THE QUALITY OF THE TIMIS RIVER WATERS

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Abstract: *The study of the quality of a river's waters is of great ecological importance if we take into account that surface water pollution is, nowadays, a major issue amplified at global scale because of the agricultural and industrial pollutants that reach the rivers. The sources most widespread of surface water pollution are organised ones – sewage water from rural localities, sewage water from animal farms and from industry – but there are also non-organised sources of pollution such as rural localities that lack sewage systems, wastes stored in improper places and ways, etc. Timiş is the biggest river of Banat: it starts in the Semenic Mountains, it is 339.7 km long (of which 241.2 km in Romania), and its basin covers 13,085 km^2, with a medium flow of 47 m^3/s. Monitoring the quality of the Timiş River waters was done in three control stations – Constantin Daicoviciu, Lugoj and Graniceri – through the sampling of the water in four sampling campaigns – February, May, August and September – during three years (2009-2011). The water was analysed in the Quality Laboratory of the Banat Water Basin Administration. The main quality indices we monitored were: suspension matter content, oxygen chemical consumption, nitrate content, and lead content. Results show that, upstream, in the control station Constantin Daicoviciu, the water is less polluted, which groups it in the 1st and 2nd quality classes; in the control point Lugoj, water was more polluted, ranging in the 2nd and 3rd quality classes, with suspension matter and lead content above maximum admitted limits; in the Graniceri section, there were significant values above maximum admitted limits in all quality indices we monitored during the three experimental years, ranging water in the 3rd and 4th quality classes because of the suspension matter, oxygen chemical consumption, nitrite content, and lead content. The conclusion we can draw is that the waters of the Timiş River are polluted in the Lugoj and Graniceri sections, that the main causes of the pollution are waste waters from households, wastes from households, wastes from crop and animal farms in the area, and hydric erosion in the hydrographic basin of the Timiş River (natural source of pollution). In order to improve the quality of the Timiş River waters downstream we need to develop effective sewage systems in rural localities, water treatment stations and controlled removal of waste waters.*

Key words: *quality of a river's waters, the quality indices, nitrate content oxygen, chemical consumption, lead content*

INTRODUCTION

The Timiş River is the longest inner river of the Banat area: it springs from the eastern slopes of the Semenic Mountains, Caraş-Severin County. The river takes shape at the confluence of three branches – Semenic, Grădişte and Brebu – and it flows into the Danube, at Pancevo, Serbia.

The river is 339.7 km long, of which 241.2 km are on Romanian territory. Its hydrological network covers 13,085 13.085 km², and its mean flow is 47 cubic metres/s.

Pollution of surface waters has serious impacts on both aquatic life and plant and animal life in the surrounding area and even on human life because of the large number of diseases that can be transmitted through direct contact with the polluted water

The main natural polluting ways of river waters is while crossing soluble rock areas (salt deposits, sulphate deposits), when large amounts of salt reach the waters, or radioactive rocks; while crossing soil erosion areas, which soils the waters because of the solid particles, particularly if the soils are made of fine particles such as marl or clay that keep in suspended for long periods of time; while crossing vegetation-rich areas because of the fallen leaves or of the entire plants falling into the water (RADULESCU, 2002).

The cases when water pollution is caused by wastes discharged into the major watercourses are rather common, particularly urban wastes and solid wastes, ashes from the thermo-electric power stations operating on coal, different slags, sterile from the mining preparations, sawdust and wood wastes from timber factories, as well as wastewaters from animal or crop farms (that are, generally, similar to urban wastewaters) (http://www.greenagenda.org/eco-aqua/supraf.htm).

MATERIAL AND METHODS

The Timiş River water quality was monitored between 2009 and 2011 in three monitoring points – *Constantin Daicovici*, *Lugoj* and *Grăniceri* according to the standards stipulated by the Law No. 161 from 2006; water was sampled from these points and then analysed in the laboratories of the Timişoara "Apele Române" Agency.

Classifying water quality was done depending on the concentration of its quality indices and on the river flow at the time of water sampling.

Water sampling for chemical analysis was done in capped or tightly closed glass or plastic bottles. The bottles were well washed with a sulphur-chrome and detergent mixture and then cleansed with tap water, distilled water, and then dried to remove any trace of organic matter or other impurities (ŞMULEAC, 2010).

To measure the amount of total suspended matter, we used the photometric method: we homogenised the sample and we measured the absorbance at a wave length of 810 nm with a DRELL DR 2000 spectrophotometer using a tub with an optic drum of 25 mm, taking distilled water as reference; we then read the concentration in mg suspended/l of water, according to the measured absorbance.

Measuring nitrates

To prepare reactant solutions and to make measurements we used glass apparatus bidistilled water.

The working sample solution I: we measured 25 cm^3 reserve sample solution I which we transferred into a 250 cm^3 graded balloon; 1 cm^3 of the working sample solution I contains 0.1 mg NO_3^-.

The working sample solution II: we measured 25 cm^3 reserve sample solution II that we transferred into a 250 cm^3 graded balloon, which we tampered with bidistilled water and stirred to homogenise; 1 cm^3 of the working sample solution II contains 0.01 mg NO_3^- (STAS 161/2006).

Measuring biochemical oxygen consumption

Biochemical oxygen consumption (BOC) is the amount of oxygen consumed by microorganisms for the oxidative degradation of the chemicals in 1 dm^3 of water. They have established that biochemical oxygen consumption should be done for an incubation period of several days (BOC_n), as a rule, a period of 5 days $\pm$ 6 h (BOC_5). Biochemical oxygen consumption is expressed in mg/dm^3.

Measuring biochemical oxygen consumption is done on water samples as such, when the value of this consumption is up to 6 mg/dm^3. In the case of water samples, whose biochemical oxygen consumption values are higher, water samples should be diluted accordingly.

Biochemical oxygen consumption represents the difference between the concentrations of the oxygen dissolved in the sample analysed at the beginning and at the end of the incubation (VARDUCA, 2000).

RESULTS AND DISCUSSION

In the study, we monitored the evolution of the main quality indices of the Timiş River water between 2009 and 2011, at three control points: Constantin Daicoviciu, Lugoj and Grăniceri. We sampled water in four sampling campaigns – February, May, August, and September.

Analysis results allowed us to process and asses the evolution of the main quality indices: amount of suspended matter, amount of nitrates and amount of nitrites.

We then assessed the quality of the river water in the three control points in correlation with the quality limits and classes stipulated by the standards during the period analysed and in the four sampling campaigns representative for each season. The three control points are representative for the Timiş River.

In 2009, the evolution of the main quality indices in the upper sector of the Timiş River: the amount of suspended matter, the amount of nitrates and the amount of nitrites are close to the maximum admitted limit, with slight values above the maximum admitted limit in nitrites, particularly in August and May, which makes the water qualify as 2nd quality. The quality of the water in the control point Constantin Daicoviciu was good (it reached normal limits).

In the control point Lugoj, in 2009, the amount of suspended matter was much larger, as well as that of nitrates and nitrites, with significant values above maximum admitted limits according to the standards, which qualifies the water as 2nd and 3rd quality in all months.

In the Grăniceri control point, where the Timiş River leaves Romania, the amount of suspended matter is much too high in May, which qualifies the water as 3rd quality in this month. The amount of nitrites is above maximum admitted limits, which qualifies the water as 5th quality class in May according to the standards. Nitrate amounts are also above maximum admitted limits, which qualifies the water as 2nd class quality in 2009 (Figure 2).

The highest chemical oxygen consumption in 2009 was in Grăniceri, followed by Lugoj, where pollution intensity was higher (Figure 3).

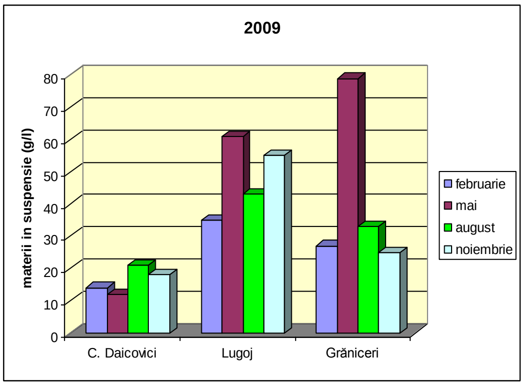


Figure 1 Evolution of suspended matter amount

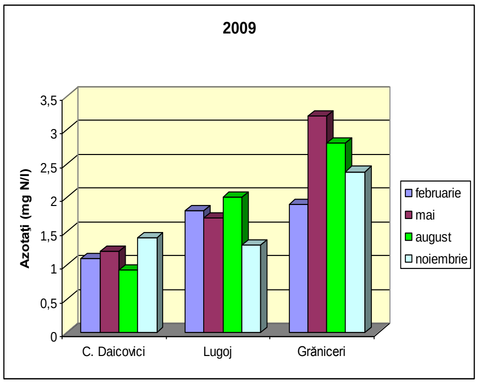


Figure 2 Evolution of nitrate content

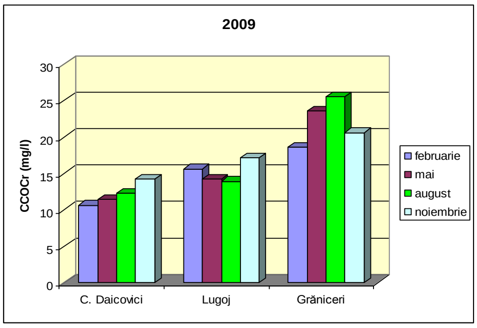
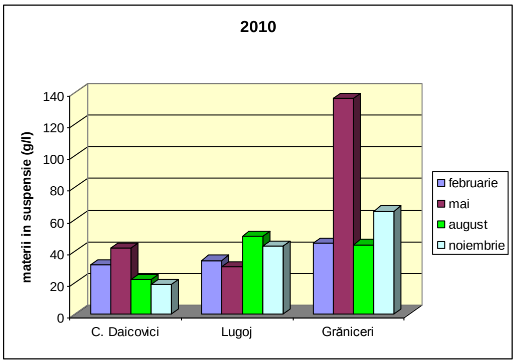


Figure 3 Evolution of chemical oxygen consumption

In 2010, in the Constantin Daicoviciu control point, the amount of suspended matter was much above maximum admitted limits in May and February, which qualifies the water as 2nd quality. The amount of nitrites was above maximum admitted limits in May and February, which qualifies water as 2nd quality. Chemical oxygen consumption was very close to the normal limits. Water in this control point in 2010 classified as good quality water.

In the control point Lugoj, the amount of suspended matter was higher in all months, which classified water as 2nd quality, while chemical oxygen consumption was higher in August and May. Nitrites content was mush higher in August and November, which classifies water as 2nd and 3rd class (Figure 4,5,6).

In the last control point, Grăniceri, the amount of suspended matter in May qualified water quality as 4th class. The amount of nitrates was above maximum admitted limits in May and February (2nd quality class); chemical oxygen consumption was much higher in this year also, with peaks in August and May.



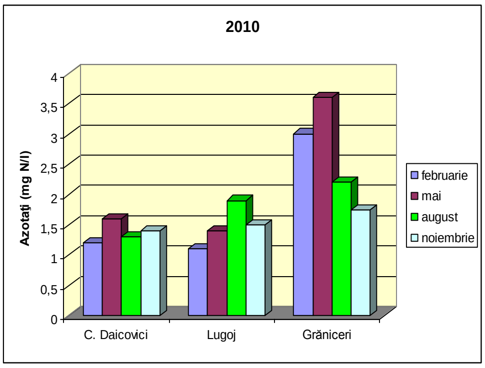


Figure 4 Evolution of suspended matter amount

Figure 5 Evolution of nitrate content

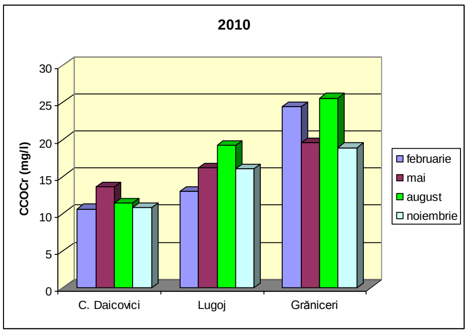


Figure 6 Evolution of chemical oxygen consumption

In 2011, in the control point Constantin Daicoviciu, water classified as 1st and 2nd quality from the point of view of nitrate content, of chemical oxygen consumption, and suspended matter amount.

The amount of suspended matter in the control point Lugoj was above maximum admitted limits: in May, it reached a peak, which qualified water as 3rd quality (Figure 7). Nitrate content was also above maximum admitted limits in May, and so was nitrite content, with a peak in February and May, which qualified water as 3rd quality (Figure 8); chemical oxygen consumption was also above maximum admitted limits (Figure 9).

In the Grăniceri control point, in 2011, suspended matter content was above maximum admitted limits in all months. Nitrate content in 2011 qualified water as 1st class, and nitrite content were above maximum admitted limits, which qualified water as 4th and 5th class. Chemical oxygen consumption also was above maximum admitted limits.

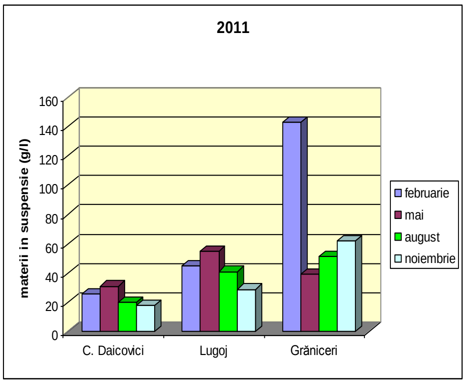


Figure 7 Evolution of suspended matter amount

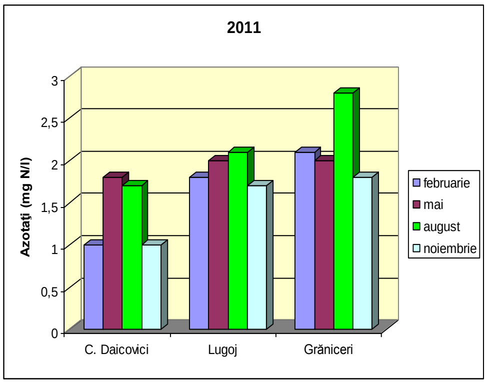


Figure 8 Evolution of nitrate content

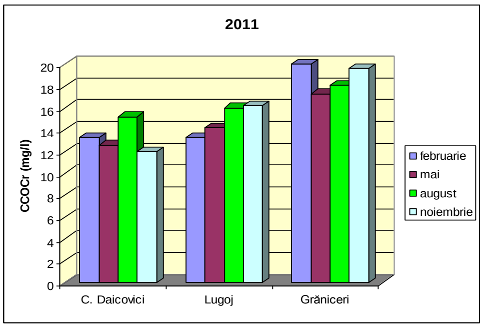


Figure 9 Evolution of chemical oxygen consumption

CONCLUSIONS

- In the control point Constantin Daicoviciu, upstream Timiş River, water sample analysis qualified water as 1^{st} and 2^{nd} class in all three analysed years due to the suspended matter content, to the chemical oxygen consumption, and to the nitrite content levels.
- In the control point Lugoj, in all three years, water qualified as 2^{nd} and 3^{rd} class, which means it was more polluted than in the previous control point. The amounts of suspended matter and of nitrites were above maximum admitted limits.
- In the control point Grăniceri, the amounts investigates were all above maximum admitted limits in the three years: water qualified as 3^{rd}, 4^{th}, and 5^{th} quality from the point of view of the amount of suspended matter and of nitrite amount.
- The Timiş River water is much polluted in Lugoj and Grăniceri because of the urban sewage, of the urban wastewaters, of the agricultural wastes and of natural causes such as erosion in the river hydro graphic basin.
- In order to improve the quality of the Timiş River water downstream, we need to build an efficient sewage system in rural localities, with water plants, and to control the discharge of wastewaters into the river.

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