheşti (8.55 mg/l in June and 7.24 mg/l in August) (9.35 mg/l in June and 8.61 mg/l in August at Vorniceni). This means that during the summer months, the waters of the studied river fall into the second class of water quality in what the oxygen concentration is concerned, since once the temperature dropped in October and December these waters have come back to the first class water quality (8.32 mg/l in October and 9.65 mg/l in December at Dolheşti and respectively 10.13 mg/l in October and 11.00 mg/l in December at Vorniceni).

This dynamic of the oxygen concentration in the analyzed water proves the fact that the value of this parameter depends greatly on the environment temperature, be it directly or due to other phenomena like the activity of the aquatic micro biota and the possible wastes discharge.

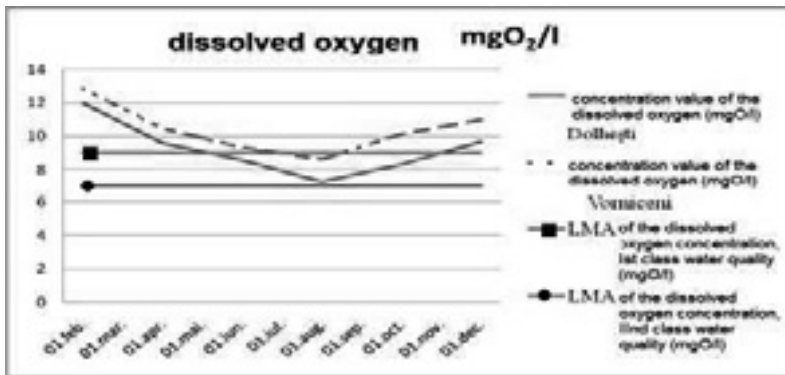


Fig.1: The concentration evolution of the dissolved oxygen in the waters of Şomuzu Mare River at Dolheşti and Vorniceni during 2008

For a clearer image of the chemical and biochemical phenomena taking place in the waters of this river we have further determined another parameter, more precisely the oxygen consumption both in the biologic and the chemical processes, by evaluating the biochemical oxygen consumption (CBO₅) and the chemical oxygen consumption (CCO-Mn and respectively CCO-Cr). The results are presented in fig 2 and fig.3

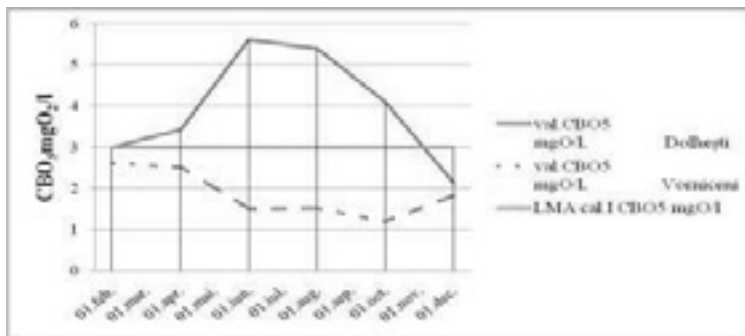


Fig. 2: The evolution of the biochemical oxygen consumption (CBO₅) in the waters of Şomuzu Mare River at Dolheşti and Vorniceni during 2008

Just as the data presented in fig. 2 reveal it, the value of the parameter CBO_5 was situated within the admitted limits of the first class water for the samples collected in February 2008 in both locations mentioned above (3.00 mg O_2/l at Dolhești and respectively 2.62 mg O_2/l at Vorniceni), taking into account the fact the maximum admitted limit for this water quality class is 3.00 mg O_2/l . During the following period, there has been registered a progressive dropping of the values of this parameter at Vorniceni; this parameter has registered further values within the admitted limits until the end of the year (1.82 mg O_2/l in December 2008). At Dolhești there has been an important increase in the following time interval, with the maximum in June (5.61 mg O_2/l), followed by a gradual decrease period, the level going under the maximum limit admitted for the first class water quality only in December (2.13 mg O_2/l).

From the data presented we can conclude that, from the point of view of the biochemical oxygen consumption, the waters of Șomuzu Mare River fall into the first class water quality during the cold half of the year (during the intervals January-April and October-December) at Dolhești, and during the warm half of the year (April-October) the same waters fall into the second class water quality for surface waters; at Vorniceni, the situation is different, since the waters of Șomuzu Mare River met the requirements for the first class water quality all along 2008.

As the chemical oxygen consumption (CCO-Mn) is concern, the values of this parameter were below the maximum admitted limit until April 2008 in both sections studied (4.00 mg O_2/l in February and 4.34 mg O_2/l in April at Dolhești and respectively 4.45 mg O_2/l in February and 3.89 mg O_2/l in April at Vorniceni), the maximum admitted limit for first class quality water being 5.00 mg O_2/l (fig. 3.)

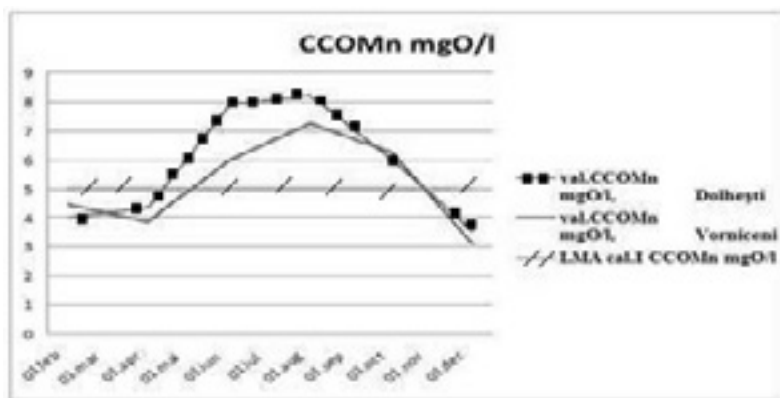


Fig. 3: The evolution of the chemical oxygen consumption (CCO-Mn) in Șomuzu Mare River at Dolhești and Vorniceni during 2008

During the following time interval there has been a slight degradation of the quality of these waters at both sections studied (with a CCO-Mn maximum in August of 8.21 mg O_2/l at Dolhești, respectively 7.24 mg O_2/l at Vorniceni, which corresponds to the third class quality water). With the dropping of temperature, the values of the CCO-Mn parameter gradually decrease at both locations studied reaching values situated below the maximum admitted limit in December.

The dynamic of the CCO-Cr parameter represents a similar aspect (fig. 4). The samples collected in February, the CCO-Cr values were below the maximum admitted limit at both locations studied, but the rest of the year these exceeded the maximum admitted limit at Dolhești, while at Vorniceni this limit is exceeded only until August.

This dynamic of the chemical oxygen consumption (CCO-Cr) correlates with the dynamic of the CCO-Mn parameter, but it is entirely different of the changes the biochemical oxygen (CBO_5) consumption registered in time especially at Vorniceni. This detail makes us think that the temperature of the environment greatly influences the chemical oxygen consumption in the sample waters collected from both locations, which implies the existence of some intense chemical transformations during the warm period of the year. However, at the same time, the oxidative biochemical processes are strongly influenced only in the water samples collected from Dolhești, because at Vorniceni these processes seem to fall into the normal limits of first class quality waters.

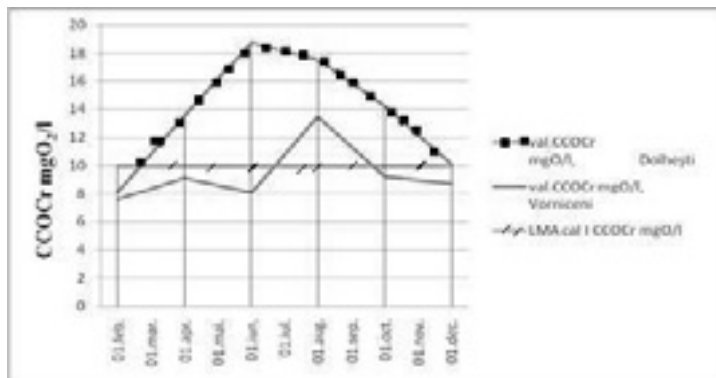


Fig. 4: The evolution of the chemical oxygen consumption (CCO-Cr) in the waters of Şomuzu Mare River at Dolheşti and Vorniceni during 2008

CONCLUSIONS

Although the experimental data analyzed represent only the results of a preliminary study, since they will be further fill in with other chemical and biochemical parameters, we can come up with some conclusions referring to the oxygen regimen in the waters of Şomuzu Mare River at Dolheşti and Vorniceni during 2008.

The concentration of the dissolved oxygen depends directly on the temperature of the environment and falls into the normal limits of first class quality surface waters only during the warm interval of the year.

The biochemical oxygen consumption falls into the normal values of first class quality waters all along the year only for the water samples collected from Vorniceni, while the water samples collected from Dolheşti correspond to this class of water quality from the point of view of the biochemical oxygen consumption only during winter.

The chemical oxygen consumption, evaluated by CCO-Cr and CCO-Mn parameters, generally exceeds the maximum values admitted for first class quality waters during the warm interval of the year, being quite close to the maximum limit admitted during the cold period of the year.

REFERENCES

- Duţă Anca**, (2001): *Pollution monitoring and water treatment*, Publishing Universităţii Transilvania, Braşov, pg. 166, 167
- Negulescu, M.**, (1982): *Protection of water quality*, Technical Publishing, Bucureşti
- Popa Elena, Pecingină Irina**, (2008): *Water quality analysis, pollution and remediation*, Publishing Sitech, Craiova, pg 19, 64, 74-76
- Popa Elena, colab.**, (2007): *Environmental organic pollutants*, Publishing Universităţii, Bucureşti
- Povară, Ioan**, (2007): *Environmental geography, pollution and environment protection*, Publishing Fundaţiei România de mâine, Bucureşti, pg 219
- Surpăţeanu Mioara**, (2007): *Hydrochemistry and water quality analysis*, Publishing Performantica, Iaşi, pg 132-135
- Surpăţeanu Mioara, Zaharia Carmen** (2002), *Methods of quality analysis of environmental factors*, Publishing T, Iaşi, pg 81-84

¹ PhD, Professor, University A.I. Cuza Iaşi

² PhDs, University A.I. Cuza Iaşi, prof. College "Mihai Eminescu", Suceava

* cris_antema@yahoo.com