WATER QUALITY OF NEAMȚ RIVER - TÂRGU NEAMȚ TOWN (NEAMȚ COUNTY)

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ABSTRACT. – Water quality of Neamț River - Târgu Neamț TOWN (Neamț County). The purpose of the present research was to assess the surface water quality of Neamț River in six sampling points located in Târgu Neamț town (Neamț County). The samples were collected during October – December 2015. Considering the calcium level, the analyzed waters belong to IInd water quality class. Based on magnesium and sodium concentrations, the samples belong to Ist water quality class. The monthly fluctuation of the analysed parameters can be correlated with the anthropic activity, maybe due to the discharge of wastewaters in sampling points 3, 4 and 6.

Keywords: surface water, Târgu Neamț.

1. INTRODUCTION

The water chemical composition represents the main characteristics of water quality, which define the suitability of water use for particularly purposes. The surface water quality can be influenced by different factors, including meteorological factors, soil type, geology, vegetation, flow conditions and human activities. The greatest impacts are usually associated with human activities like the discharge of wastewater from municipalities and industries. In recent decades, in Romania there is a significant improvement of wastewater treatment technology, fact that reduced the impact of point source pollution to rivers (Iosub et al, 2015).

In the present study, the water quality of Neamț River (also called as Ozana River) was investigated. The investigated river area is located in Târgu Neamț town, which is the third largest city from the Neamț County. The town is situated at an altitude of 365m on the terrace of Neamț River, a tributary of Moldova River, which flows into the River Siret. The Neamț drainage basin is located in the northern part of the Neamț County, NE of Romania. The valley of the Neamț River covers an area of three communes (12 villages) and one city (Târgu Neamț) (Iosub et al, 2015). The area of the Neamț basin occupies a total of 419 km², and its perimeter is 136 km long (Iosub et al, 2015). The Neamț River is increasing significantly during rainy season and decreases in dry periods, when water level is low, about 25-50 cm.

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The urban and industrial development along the Neamț River basin, from the last decades, has induced a stress ultimately leading to water pollution and environmental damaging. The purpose of the present research was to assess the surface water quality of Neamț River in six sampling points located in Târgu Neamț town (Neamț County) and to investigate the monthly fluctuations of water quality parameters.

2. MATERIALS AND METHODS

The samples were collected during October, November and December 2015, from six sampling points located in Târgu Neamț town (Fig. 1) as follows:

- Sampling point 1 (47°13'11"N and 26°18'5"E), located at the exit of Pipirig commune, in the close vicinity of municipality waste water discharging point;
- Sampling point 2 (47°13'11"N and 26°19'5"E), located close to capture station;
- Sampling point 3 (47°12'33"N and 26°20'16"E), located close to a sawmill;
- Sampling point 4 (47°12'11"N and 26°21'4"E), located in Humulești area, close to a slaughterhouse
- Sampling point 5 (47°12'2"N and 26°21'33"E) located in Humulești area, after the bridge
- Sampling point 6 (47°11'48"N and 26°23'14"E) close to a former furniture factory.

Fig.1. ***The investigated area and the sampling points location.***

In order to evaluate the water quality, several physico-chemical parameters (pH, redox potential, total dissolved solids, electrical conductivity

and salinity) and chemical parameters (major dissolved cations: Li^+, Na^+, K^+, Mg^{2+}, Ca^{2+}, NH_4^+) were investigated.

The major dissolved cations were analyzed only in samples 1, 3 and 6, because of the locations of these sampling points in the close vicinity of important anthropic pollutions sources. The physico-chemical parameters were analysed *in situ* by using a portable multiparameter WTW 350i, while the major dissolved cations were analysed in laboratory, by ion chromatohraphy (IC system Dionex 1500).

3. RESULTS AND DISCUSSIONS

The results are presented in Fig. 2 and 3. Generally, the analyzed waters were slightly acidic to neutral, having the pH between 6.0 and 7.87. As it is shown in Fig. 2, the pH velues were lower in November 2015 comparing to October and December 2015, being lower than the permissible limit (6.5 – 9) imposed by the Romania legislation for surface water (Order 161/16 February 2006). The majority of aquatic organisms prefer a pH range of 6.5-9.0. As a consequence, the low pH registered during November can affect the aquatic species from Neamț River. Lower pH levels increase the risk of toxic metals, causing other indirect risks. The pH fluctution can be correlated with precipitation and wastewater discharges.

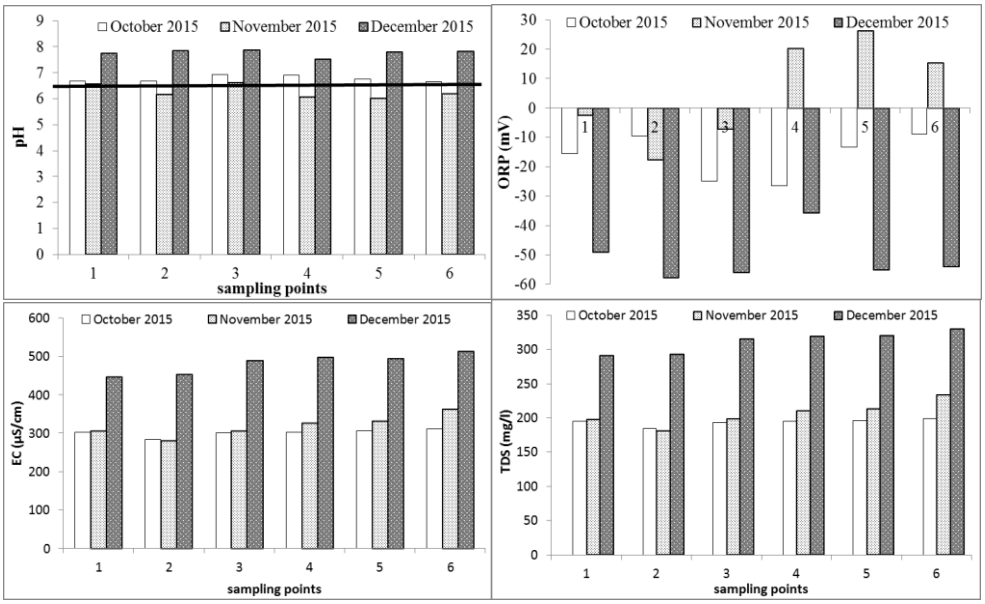

Fig. 2. ***Monthly fluctuation of physico-chemical parameters of analyzed water samples.***

The redox potential was generaly positive indicating the presence of an oxidizing environment. The redox potential was indirectly correlated with pH.

The analysed water samples had a relatively low salinity (0-0.2‰). the total dissolved solids ranged between 181 and 330 mg/l, while thet electrical conductivity ranged between 281 and 514 µS/cm. The electrical conductivity reflects the physical presence of dissolved chemicals in water. The measurement of the water's conductivity can provide a clear view of the concentration of ions in the water (Florescu et al., 2011). An increased conductivity can be the result of released heavy metals ions from water pollutants. A higher conductivity reflects higher water pollution (Florescu et al., 2011)

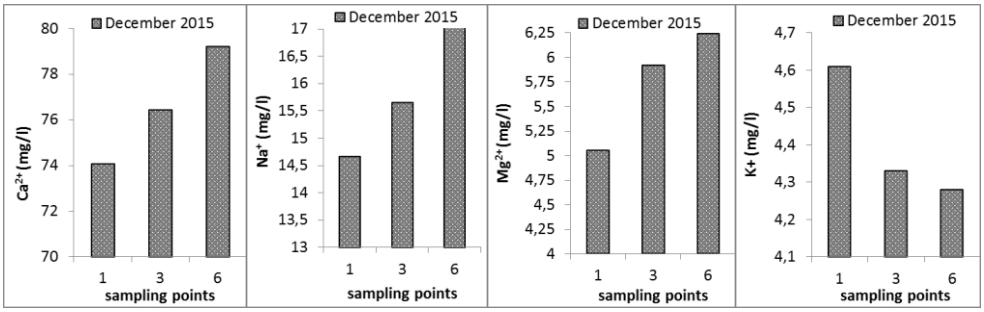

Fig. 3. ***Major dissolved ions abundance in the analyzed water samples.***

The relatively low levels of TDS and EC, reflect the low level of dissolved salts and the low pollution of the investigated water samples.

The TDS and EC values were higher during December 2015, than in November and October 2015. This fluctuation can be correlated with the anthropic activity, maybe due to the dischardge of wastewaters in sampling points 3, 4 and 6.

Lithium and ammonium were not detected in the analysed samples, while Ca^{2+}, Mg^{2+}, K^{+} and Na^{+} were detected in all samples. The ions distribution was dominated by the presence of calcium (74.07 – 79.19 mg/l) and sodium (14.66 – 17.03 mg/l), while magnesium and potassium were detected in lower concentratiosn (5.05 – 6.24 mg/l, respectively 4.28 – 4.61 mg/l). Considering the calcium level, the analysed waters belong to IInd water quality class, having the Ca^{2+} level between 50 and 100 mg/l (Order 161/16 February 2006).

Generally, the rivers contain 1-2 mg/l calcium, but in lime rivers area they may have calcium concentrations as high as 100 mg/l (Florescu et al., 2011). The calcium ion influences aquatic organisms concerning metal toxicity. In softer water, membrane permeability is increasing in the gills is. The presence of high calcium levels influences the hydro-geo-chemical processes because calcium competes with other ions (heavy metals) for binding surfaces. In low mineralized water, calcium is the dominant cation, while in high mineralized waters the ratio between calcium and magnesium is changing due

to the increase of magnesium. This is the consequence of the higher solubility of magnesium salts (sulphate and hydrocarbonate) as compared to equivalent compounds of calcium (Nikanorov and Brazhnikova, 2009).

The sodium migratory ability is relatively high because its salts have high solubility. A high content of sodium salts in water is balanced by a high level of chlorine ions, forming a mobile combination that migrates with high velocity in a solution (Nikanorov and Brazhnikova, 2009). Sodium ions can be displaced from the absorbed complex of rocks by calcium and magnesium (Nikanorov and Brazhnikova, 2009).

Based on Mg^{2+} and Na^{+} concentrations, the samples belong to I^{st} water quality class, having the Mg^{2+}level lower than 12 mg/l and the Na^{+} lower than 25 mg/l (Order 161/16 February 2006).

4. CONCLUSIONS

The analyzed waters were slightly acidic to neutral, having the pH between 6.0 and 7.87. The pH velues were lower in November 2015, being lower than the permissible limit (6.5 – 9) imposed by the Romania legislation for surface water. The redox potential was generaly positive indicating the presence of an oxidizing environment. The analysed water samples had a relatively low salinity (0-0.2‰), TDS (181 and 330 mg/l) and EC (281 and 514 µS/cm).

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The measured parameters in analyzed water samples showed slight variations depending on location, being generally higher in sampling point 6, due to the accumulation effect of pollution sources located upstream of this sampling point.

The monthly fluctuation of the analysed parameters, can be correlated with the anthropic activity, maybe due to the dischardge of wastewaters in sampling points 3, 4 and 6.

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