

Monitoring of nitrogen compounds content in underground water from Timis river

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Abstract The purpose of this paper is to present the results of monitoring the river Timis in terms of nitrogen compounds content in the period 2011. Experimental were determined nitrogen compounds (nitrate, nitrite, ammonium) in wells from six localities situated along the river Timis Slatina-Timis Caransebes, Gavojdia, Cebza, Graniceri, Lugoj points distributed between the source and the point out of the river, namely the border with Serbia. Samples determinations were done with the help of Spectrophotometer SQ 118. In autumn and winter months, concentrations of nitrogen compounds have higher values and are due to frequent rainfall recorded during this period of year. Samples analyzed from drilling along the Timis River, are characterized with low nitrates, nitrites and ammonium ion content. In July 2011, concentrations of nitrogen compounds have maximum values and are due to excessive rainfall of 107.9 mm.

Key words

nitrates, nitrites, ammonia, water, Timis river

Timis River, the richest water resources in the Area of Banat River basin drains an area of over 5677 km². His length is 244 km [8]. Timis has its sources on the eastern slopes of the mountains Semenic in Caras-Severin. River is formed at the confluence of three branches: Semenic Gradiste and Brebu. Overcoming the barrier of the Three Waters, stormy river flows in a narrow channel oriented NW - SE. From the Timis Teregova take direction from south to north, and from Caransebes, due to lower slope, the river meanders describes large [8]. In the category of polluting factors of surface and depth is an important chemical compounds. A first effect of chemical pollution is the potential for toxic chemicals. Among the chemical compounds with toxic effects on the human body an important role has nitrogen compounds (nitrates, nitrites, ammonium) [9].

Following the biological effects caused by chemical pollutants, legislation of countries technologically advanced, or with a strong chemical industry, considered and imposed limits that must not exceed the concentrations of pollutants in the environment (the maximum allowable limit - MAL) [4].

Nitrogen compounds (ammonia, nitrites and nitrates) are important steps in the presence of inorganic nitrogen in its complex cycle in nature [2]. Nitrates may be either obtain synthetically or used as fertilizer. Industrial nitrates are produce on a large scale, nitric acid, ammonium formed by catalytic oxidation. Nitrite (NO_2) is also a metabolite in the biological nitrogen cycle, both as an intermediate compound in the nitrification and denitrification process. Effect of nitrogen pollutants on the environment due to anthropogenic sources of data using synthetic

fertilizers in agriculture and horticulture crop fertilization, and because of waste from livestock farms cultivated soils. Literature studies have indicated that the waste produced within 7-8 cattle, can be use on one hectare of land and implementing this high dose may increase nitrate levels above 10 mg /L in groundwater [1].

The existence of ammonium ion concentration in water and absence of nitrates indicate a recent water contamination. When water contains both ammonia and nutrient indicates a pollution since that passed a certain period. Lack of ammonia, but the presence of nitrates and nitrites, involves a contamination that occurred a long time ago. Therefore, in this time, water was self-cleaned [2].

Material and Method

Experimental were determined nitrogen compounds (nitrate, nitrite, ammonium) in wells from five localities situated along the Timis river : Slatina-Timis, Caransebes, Gavojdia, Cebza, Graniceri, Lugoj points distributed between the source and the point out of the river, namely the border with Serbia. Samples were taken quarterly, during one year 2011, the results were interpreted according to the requirements of the Law 458/2002 regarding chemical parameters of water quality [7]. Sampling points are shown in Table 1. The tests used for nitrogen compounds from water samples were SPECTROQUANT NITRATE 14773, SPECTROQUANT NITRITE 14776 and SPECTROQUANT AMONIUM 14752. The determinations were made in Laboratory for the Measurement of Residues of the Department of Agro-

techniques of the U.S.A.-V.M.B in Timisoara, with the help of SQ 118 Spectrophotometer at wavelengths: 515 nm, 525 nm, 690 nm for nitrate, nitrite, respectively ammonium.

Maximum admitted value for nitrogen compounds in drinking water according to the Law nr. 458/2002 on drinking water quality are 50 mg/L (nitrate), 0,50 mg/L (nitrite) and 0,50 mg/L (ammonia) [7].

Table 1

Sampling points descriptions

Sampling points	Characteristics
<i>Slatina- Timis</i>	The sampling point is located on the upper reaches of the Timis river and can be considered, as a reference point, a witness, being located upstream of potential pollution point sources such as Caransebes, Lugoj cities or some factories and livestock complexes.
<i>Caransebes</i>	The sampling point is located near the water intake for drinking water abstraction in the city water plant No.2 Caransebes. Timis river water is used to supply the five wells (S = 1800 m ²) that complement the underground flow of 15 wells which provide 25% of the needed water of city of Caransebes
<i>Gavojdia</i>	The sampling point is located downstream of the junction points of Timis with Nădrag and Spaia streams and Bistra River, possible pollution sources of the Timis, but situated before Lugoj city, a major source of pollution. To a small distance, about 10-15 km downstream, there is no. 2 drinking water plant Lugoj.
<i>Cebza</i>	Sampling point is located downstream of the Timis-Bega River splitting point, downstream from the discharge of sewage from the city of Lugoj.
<i>Graniceri</i>	The sampling point is located close to the border with Serbia, about 7 km downstream from the confluence with the streams –Birda-Lanca that collects wastewater from livestock belonging to Ciacova farm and downstream of the pig farm Peciu which discharging sewage directly into the Timis river.
<i>Lugoj</i>	The sampling point is located downstream of the Cebza point and the Timis river go through aprox.4 kilometers,divining it in two parts.

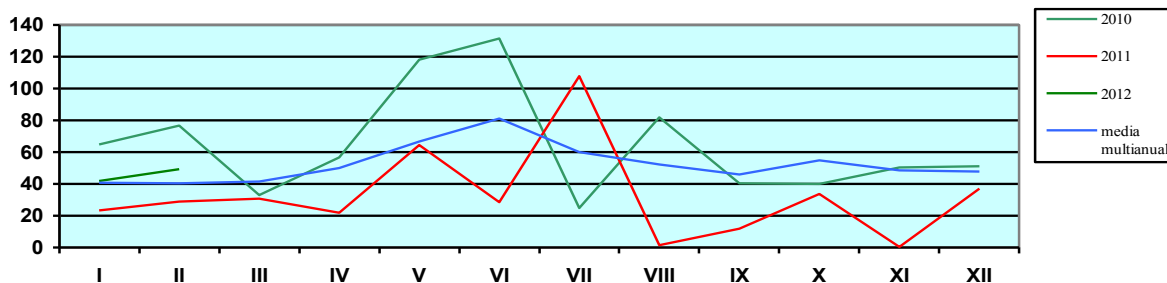


Fig. 1. Rainfall (mm) monthly average recorded in 2010 - 2012 and annual average

From Figure 1, can be observed oscillations in very large limits, so August 2011 and November 2011 were extremely dry (1.3 mm - 0,2 mm) and July 2011 was characterized by excessive rainfall (107.9 mm) which had direct influence on the accumulation of nitrogen compounds in groundwater.

Results and Discussions

The obtained experimental results are shown in tables 2-4.

Table 2

The nitrate (NO₃) (mg/L) content in water samples in monitored sampled points in 2011

LOCATION	JANUARY	APRIL	JULY	OCTOMBER	AVERAGE ±SD
Lugoj	5.2	6.1	15.6	4.8	7.93±5.14
Gavojdia	2.5	3.5	9.8	3.9	4.92±3.30
Caransebes	5.9	5.5	16.8	7.8	9.00±5.29
Slatina-Timis	3.3	3.6	9.3	8.8	6.25±3.24
Cebza	10.7	2.3	21.3	12.1	11.6±7.78
Graniceri	2.0	2.7	6.3	7.8	4.70±2.79

In January 2011, the variation limits of nitrate content ranged from 2.0 mg / L (Graniceri) - 10.7 mg / L (Cebza), in April the range value was between 2.3 mg / L (Cebza) - 6.1 mg / L (Lugoj). It can be observed from Table 2 higher values of nitrate content in July, in all sampling points. Interval ranging between 6.3 mg /L (Graniceri) and 21.2 mg/L (Cebza), this is due to

excessive rainfall fallen in June of 107.9 mm. Risk of nitrate losses in the soil because of rainfall it appears in months when the rainfall is in large amount and low growth plants and low consumption of nitrogen. As a consequence in this period can be expected increases of nitrate content in groundwater [3].

Table 3

The nitrite (NO₂⁻) (mg/L) content in water samples in monitored sampled points in 2011

LOCATION	JANUARY	APRIL	JULY	OCTOMBER	AVERAGE ± SD
Lugoj	0.08	0.13	0.21	0.19	0.15±0.06
Gavojdia	0.10	0.10	0.19	0.21	0.14±0.07
Caransebes	0.05	0.22	0.14	0.18	0.15±0.07
Slatina-Timis	0.09	0.11	0.25	0.16	0.21±0.13
Cebza	0.03	0.22	0.32	0.28	0.17±0.11
Graniceri	0.02	0.16	0.26	0.22	0.15±0.06

Values of nitrite content in the analyzed samples were within the limit values set by standards, of 0.5 mg /L, the highest values were recorded in July with values that ranged between 0.14 mg/L (Caransebes) and 0.32 mg/L (Cebza). The average for those 4 months monitored ranged between 0.14 mg/L (Gavojdia) and 0.21 mg/L (Slatina –Timis) (table 3).

Ten years ago researches made in the studied area discovered very high ammonia content of 0.84

mg/L in Gavojdia sampling point, that is located downstream of the confluence with the streams –Birda-Lanca that collected wastewater from livestock belonging to Ciacova farm and downstream of the pig farm Peciu which discharged sewage directly into the Timis river. According to researches made in 2011 the problem was resolved and those farms implemented an ecological discharge for sewage in special containers.

Table 4

The ammonium (NH₄⁺) (mg/L) content in water samples in monitored sampled points in 2011

LOCATION	JANUARY	APRIL	JULY	OCTOMBER	MEDIA±SD
Lugoj	0.021	0.137	0.215	0.003	0.094±0.10
Gavojdia	0.022	0.041	0.109	0.002	0.044±0.05
Caransebes	0.024	0.053	0.099	0.003	0.045±0.04
Slatina-Timis	0.020	0.065	0.074	0.002	0.040±0.03
Cebza	0.100	0.068	0.081	0.028	0.069±0.03
Graniceri	0.102	0.050	0.075	0.013	0.060±0.04

In 2011, there was a decrease of ammonium content in October, the values ranged between 0.002 mg/L (Gavojdia, Slatina –Timis) and 0.028 mg/L (Cebza). Higher values were registered in July, of 0.074 mg/L (Slatina - Timis) and 0.215 mg/L (Lugoj) correlated with the rainfall level recorded in this month (table 4). The studies presented in this paper are in accordance with other studies conducted by the *Faculty of Horticulture and Forestry* in 2000, made by Lăzureanu, A., et all., [4], 2006 by Cozma et all., [3] and Popoviciu Lenuta in period 2010-2011 [5,6].

Conclusions

-Analyzed samples from wells along the Timis River, are characterized by low content of nitrates, nitrites, and ammonium ion concentration. The existence of ammonium ion in water and lack of nitrates indicate a recent water contamination.

- Were registered higher values of nitrate content in July, in all sampling points. Interval ranging between 6.3 mg /L (Graniceri) and 21.2 mg/L (Cebza), this is due to excessive rainfall fallen in June of 107.9 mm.
- Values of nitrite content in the analyzed samples were within the limit values set by standards, of 0.5 mg /L, the highest values were recorded in July with values that ranged between 0.14 mg/L (Caransebes) and 0.32 mg/L (Cebza). The average for those 4 months monitored ranged between 0.14 mg/L (Gavojdia) and 0.21 mg/L (Slatina –Timis)
- In July 2011, concentrations of nitrogen compounds have maximum values and are due to excessive rainfall of 107.9 mm, recorded during this time of year.

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