INFLUENCE OF ANTHROPOGENIC ACTIVITIES ON MURES RIVER WATER QUALITY

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Abstract

Given the current climate changes and the increasing anthropogenic stress, maintaining the quality of natural resources is increasingly stringent. Water, a vital yet limited in time and space natural resource, deserves more and more attention. To maintain water quality at accepted values, we need monitoring measures to reduce the impact of human activities on water resources. This paper presents a study of downstream Mures River water quality. Water was sampled in February, April, May, June, July, August and September 2016 in the Ilia Pod sector. Analyses show that water was slightly basic and that the water flow was fluctuating (it depends on the amount of precipitation in the river basin. As for the oxygen regime, it was good: it decreased only in July while biochemical and chemical consumption of oxygen increased in April, May and June, pointing to a water nutrient load. Nitrate, nitrite and total nitrogen content was higher, ranking the water in the 2nd quality class, unlike phosphorus content, whose values are very low. The impact of human activities on Mures River water quality was low, with values slightly above maximum admitted limits in nitrogen and oxygen regimes.

Keywords*: Mures River water quality, oxygen regime, nutrient regime, impact of human activities*

INTRODUCTION

There is no human activity, no life form or equilibrium on the planet Earth without water. Humankind has long believed that water resources are infinite, that nature has enough water supplies. The last decades and particularly the last years have shown in an alarming way that Earth's fresh water resources are not infinite. This may seem paradoxical given that 2/3 of the planet's surface are covered by water (PIȘOTA I, 2010, VĂDINEANU A, 2009, ȘERBAN, P, 2006).

We need to note that the fresh water from rivers and lakes that humans can exploit with current water supply technology shares a little below 0.10% of the total water on Earth (ȘMULEAC L 2012, 2016, BRETOTEAN M., 2004,).

Current climate changes, industrial activities, water use in agriculture, the growth of population and the raise of the standards of living increase water demand all over the world (NIȚĂ L, 2013). This is why maintaining water quality at value that ensure sustainability is possible only if we continuously monitor water quality and reduce the impact of human activities on water resources (RADULOV I, 2016).

MATERIAL AND METHOD

The Mures River basin is located in the centre of Romania: oriented towards the west, it springs from the Oriental Carpathians (the Giurgeu Depression in the Hasmas Mare Mountains), and it neighbours the Siret, Olt, Jiu, Banat, Criș and Someș-Tisa river basins.

The total area of the river basin (including the Ier Canal), according to ArcGIS, is 28,418 km^2, i.e. 11.97% of Romania's area. The hydrographic network covers 798 cadastral watercourses totalling 10,861 km with a mean density of 0.39 km/km^2 (Figure 1).

Figure 1. Mures River basin (Management plan of the Mures River basin)

The River Mureş is the longest river of Romania: 789 km. Along 22.3 km, it makes up the natural border with Hungary after which it flows into the River Tisa.

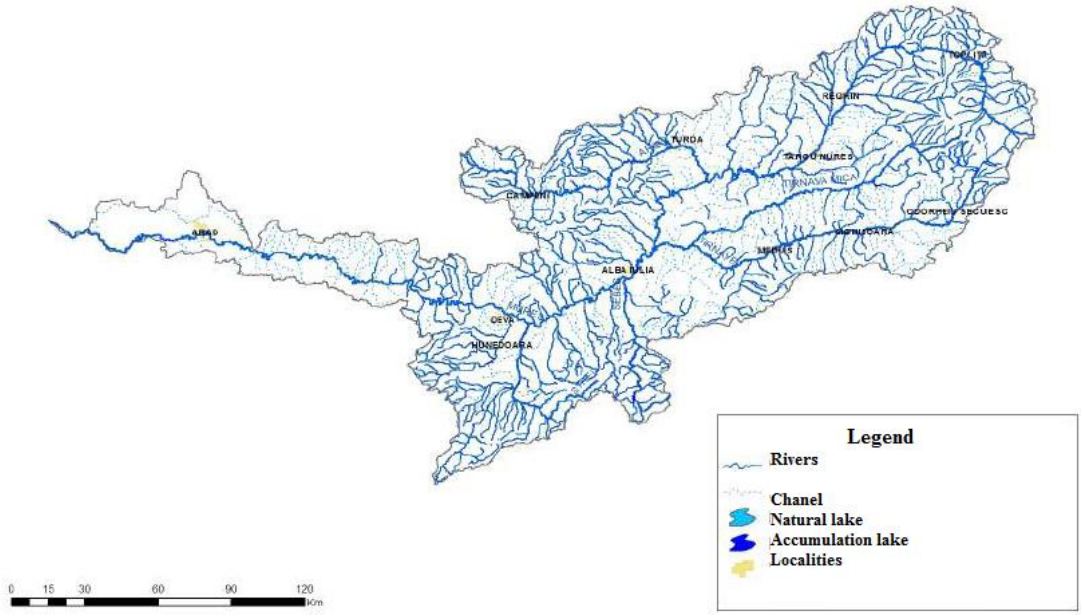

Figure 1. Mures River basin
(Management plan of the Mures River basin)

To monitor the quality of the Mures River, we sampled water from the Ilia Pod sector in February, April, May, June, July, August and September 2016. Analyses were made in the Laboratory for Water Quality of the Mures River Basin Administration. We focused on pH, dissolved oxygen, oxygen biochemical consumption over 5 days, chemical consumption of oxygen, ammonia, nitrates, nitrites, total nitrogen, total phosphorus, and calcium. Results were compared with the physical and chemical quality standards of the Order no. 161/2006 stipulating the classification of water into water qualities from 1st to 5th.

RESULTS AND DISCUSSION

Measurements made on the River Mures show that water flow (Figure 2) in the Ilia Pod sector was fluctuating from 105 m^3/s in September to 249 m^3/s in June. This fluctuation was closely linked to the amount of precipitations and it influences only the degree of mineralisation of the water.

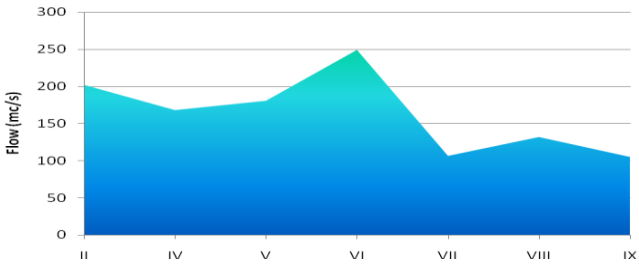

Figure 2 Flow of Mures River în Ilia Pod Section

Thus, water pH ranges within normal values as stipulated by Order no. 161/2006, i.e. between 6.5 and 8.5. Water was slightly basic (Figure 3), with values between a minimum of 7.31 pH units in August to a maximum of 8.31 pH units in September.

As for dissolved oxygen content (Figure 4), in February, April and May, it ranked water in the 1st quality class, with a maximum of dissolved oxygen of 11.3 mg/l in February. In the rest of the months, water quality decreased from the point of view of dissolved oxygen content to a minimum of 8 mg/l in July because of the high temperatures.

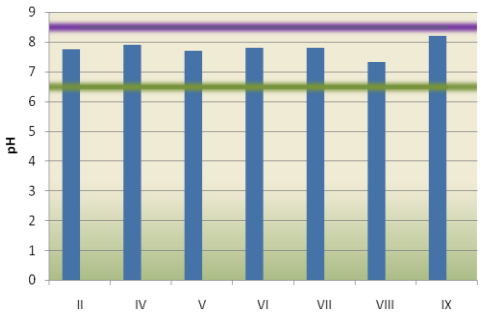

Figure 3. pH of Mures River

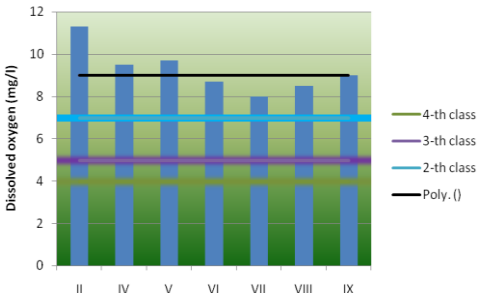

Figure 4. Content of dissolved oxygen

Biochemical oxygen consumption over 5 days, an indicator of water pollution, shows low values (Figure 5): between 1.5 mg/l in September to a maximum of 4.6 mg/l in April, when water ranked 2nd quality class. Chemical oxygen consumption (Figure 6) points to good quality water only in July-September, with values of 9-10 mg/l. In the other months, water ranked 2nd quality, with values between 12.5 mg/l in February and 18.72 mg/l in April.

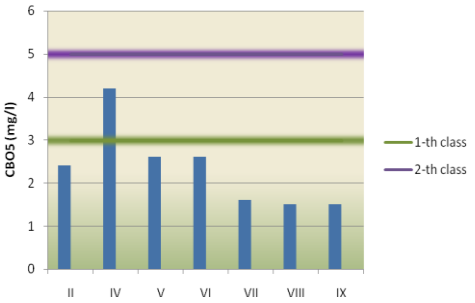

Figure 5. Biochemical oxygen consumption over 5 days

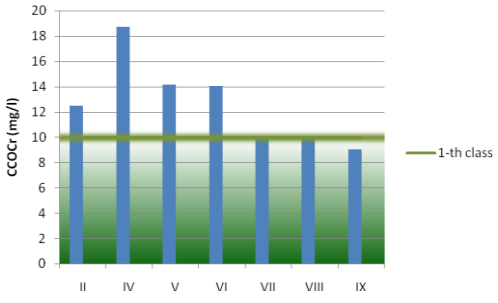

Figure 6. Chemical oxygen consumption

As far as nutrient regime is concerned, ammonia content (Figure 7) ranged between 0.023 mg/l in September and 0.093 mg/l in June, much below the limit of the 1st quality water (0.4 mg/l). Nitrite amount (Figure 8) was above the limit of the 1st quality class: 0.031 mg/l in August and 0.019 mg/l in April and June, which ranked water in the 2nd quality class. The highest value was in February, 0.034 mg/l, which ranked water 3rd quality class.

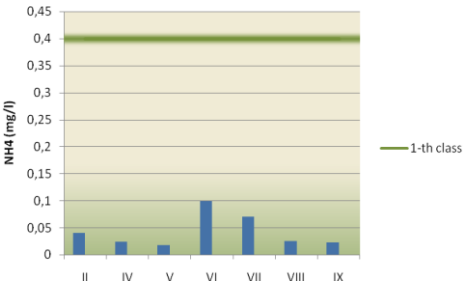

Figure 7. Ammonia content

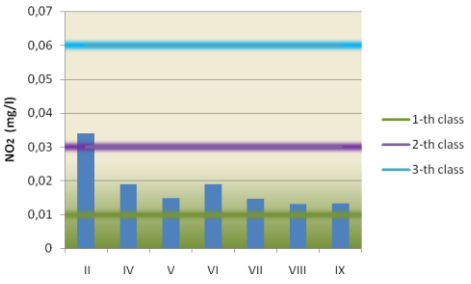

Figure 8. Nitrite amount

As for nitrate content (Figure 9), water ranked 2nd quality with values between 1.219 mg/l in August and 1.81 mg/l in February. Total nitrogen content was low only in August and September (1.32 mg/l); in the rest of the year, the values were above the limit of the 1st quality: 1.6 mg/l in June to 2.5 mg/l in February (Figure 10).

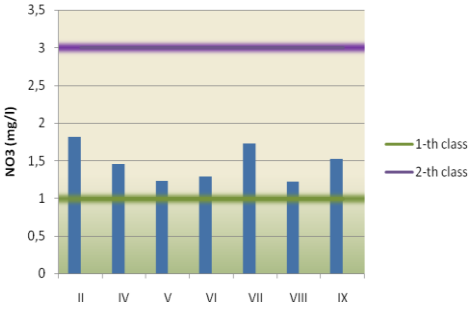

Figure 9. Nitrate content

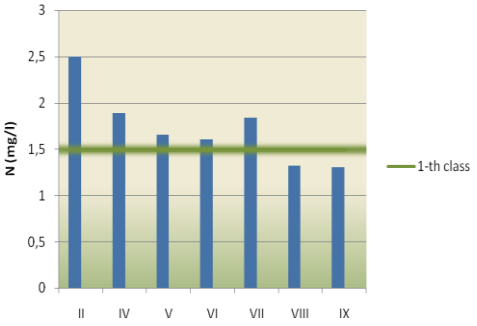

Figure 10. Total nitrogen content

Phosphorus content (Figure 11) was low, with no impact on water quality, with values much below the limits of the 1st quality class: a minimum of 0.04 mg/l in February and a maximum of 0.13 mg/l in June.

Calcium content (Figure 12) was low, between 32 mg/l in August and 46 mg/l in April, much below the limit of the 1st quality class that make water little hard.

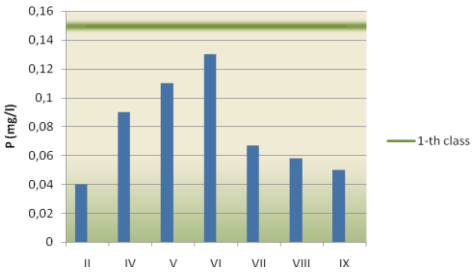

Figure 11. Phosphorus content

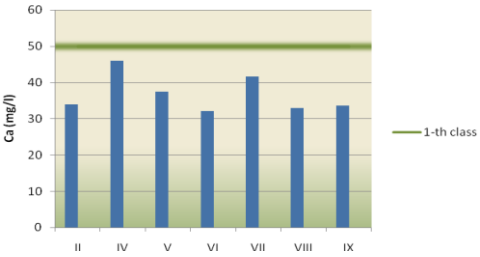

Figure 12. Calcium content

CONCLUSIONS

Analyses of Mures River (Ilia Pod sector) water quality show the following:

- The water is basic, which ranks it within the normal values accepted by Order 161/2006;
- Oxygen regime is within good limits, with a decrease of oxygen content in July and an increase of the biochemical and chemical oxygen consumption in April, May and June, which points to a nutrient load of the water;
- The levels of nitrates, nitrites and total nitrogen rank water in the 2nd quality class;
- The impact of human activities on the Mures River water quality is low, with slight values above admitted ones only in nitrogen and oxygen regimes.

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