

QUALITY INDICES OF THE WATER IN THE MIDDLE TIMIȘ RIVER BASIN

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Abstract

Nowadays, that the drinking water resources are limited and the population is increasing steadily – which causes an increase of the pollution – we need to know and monitor water quality. The River Timiș is the richest hydric resource in Banat since it drains water from an area of 5,795 km³, along 241.2 km. In this context, knowing the quality of the water of the Timiș River is a necessity. Water quality was monitored in the middle of the basin in two control points: upstream Lugoj and in Grăniceri. The two control points were rationally chosen: the first one is downstream from two important cities, Lugoj and Timisoara, which it supplies water for directly; the second, at the border with Serbia. Water was sampled in February, May, August, and November 2011 and 2012. The main quality indices we analysed were the pH, dissolved oxygen, nutrient regime, heavy metals, fixed residue. Laboratory analyses showed that the water from the control point in Grăniceri with values classified lower than that upstream Lugoj (4th and 5th quality).

Key words: River Timiș, water quality, pH, nutrient regime, heavy metals, fixed residue.

INTRODUCTION

Water, a substance common by definition, is vital for vegetal and animal bodies, since all vital processes take place in a moist environment (Zăvoianu, 2002; Gășteșcu, 2003). Despite its importance, water is one of the resources worst managed: it is spilled and turned to nature in bad state (Vârsta, 2005).

The continuous and increasingly more intense development of the human society from the point of view of the number of people and of social and economic activities caused both an increase of water consumption and deterioration of this vital resource through pollution. This is why humankind is facing a true water crisis both quantitatively and qualitatively (Pișota, Zaharia, 2002).

One of the negative aspects of water resource use is the deterioration of its quality. The network of rivers is very much involved in the life of human communities: thus, of the 70,000 km of rivers in Romania, 20,000 km supply water for the population, industry, and agriculture (crop farms and animal farms). Of these 20,000 km, 53% rank 1st quality, 30% rank 2nd quality, 5.7% rank 3rd quality, and 10.7% rank 4th and 5th quality (Zăvoianu, 2005). Compared to 1989, there has been constant improvement of 1st quality water and a decrease of the length of degraded waters (Ilie C., 1996).

If, at national level, the quality of the water of the rivers is good, at regional level there are cases of serious pollution. In this context, knowing the quality of the main parameters of the Timiș River is a priority, particularly because of the cases of transborder pollution.

MATERIAL AND METHOD

The Timiș River is the main hydrographic artery in south-west Romania. The total length of its watercourse is 359 km, of which 241.2 km on Romanian territory (from its spring to Grăniceri, where it leaves Romania). The hydrographic basin of the Timiș River is part of the hydrographic system of the Danube River; it drains a total area of 7,319 km³, of which 5,795 km³ in Romania, as part of the Banat hydrographic system. The hydrographic basin of the Timiș River is part of the large, complex basins; the area of the receiving basin overlaps distinct relief units such as mountains, hills, and plains. The basin is prolonged from east to west, with an obvious asymmetry in the upper and middle sectors because of the length of its affluents. Thus, in the upper sector, the hydrographic basin is oval, since the river flows from south to north. In the middle sector, the Timiș River flows from east to west, and the basin has a trapeze shape with its longest basis at the north. The lower sector is outside Romanian borders (Schneider et al., 2011).

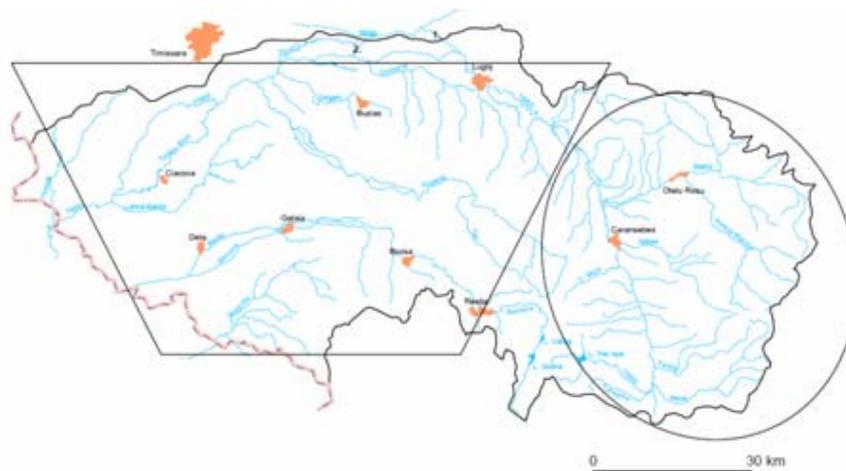


Fig. 1. The shape of the middle hydrographic basin of Timis river (Schneider E. et al., 2011)

The quality of the water of the River Timiș was monitored in the middle sector in two strategic points, Lugoj and Timisoara, which it supplies indirectly, and at the border with Serbia.

The water samples were collected in February, May, August, and November 2011 and 2012. The main quality indices we analysed were pH, dissolved oxygen, nutrient regime, heavy metals, and fixed residue.

The water samples were analysed in the quality laboratories of the Banat Water Basin Administration and the results were processed and compared with physical and chemical standards (Order 161/2006) that allows the classification in quality classes from 1st to 4th quality.

RESULTS AND DISCUSSION

Laboratory analyses show that in the sector upstream Lugoj, in 2011, the water was slightly basic: its pH had values ranging between 7.2 and 7.5, with the highest value (7.5) in November. In 2012, there was an increase of pH values: it reached 7.6 in May.

The dissolved oxygen amount was relatively high: it reached a maximum 10.5 mg/l in February, May, and November 2011, which ranks it 1st quality, with a decrease in August, to 7.3 mg/l, which ranked it 2nd quality. In 2012, there was an increase of the content of dissolved oxygen, which reached 11.1 mg/l ranking the water 1st quality.

As far as nutrient regime was concerned, chloride content in 2011 had values between 7.5 and 11.2 mg/l, ranking the water upstream Lugoj 1st quality. In 2012, there was an increase up to 11.5 mg/l in May.

As for nitrite content, in 2011 it had values between 0.012 and 0.071 mg/l, with a peak in November, which ranked water 4th quality. In 2012, the minimum value in May, 0.05 mg/l, ranked the water 2nd quality; in February, August, and November, there was an increase of the content of nitrites which ranked the water upstream Lugoj 4th quality.

Nitrate content was relatively low in 2011, reaching 1.1-1.5 mg/l, which ranked the water 1st quality. In 2012, there was an increase of the content of nitrates, and in August, it reached 2.1 mg/l, ranking the water upstream Lugoj 2nd quality.

Ammonia content ranked 1st quality in February 2011, reaching 0.09 mg/l; in May, August, and November, there was an increase of the content of ammonia, which ranked water in the 3rd quality class. Ammonia content in 2012 had values that ranked the water 3rd category.

As far as the lead content is concerned, in February and August 2011 it had values, which ranked the water 1st quality; in May and November, water quality was 2nd. The year 2011 had values ranking the water 1st quality.

Cadmium content in the analysed sector had, in 2011, values between 0.25 and 0.51 µg/l, ranking the water upstream Lugoj 2nd quality. In November 2012, cadmium content was 0.3 mg/l, ranking water 1st quality;

in February, May and August, cadmium content increased ranking water 2nd quality.

As for the content of fixed residue, the years 2011-2012 had values between 241 and 284 mg/l, which rank the water 1st quality.

After analysing the samples collected from the **Grăniceri sector**, we could see that, in 2011, water pH was basic, with a peak in November (7.5). In 2012, maximum value was recorded in February (7.6).

The content of dissolved oxygen was, in 2011, between 8.5 and 10.2 mg/l, ranking water in February, May and November 1st quality. In August, the content of dissolved oxygen was 8.5 mg/l, which ranked it 2nd quality. In 2012, there was a decrease of the content of dissolved oxygen: it was between 7.8 and 9.4 mg/l, ranking the water 1st quality.

As far as salinity is concerned, the contents of chloride in 2011 oscillated between a maximum 11.2 mg/l in February and a minimum of 9.3 mg/l in August. These values rank water 1st quality. In 2012, there was a decrease of the contents of chloride: it had values between 8.3 and 13.0 mg/l, which ranked it 1st quality.

Nitrite content was low: in 2011, it had a maximum value of 0.069 mg/l in November and a minimum value of 0.036 mg/l in May, ranking water 3rd quality. In 2012, there was a significant increase of nitrite content: in May, it reached 0.071 mg/l. these values rank the water in this sector 3rd quality.

As far as the nitrate content is concerned, in 2011 it had, in February, August, and November, between 0.96 and 1.3 mg/l, ranking water 1st quality. May had values above 1st quality. In 2012, nitrate content was relatively lower, with a peak in February (1.7 mg/l) and a minimum in May (0.88 mg/l). These values rank the water in this sector 1st quality.

Ammonia content in this sector in the two study years rank water 3rd.

As for lead content, the water in this sector ranked 1st quality in both 2011 and 2012.

Cadmium content in 2011 rank the water 1st quality, with values between 0.25 and 0.41 ug/l. In February, August, and November, cadmium content was between 0.36 and 0.81 ug/l, ranking water 1st quality. In May 2012, cadmium content was 1.0 ug/l, ranking water 2nd quality.

Fixed residue content in the samples analysed for 2011 show a peak of 284 mg/l in August, and a minimum value of 241 mg/l in May. In 2012, there was a decrease of the content of fixed residue with a peak of 275 mg/l in February. These values rank water 1st quality.

The comparative analysis of the two sectors upstream Lugoj and Grăniceri shows that the pH reached, in 2011, 7.5 and, in 2012, 7.6 (Figure 2).

As for the analysis of dissolved oxygen, we can see (Figure 3) that in 2011 the concentration was lower (10.2 mg/l) in the Grăniceri sector, which ranked water 1st quality. In 2012, the highest concentration was upstream Lugoj (11.1 mg/l).

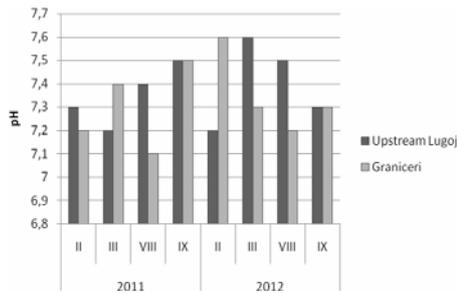


Fig. 2. Evolution of pH during 2011-2012

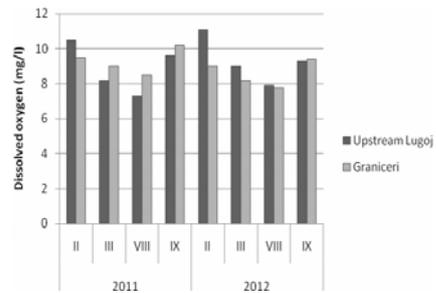


Fig. 3. Evolution of dissolved oxygen during 2011-2012

Figure 4 shows that the water in the Grăniceri sector has high values of chloride contents, with a peak in 2012. Chloride content upstream Lugoj had values between 11.2 mg/l in 2011 and 11.5 mg/l in 2012. These values rank the water 1st quality.

As for the analysis of nutrient regime, in 2011, the water upstream Lugoj had the highest content of nitrites as that of the Grăniceri sector in 2012. These values rank the water in the two sectors 3rd quality (Figure 5).

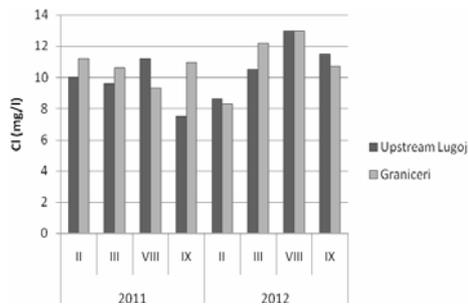


Fig. 4. Evolution of chloride content 2011-2012

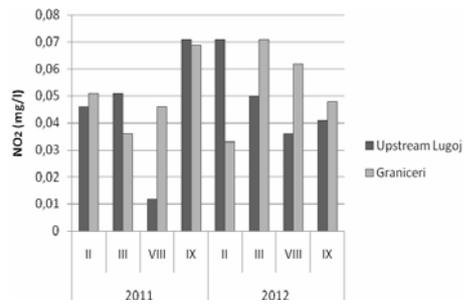


Fig. 5. Evolution of nitrites content 2011-2012

The comparative analysis of the water in the two sectors show that the highest content of nitrates was in the Grăniceri sector, while the lowest value (1.5 mg/l) was in 2011, upstream Lugoj (Figure 6). These values rank water in the two sectors 2nd quality.

Figure 7 shows the values of ammonia content: the water in the Grăniceri sector had a high concentration, with peaks in 2012 in both sectors. Ammonia content ranks the water 3rd quality.

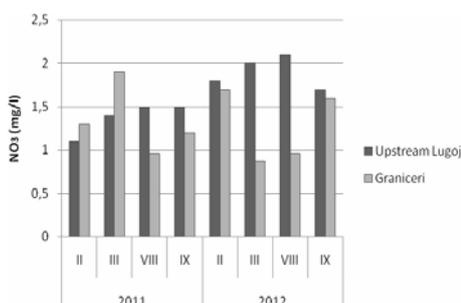


Fig. 6. Evolution of nitrates content 2011-2012

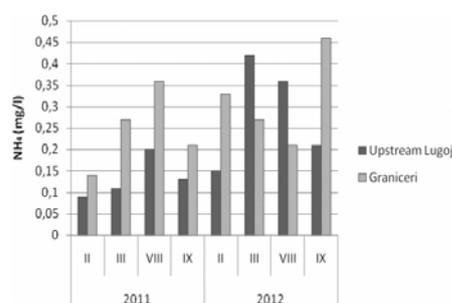


Fig. 7. Evolution of ammonia content 2011-2012

As for lead content, the maximum concentration in 2011 was in the Grăniceri sector (8.1 mg/l), while the maximum concentration in 2012 was upstream Lugoj (7.8 mg/l). these values rank the water 1st and 2nd quality (Figure 8).

Figure 9 shows that the water in the Grăniceri sector had significant amounts of cadmium compared to the upstream Lugoj sector, where the values were lower. The cadmium amounts had values ranking the water in the two sectors 1st quality.

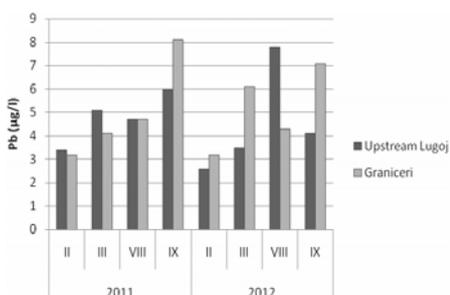


Fig. 8. Evolution of lead content 2011-2012

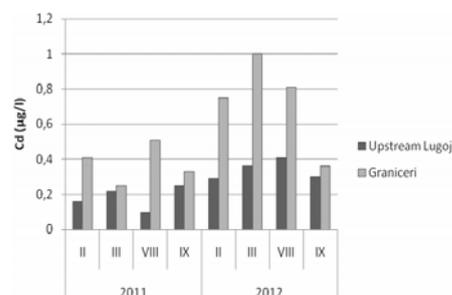


Fig. 9. Evolution of cadmium content 2011-2012

The comparative analysis of the two sectors showed that the water in the Grăniceri sector had higher contents of fixed residues in both studied years than the upstream Lugoj sector, ranking water 1st quality (Figure 10).

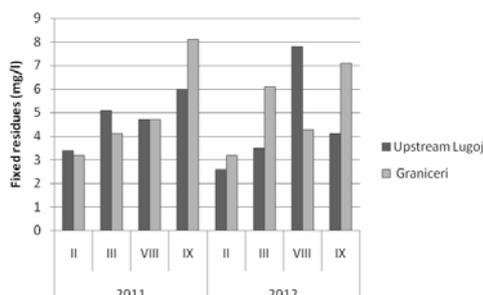


Fig. 10. Evolution of fixed residues content 2011-2012

CONCLUSIONS

1. The study of the quality of the water of the River Timiș was done by sampling in two control points: upstream Lugoj and Grăniceri.
2. The water was sampled in February, May, August, and November for the years 2011-2012.
3. As for the content of dissolved oxygen, the two sectors had values ranking the water 1st quality.
4. The analysis of the chloride content shows that the water in the Grăniceri sector had higher concentrations with a peak in 2012. These values rank water 1st quality.
5. Nitrite content in both upstream Lugoj and Grăniceri sectors show values that rank water 3rd quality.
6. The comparative analysis of the two sectors shows that the highest content of nitrates was in the Grăniceri sector, and in 2011, the lowest value was in the upstream Lugoj sector. These values rank the water in the two studied sectors 1st and 2nd quality.
7. Ammonia content ranks water in the 3rd quality: the water in the Grăniceri sector had a high concentration, the highest values being recorded in both sectors in 2012.
8. As for lead content, the maximum concentration was in 2011 in the Grăniceri sector, while the maximum concentration in 2012 was in the upstream Lugoj sector. These values rank the water 1st and 2nd quality.
9. We could see that the water in the Grăniceri sector had significant amounts of cadmium compared to the upstream Lugoj sector, where these values were lower. The amount of cadmium had values ranking the water in the two sectors studies 1st quality.
10. The compared analysis of the sectors upstream Lugoj and Grăniceri showed that the Grăniceri sector had higher fixed residue contents in both study years compared to the upstream Lugoj sector, ranking the water 1st quality.

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