COMPARATIVE STUDY OF PHYSICAL INDICATORS AND THOSE OF THEIR REGIME OF OXYGEN, ON WATER QUALITY OF THE GREAT ŞOMUZU RIVER, IN THE YEAR 2009

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Keywords: Surface water, pollution, quality indicators, methods of analysis, monitoring.

Abstract: Water quality is an organic component of the system and economic management of water sources. The experimental data analyzed in this paper are part of a broader study on the assessment of water pollution in the upper basin of the Siret River and refers to the dynamics of physico-chemical and biochemical parameters, of Şomuzu Great River, a tributary of the Siret from Suceava County.

To do this, were collected every two months, samples of river water Şomuz from two different locations, from Dolhesti and Vorniceni, located 43 km apart. Water Sampling was done according to standards.

There were included in the main study physico-chemical quality, according to current regulations, PH - The concentration of dissolved oxygen, biochemical oxygen demand (BOD5) and chemical oxygen demand. Determinations and titrimetric methods are generally Spectophotometric. Determination of pH was done with a Seven Easy pH meter, which operates on the basis of electrochemical methods, and dissolved oxygen content was determined experimentally using electrochemical probe method

Based on data from water quality was monitored and were found to match the physical and chemical quality indicators.

The results allowed a characterization of water chemistry and establishing relationships with the natural factors, such as, fluid flow and temperature.

It can be concluded therefore that both the anthropogenic and natural factors can influence the general indicators describing the water chemistry.

INTRODUCTION

One of the major problems of the modern times is that of pollution of the soil, waters, air and of course of the aliments.

Romania as a member country of the EU, undertook that until November 2015 to reach a good ecological stage of the waters. The implementation of the nonpolluting, ecological technologies, must be accompanied by the constant monitoring of the surrounding environment in order to adopt optimal measures of stopping the pollution. Because of the fact that in Suceava are a multitude of industrial companies, mining complexes and animal farms with pollutant potential, in this work we have proposed to analyze some chemical and biochemical indicators of the chemical consumption and of the biochemical indicator of the oxygen (CBO, CCO-Mn and CCO –Cr) of the pollution degree of the waters of a branch of the river Siret from the territory of this county.

MATERIALS AND METHODS

To assess the dynamics of river water pollution Şomuzu Great water samples were collected from two different locations - Vorniceni section, the upstream location at 56 km from the mouth and Dolhesti section, downstream, 13 km away from the estuary - throughout the year 2008, every two months. There were included in the study as the main indicators related to the aeration system according to current regulations: the dissolved oxygen concentration was measured by electrochemical probe method, biochemical oxygen demand after five days (BOD5) and chemical oxygen demand, method potassium permanganate (COD-Mn) and potassium dichromate (COD-Cr).

RESULTS AND DISCUSSIONS

For a correct interpretation of values obtained in measurements of dissolved oxygen concentration, biochemical oxygen demand in 5 days (BOD5) chemical oxygen demand (COD and COD-Cr-Mn), we analyzed the results compared with the maximum permissible values for

the five classes of surface water quality, according to the Order 161/2006 on the approval of the standard benchmarks for surface water quality classification.

Permissible values of quality indicators of surface water according to the Order 161/2006 for approving the Norms on the benchmarks for quality classification

INDICATORS OF PHYSICAL AND CHEMICAL DYNAMICS OF THE GREAT RIVER SOMUZU , YEAR 2009

Table. 1.Dynamics of pH in The Great Somuzu River , locations : Voroniceni and Dolhesti in 2009

Collection Day	***03/02/2009***	***05/04/2009***	***07/06/2009***	***09/08/2009***	***10/10/2009***	***08/12/2009***
Dolheşti	**8.0**	**8.1**	**8.0**	**8.1**	**8.0**	**8.3**
Vorniceni	**8.1**	**8.2**	**8.0**	**8.1**	**8.1**	**8.2**

PH values, table 1, are almost constant, slightly alkaline water is determined by content of character appreciable alkali and alkaline earth carbonates. These waters will solubilize mineral acid rocks (sulphates, nitrates), resulting in increased concentration of anions SO_4^{2-} and NO_3^- in water. *(Daniela Cîrţînă, 2005)*

Apparently constant pH of natural waters suggest that they may be treated as steady state systems *(Mioara Surpăteanu, 2007)*

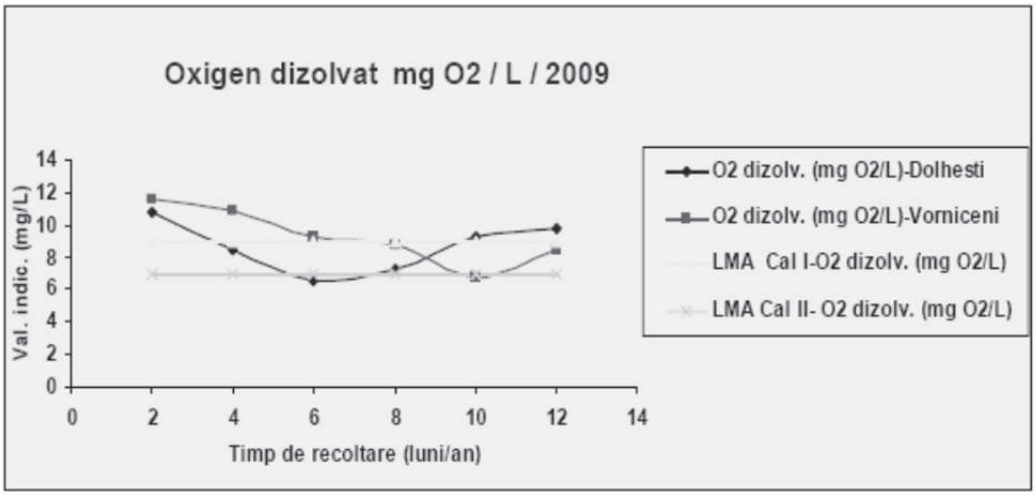

Figure 1. Evolution of dissolved O_2 concentration in The Somuzu Great River waters, location: Dolhesti and Vorniceni, during 2009

Dissolved oxygen content is the most important water quality parameter because the presence of oxygen is essential for aquatic life. The level of oxygen content can appreciate the

effect on aquatic organisms and oxidation residue of self-purification process development, *(Mioara Surpăţeanu, 2007).*

During 2009, the amount of dissolved oxygen is lower in downstream than upstream, until the eighth month and this month, with decreasing temperature increases the amount of dissolved oxygen downstream (Dolhesti) and decreases in the upstream (Vorniceni) Figure 1. This decrease in dissolved oxygen due to photosynthesis and improving processes to reduce oxidation of organic substances. Decrease the amount of oxygen in the water, reducing self-purification capacity of natural waters, favoring persistence of pollution. *(Mioara Surpăteanu,2002)*

In the spring-summer the river falls into the category Şomuz water quality II in Dolhesti location, and dissolved oxygen concentration Vorniceni exceeds the maximum permissible water quality I only in the tenth month, at a temperature of 140C (Fig. 1). Increasing the dissolved oxygen concentration may be due, first, contact with atmospheric air and secondly, UV radiation of sunlight, which in addition to their bactericidal role, allowing the aquatic plants photosynthesis reaction that results in the formation of glucose and oxygen:

$$6CO_2+6H_20 = C_6H_{12}0_6+6O_2$$

This explains the fact that daytime oxygen in water could double the quantity of oxygen during the night. Molecular oxygen, dissolved, promotes the destruction of anaerobic bacteria and at the same time contributes to the oxidation of organic matter. In addition, molecular oxygen dissolved aerobic bacteria help in their fight against anaerobic bacteria (much more dangerous to humans). Regarding the indicator changes BOD5 (Figure 1), which indicates the amount of oxygen used in a given time for the bacterial oxidation of organic matter present in water, the value of this parameter exceeds the maximum permissible water quality I, downstream (Dolhesti) throughout the year 2009, the sixth month reaching a maximum of 5.36 mgO2 / L, making in the River Şomuz in this case a third quality water. A high value of BOD5, water indicates the presence of large amounts of biodegradable organic compounds. Biochemical oxygen demand increases with the amount of organic substances in water *(Trufas Valer, 1980)* Upstream (Vorniceni), where the elevation is higher BOD5 parameter value does not exceed the maximum permissible water quality I, but very little at the end, probably due to low temperature.

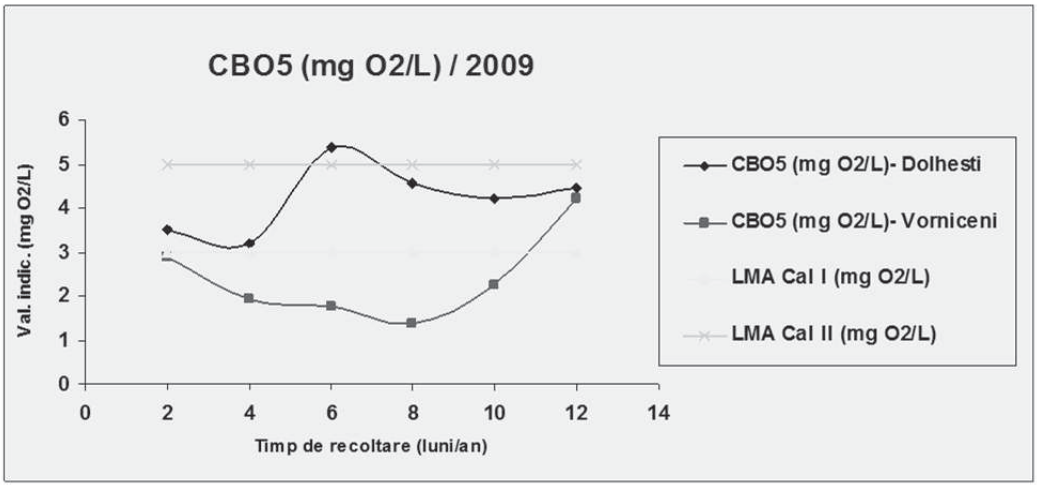

Fig 2. The Evolution of the BOD5 indicator in the Great River Somuzu , location : Dolhesti and Voroniceni, during 2009

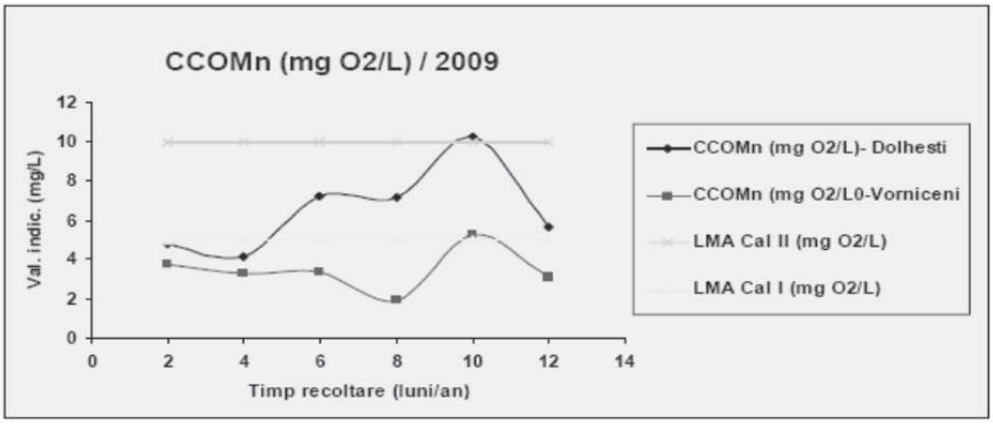

Figure 3. The evolution of the CCO-Mn indicator in the Great Somuzu River , locations : Dolhesti and Voroniceni , during 2009

CCOMn determination requires action on the excess KMnO4 oxidizable substances in water, in acid medium,at hot temperature

Subst. MnO_4 oxidizable $+ 8H^+ \rightarrow$ subst. oxidized $Mn^{2+} + 4\ H_2O$
(Trufas V., 2003).

COD-Mn dynamics indicator (fig.3) is similar to the BOD5 in the two locations. COD-Mn Downstream value increases during the spring-summer (high content of organic matter) and decreases at the end of the year, with decreasing temperature. During 2009, the river Şomuz in Dolhesti location is within the water quality category II, and the tenth month, less than the

maximum permissible limit for water quality II. Upstream (Vorniceni), CCO-Mn parameter value does not exceed the maximum permissible water quality I Şomuz river water quality is an I in terms of this parameter.

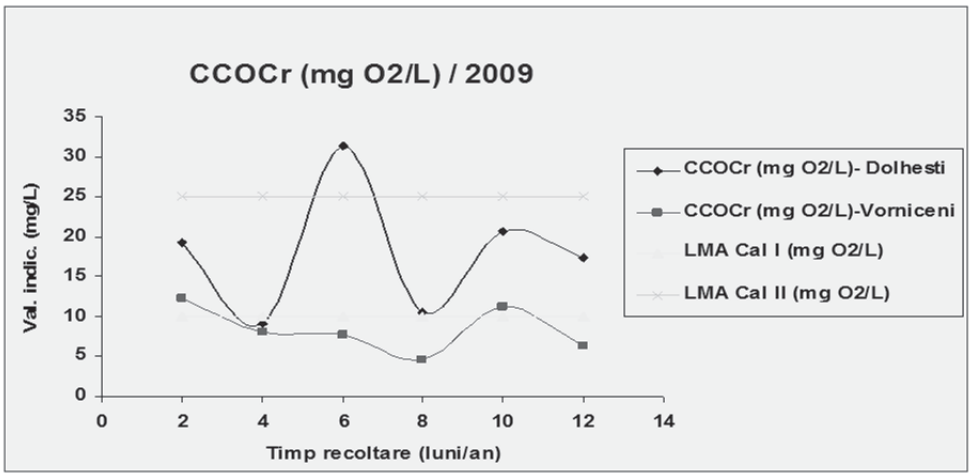

Figure 4. The evolution of the CCO-Cr indicator in the Great Somuzu River waters , location :Dolhesti and Vornoniceni , during 2009

Looking at Figure 4 reveals fluctuating parameter variation CCO-Cr Şomuz river water, downstream, the location Dolhesti, this indicator values exceeding the maximum permissible limit for water quality I. In the sixth, CCO-Cr value is 31, 25 mg O2 / L, river water is Şomuz this month, a water quality III a. The CCO-Cr causes 70% of non-biodegradable organic mass, so in the sixth month in Dolhesti location, the river water is rich in organic matter. Upstream, in terms of COD-Cr indicator, the river is the water quality Şomuz I, throughout the year 2009.

Comparative study of the chemical and physical indicators on the quality of the Great Somuzu River waters, location Dolhesti, year 2009

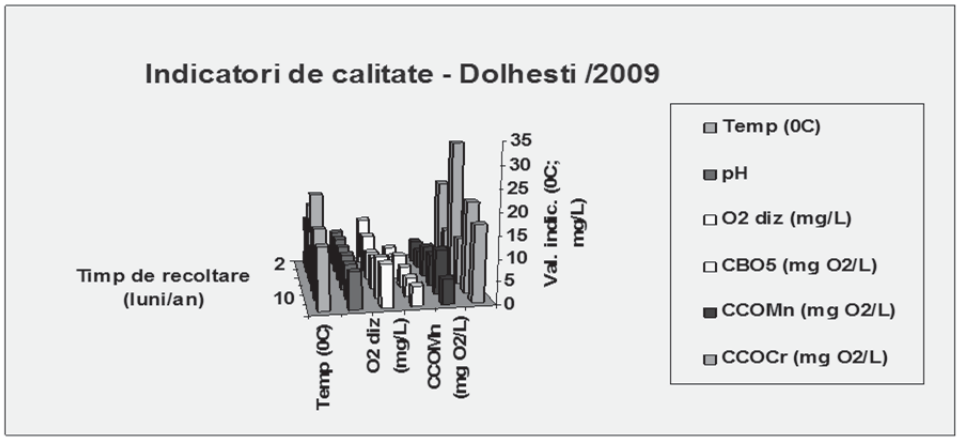

Figure 5. Comparative study of the physical indicators(temperature,pH,dissolved O2)with the chemical indicators(CBO5, CCO-Mn, CCO-Cr),location Dolhesti , year 2009.

The comparative study of physical indicators (temperature, pH, dissolved O2) with chi-small and biochemical indicators (BOD5, COD-Mn, CCO-Cr), the location Dolhesti, 2009 (Figure 5 shows the following:

- ✓ At the lower temperature regime indicators increased concentrations of oxygen, O2 dissolved due to the reduction of oxidation processes of riverbeds, and increase opportunities to dissolve a larger amount of oxygen in the atmosphere;

- ✓ At low dissolved oxygen concentrations correspond to high levels of COD-Cr indicator which confirms the presence of biodegradable organic matter in water; In water devoid of oxygen, decompose organic matter by anaerobic processes,produce the production of hydrogen sulphide and other toxic gases with bad smelling *(Gavrilescu Elena, 2007*)

- ✓ Once the heating water,) there is a decrease of oxygen in hipolimnion due to oxidation processes, bacterial decomposition or fermentation of organic matter, and breathing creatures, processes that occur with the consumption of oxygen;

- ✓ At high concentrations of dissolved oxygen indicators correspond to small values of BOD5 and COD-Mn. These indicators correlate best: report CBO5/CCO-Mn having values*;(Daniela Cîrţînă,2005)*

- ✓ Biological self-purification ≥ 0.6 indicates, there is a synergistic context (cumulative) of the determinants of self-purification capacity of water;

- ✓ BOD5 parameter values relatively low, indicating reduced amount of biodegradable compounds in water, so the amount of oxygen consumed by microorganisms to decompose, the biochemical pathway, existing organic substances in water is low.

Comparative study of the physical and chemical indicators on the quality of the Great Somuz River waters, location Vorniceni, year 2009

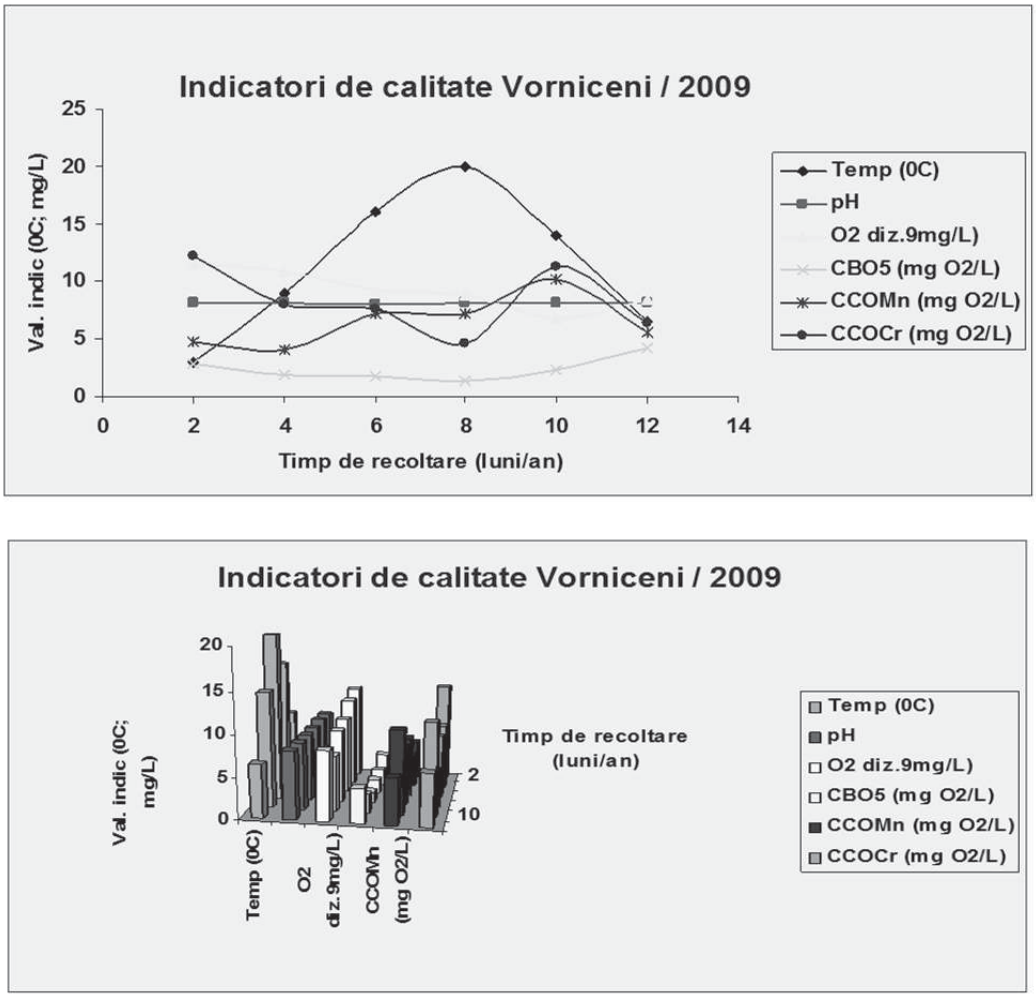

Figure 6. Comparative study of the physical indicators(temperature ,pH, dissolved O2) and chemical indicators(CBO5, CCO-Mn, CCO-Cr),location Vorniceni,year 2009.

From the data analysis presented in Fig. 6, we deduce:

- At high temperatures, corresponding to small amounts of oxygen dissolved in water and low levels of BOD5 indicators, and CCOMn CCOCr, so small amounts of biodegradable and non-biodegradable organic matter;
- BOD5 parameter correlates better with CCOMn parameter, the report has value ≥ 0.6 CBO5/CCO-Mn which confirms the existence of a synergistic context (cumulative) of the factors that caused a slight biological self-purification**;**
- The presence of large amounts of water causes oxygen levels low BOD5. The BOD5 value is less than the amount of biodegradable compounds in water is less; In oxygen-rich waters, biological mineralization of organic matter is a complex process that takes place in two phases: first phase oxidizes carbon in organic substrate, and the second phase, nitrogen (nitrification). The difference between the chemical oxygen demand COD and BOD5 water is due to substances that cannot be decomposed microbiologically.

CONCLUSIONS

By studying the evolution of some physical and chemical parameters of river Great Şomuz over a period of two years, as it considers its status in the locations studied. Observe how the river responds to the elements disrupters, such regains balance through a process of self-purification.
Water quality does not remain constant over time, it may vary due to many factors, either man-made (anthropogenic factors) are of natural origin (of which, obviously, some man has a contribution).
The Report BOD5 / COD-Mn gives information about biological self-purification capacity: ≥ 0.6 if self-cleaning will be easier if the range of 0.2 to 0.4 will produce only self-cleaning thermal conditions favorable, and the report below 0.2 there is no biological self-purification. The experimental data shows that for all locations studied, the report CBO5/CCOMn is ≥ 0.6, which indicates that it has the ability to neutralize the natural water impurities falling into it and restore the ecological balance previously existing contamination: physical processes : dilution, mixing, diffusion, sedimentation, flocculation, dissolved oxygen, releasing gas into the air, influenced by IR and UV solar radiation, water temperature - chemical processes: neutralization, oxidation, reduction, floculaţie, precipitation, adsorption, absorption , photochemical degradation - biological processes: the biocoenosis own competing foreign elements, either directly, by action lithic (bacteriophages), filtering (scallops), consumption or secretion of toxic substances for intruders - biochemical processes - in the nitrogen cycle, sulfur and carbon, based on specific microorganisms (bacteria, fungi). They are more influenced by various factors such as pH, sunshine, oxygen saturation, temperature. The latter acts as Van `t Hoff's law: increase doubles decompositions 10oC.
In 2009, the situation is worsening in location Dolhesti, over 2008,indicator values CCOCr, CCOMn, nitrates, phosphates,phosphorus, water quality remains at the level II, but concentrations of CBO5, ammonia, nitrates value indicates the quality of water III, and nitrates indicates the quality IV, for Somuz rever water.
In 2009, water quality at Vorniceni Section is kept at I for all indicators studied, except nitrogen indicator, which places the Great Somuz River waters at grade II quality.
During one year, the average monthly dissolved oxygen in river water has an opposite variation of temperature. In summer high temperatures acting on the lower oxygen solubility, and promote

the growth of bacteria that consume it, winter supply of groundwater reduces oxygen saturation water *(Valer Trufas, 2003*)

All the conclusions presented above show that the assessment of water quality (and hence the possibility of using it for different purposes) is a task of great complexity. The mere existence of accurate results of a large variety of organoleptic analysis, physical, chemical, biological and bacteriological etc. proves insufficient for a correct interpretation, determining causality, the prediction of evolutionary trends and other elements necessary to establish an appropriate management accordingly. It requires interdisciplinary collaboration between biologists, chemists, physicists, geographers / hydrologists, geologists, meteorologists, physicians, computer, etc..

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