

# MONITORING OF NITROGEN COMPOUNDS CONTENT IN UNDERGROUND WATER FROM TIMIS RIVER

## MONITORIZAREA CONȚINUTULUI ÎN COMPUȘI CU AZOT AL APEI FREATICE DE PE CURSUL RÂULUI TIMIȘ

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**Abstract.** The purpose of this paper is to present the results of monitoring the river Timis in terms of nitrogen content in the period 2009-2010. Experimental were determined nitrogen compounds (nitrate, nitrite, ammonium) in wells from five localities situated along the river Timis Slatina-Timis Caransebes Gavojdia, Cebza, Graniceri, 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 maximum 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 and nitrites content, but with higher values of ammonium ion concentration. The existence of ammonium ion 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.

**Key words:** nitrates, nitrites, ammonia, Timis river

**Rezumat.** Scopul acestei lucrari este de a prezenta rezultatele monitorizării râului Timiș din punct de vedere al conținutului de compuși cu azot în perioada 2009-2010. Experimental s-au determinat trimestrial compușii cu azot (nitrați, nitriți, amoniu) în foraje provenite din 5 localități situate de-a lungul râului Timiș: Slatina-Timiș, Caransebeș, Găvojdia, Cebza, Grăniceri, puncte distribuite uniform între izvoare și punctul de ieșire din țară a râului, și anume granița cu Serbia. Analizele au fost efectuate în Laboratorul de determinări reziduuri de la USAMVB Timișoara, iar aparatul utilizat pentru determinarea compușilor studiați a fost Spectrofotometru SQ 118. În lunile de toamnă-iarnă, valorile concentrațiilor de compuși cu azot sunt maxime și se datorează precipitațiilor frecvente înregistrate în această perioadă a anului. Probele analizate, provenite din foraje efectuate de-a lungul râului Timiș, se caracterizează prin conținut scăzut de nitrați și nitriți, dar prin valori mai ridicate a concentrației ionului amoniu. Existența în apă a ionului amoniu și lipsa azoților indică o impurificare recentă a apei. Când apa conține atât amoniac, cât și nutrienți se presupune o poluare de la care a trecut un anumit interval de timp. Lipsa amoniului, dar prezența azoților și azoților, presupune o impurificare care s-a produs de mult timp. Astfel că, în acest interval de timp, apa s-a autoepurat.

**Cuvinte cheie:** nitrați, nitriți, amoniu, râul Timiș.

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## INTRODUCTION

Timis River, the richest water resources in the Area of Banat River basin drains an area of over 5677 km<sup>2</sup>. His length is 244 km. Timis has its sources on the eastern slopes of the mountains Semenik in Caras-Severin. River is formed at the confluence of three branches: Semenik 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 ([http://ro.wikipedia.org/wiki/R%C3%A2ul\\_Timi%C8%99\\_Dun%C4%83re](http://ro.wikipedia.org/wiki/R%C3%A2ul_Timi%C8%99_Dun%C4%83re))

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) (European Directive 98/83/EC water quality for human consumption).

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 permissible concentration - MPC) (Cuc Liana, 2002).

**Nitrogen compounds (ammonia, nitrites and nitrates)** are important steps in the presence of inorganic nitrogen in its complex cycle in nature (Alexa Ersilia, 2008). 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<sub>2</sub>**) 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 (Adriano C. et al., 2003).

## 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, points distributed between the source and the point out of the river, namely the border with Serbia. Samples were taken quarterly, during the two years 2009-2010, the results were interpreted according to the requirements of the Law 458/2002 regarding chemical parameters of water quality. Sampling points are shown in table 1.

The content of nitrate, nitrite and ammonium in water was determined experimentally in the laboratory using rapid tests MERCK, the SQ 118 Spectrophotometer at wavelengths: 515 nm, 525 nm, 690 nm for nitrate, nitrite, respectively ammonium.

Table 1

Sampling points descriptions	
Sampling points	Characteristics
<b>Slatina-Timis</b>	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.
<b>Caransebes</b>	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 ( $S = 1800 \text{ m}^2$ ) that complement the underground flow of 15 wells which provide 25% of the needed water of city of Caransebes
<b>Gavojdia</b>	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.
<b>Cebza</b>	Sampling point is located downstream of the Timis-Bega River splitting point, downstream from the discharge of sewage from the city of Lugoj.
<b>Graniceri</b>	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.

## RESULTS AND DISCUSSIONS

The experimental results obtained are show in figures 1-6.

The maximum ammonia content in water wells was established according to Law 458/2002 to 0.5 mg ammonium /L of water (Legea 458/2002).

In 2009 were registered values that exceeded the ammonium limit on drilling at Gavojdia (1.05 mg/L in January) and Graniceri (1.23 mg/L in January, 0.75 mg/L in July and 0,90 mg/L in October).

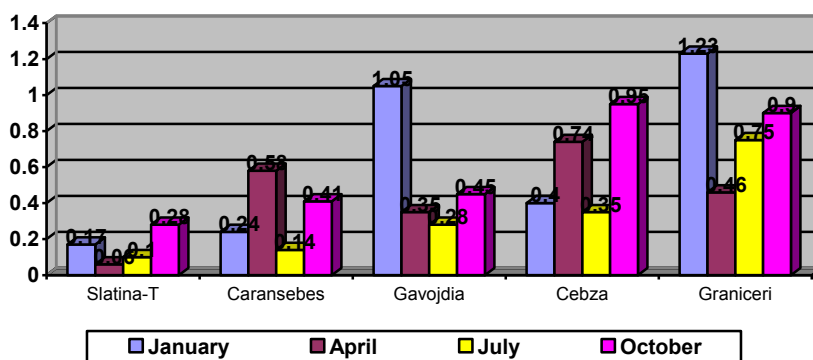


Fig. 1 - Ammonium content (mgN/L) in water samples taken from drillings along of Timis river 2009

Gavojdia sampling point is located downstream of 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, so explains the annual average value of 0.84 mg ammonia /L (figure 1).

Chemical parameters of water quality according to Law 458/2002 for nitrate are limited to 50 mg/L (Legea 458/2002).

This value was exceeded in Cebza sampling point (65.4 mg /L) in January 2009 and drilling from Graniceri, in October when has been recorded a maximum value of 126.1 mg/L exceeding the limit maximum allowed of 2.52 times .

In autumn and winter months, concentrations of nitrogen compounds has maximum value and are due to frequent rainfall recorded during this time of year (figure 2).

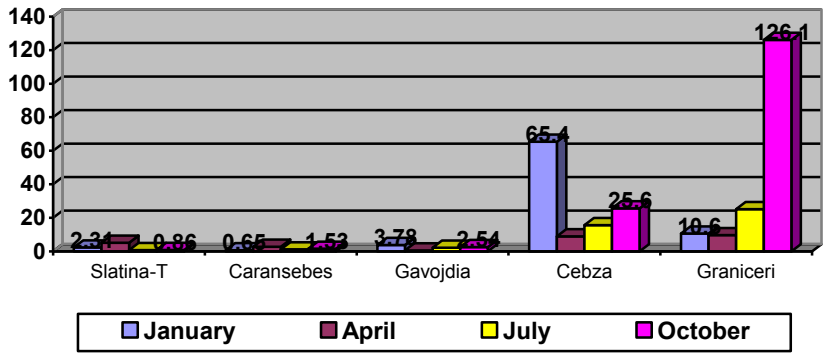


Fig. 2 - Nitrates content (mgN/L) in water samples taken from drillings along Timis river 2009

Values of nitrite content in the analyzed samples is within the limit values laid down in standards, except Graniceri sampling point with a value exceeding the limit of 0.5 mg /L in April and in October 2009. Also, in drilling from Gavojdia has been registered a value of 0.52 mg/L near the maximum allowable limit of 0.5 mg/L nitrite (figure 3).

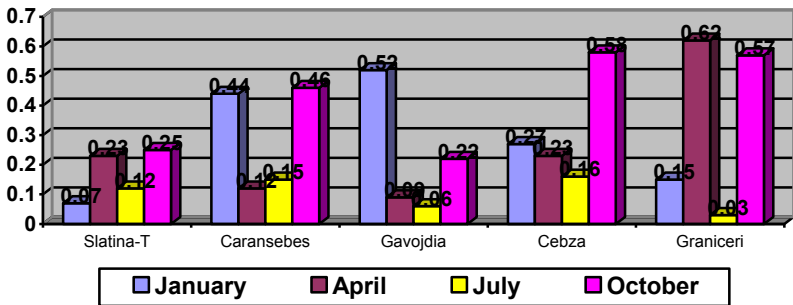
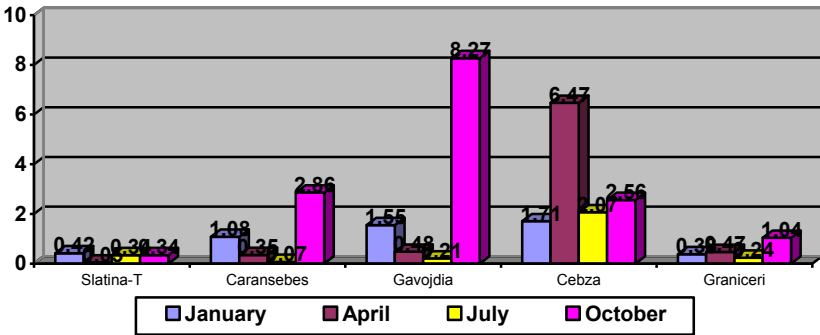


Fig. 3 - Nitrites content (mgN/L) in water samples from drillings along Timis River, 2009

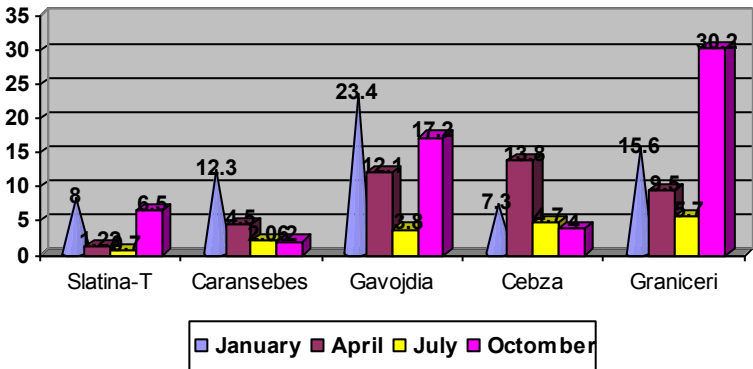
In 2010, there was a decrease of ammonium content in the annual average value in the Graniceri sampling point to 0.53 mg ammonia/L water compared with 2009 when it scored an average value of 0.9 mg/L. Maximum allowed limit of 0.5 mg/L was exceeded in October when was recorded the maximum value of 1.04 mg/L. In the sampling points Caransebes, Cebza and Gavojdia were recorded in 2010, annual average values that exceeded maximum allowed value. In January and October 2010 were recorded values that exceed the maximum permissible limit of 0.5 mg /L in the three sampling points earlier mentioned, correlated with the rainfall level recorded in this year (figure 4).



**Fig. 4 - Ammonium content (mgN/L) in water samples taken from drillings along of Timis river 2010**

Nitrate content in wells existing in the area of Timis watercourse does not exceed the maximum allowable value of 50 mg/L stipulated by law in Law 458/2002 (figure 5).

In 2010, with the exception Graniceri sampling point, in January, when there was a nitrite content of 0.64 mg/L, was not exceeded maximum permissible limit of 0.5 mg /L (figure 6).



**Fig. 5 - Nitrates content (mgN/L) in water samples taken from drillings along Timis River 2010**

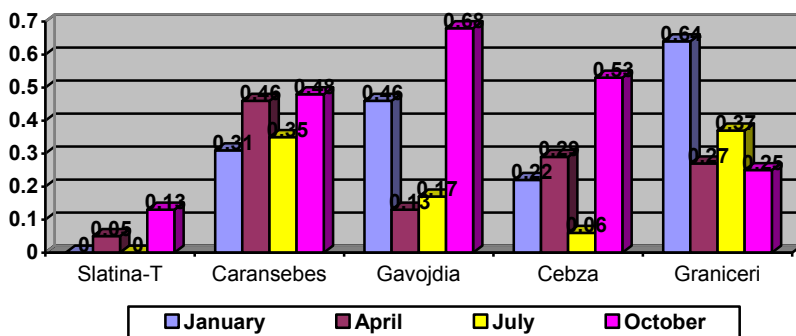


Fig. 6 - Nitrites content (mgN/L) in water samples from drillings along Timis River, 2010

## CONCLUSIONS

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

2. Maximum allowable limit of 0.5 mg/L established for ammonium ion was exceeded in samples collected from localities Gavojdia and Gradinari. Gavojdia sampling point is located downstream of the confluence with the Lanca-Birda creek, that collects wastewater livestock farm belonging Ciacova and downstream of the pig farm Peciu Nou which discharging manure directly into the Timis River, which explain the exceeding of the maximum allowed value.

3. In autumn and winter months, concentrations of nitrogen compounds have maximum values and are due to frequent rainfall recorded during this time of year.

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