

# Studies Concerning the Quality of Underground Water from West Area of Romania.

## I. Nitrogen Inorganic Compounds

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**Abstract:** Nitrogen inorganic compounds take an important place in the field of the chemical substance pollution of drinking water. In this paper our interests were to evaluate the nitrogen inorganic compounds of Timis country in ground water resources, in the year 2005. This data is the cornerstone of the health status research lead especially on the child population from these areas, who is exposed to high concentration of that nitrogen compounds and to find viable solution for the improvement of the drinking water supply system.

**Keywords:** ammonia, nitrit, nitrat, ground drinking water

### 1. Introduction

The underground water was considered a source of drinking water qualitative properly, being in general much better protected [1]. This water has suffered modifications due to changes in surface activities.

The changes regarding the quality are still in an incipient phase because the time necessary for the surface water to infiltrate in the ground is long [2].

The cycle of nitrogen's compounds in soil is schematic showed in figure 1 [3].

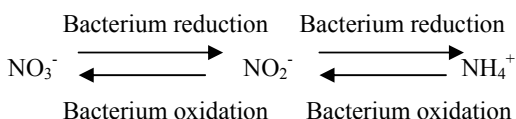


Figure 1. The cycle of nitrogen's compounds in soil

The nitrates are the final stage of the organic nitrogen oxidation [4]. The nitrogen contained in the nitrates, nitrites or ammonia, is a nutritive element for the plants and it is used with phosphor in agriculture [5, 6].

The presence of nitrates in natural water results from the contact of water with the soil of the hidrographic basin.

The nitrites are an important stage in metabolism of nitrogen compound in soil. They are an intermediary phase between ammonia and nitrates [7, 8]. Their presence in soil is due either to the bacteria oxidation of the ammonia or to the reduction of the nitrates (figure 1).

An important fact is the presence of the nitrites of natural origin in water is very rare and it was found in water who came from melting snow or in the deep water layers.

In the case of good quality water but containing nitrites is necessary to be analysed microbiological and chemical to establish the causes of the nitrites presence in water [9].

Ammonia result in water from incomplete degradation of the organic substances that contain azoth or it can also come from soil [7, 10-12]. It represents the first stage of decomposition of organics substances who contain nitrogen in their molecule and that's who it indicates a recent pollution (hours – days) and by consequence a dangerous one.

The human activity accelerates the enrichment of water sources with inorganic compounds of nitrogen:

- discharge of domestic used water;
- the use of fertilizers on agricultural fields;
- offal's who come from fertilizer's industry, etc [13].

### The effects of pollution with inorganic compounds of nitrogen

The first effect of chemical pollution with nitrogen inorganic compounds is the toxic potential of these substances who has determined a chemical pathology of hydrological nature. These toxic effects are dangerous because they can determinate acute, sub acute or chronic intoxications and also because they can transform into long time effects dues to the micro quantities daily consumed. The long time effects can be non-specific or they can manifest on descendants.

Other effects frequently meet and noticed by the consumers is the modification of organoleptic characteristics of water who has determined unpleasant sensory reactions. This includes particular taste and odour, visual modifications of colour and turbidity, colour water and unpleasant sensation provoked by the contact with water. These changes of water proprieties leas to discomfort and limitation of water utilisation by the population especially because a large number of chemical substances are liable to alter the organoleptic properties of

water even at very low concentrations that overtake ppm order.

The most frequent effect is the ecological one and it consist in the influence of certain pollutant substances on biological process in natural water. In water there is an ecological balance of different biocenosis. This balance is very sensitive to that small changes but persistent in water composition can lead to important perturbations. Their results are destruction of water micro organisms and consequently by consequence the cessation or the slowness of natural phenomenon of self-cleaning, sometimes economical consequences may appear due to the watery fauna and flora destroy, especially fished who are very sensitive to chemical pollution of water.

The water pollution is considered to be a direct or indirect modification of its normal composition as a result of human activity. The substance how pollute provoke by their nature, concentration and time of action, harmful effects on health, they create discomfort and they make more difficult to use the environment.

It must to be specifying that the simple introduction in the environment of some substances, who can affect negatively the state of an ecological system, mustn't be considered as pollution because the nature has numerous mechanisms of assimilation and transformation of these substances and by this way it can reduce their harmful (self purification). Thus, pollute water can suffer a decrease given the initial value because of his capacity of self purification. This means to dilute the substances from the pollute water and to lower their concentration, the fall out of insoluble substances, to degraded the organic substances and to transform them through biological process using micro organisms present in water. To this process we can add different physical-chemical reactions who take place between different pollutants substances or between them and those who belong to the natural composition of water like: oxidation, reduction, precipitation, adsorption, and absorption, all of this make a reduction of pollutant substances concentration. These phenomena who's purpose are to self purify the water, had started lately to lose their importance as a result of the increasing of frequency of pollution and the rising of necessary time to bring the environment to his initial characteristics.

The phenomena of *consecutive pollution* lead to accumulation of pollutant substances and to growth and maintain of the pollution level reached. If we add the reduced possibilities of degradation of pollutants or their absence we can realise the true value of consequence reduction of natural's reserves that humanity benefits this days.

Self pollution is due to the presence in environment of some natural elements that degrades it. For example the destruction of aquatic plants mass as a result of a good period of developments („*water blossoming*”).

The ecological balance of different biocenosis in water is very sensitive so that small changes, but persistent in water composition may lead to important perturbations and consequences may appear due to the distinction of aquatic flora and fauna, especially fishes who are very sensitive to chemical pollution of water.

The chemical pollution of water, especially of drinking water is a serious problem, because it is difficult to eliminate the chemical pollutants, especially those in low concentrations. These finding had led to big efforts for reaching complex method of treatments to obtain water with the same qualities with the one before pollution. The result is the growth of expenses necessary for the treatments of water [14-18].

The presence of the nitrogen inorganic compounds in drinking water doesn't represent a danger for child or adults, but only for new-born babes the last ones absorbs directly or indirectly the compounds founded in food. The processes implicated are reduction or oxidation to nitrites lengthways the digestive tube, how can make methemoglobinemia [7, 19, 20]. These sicknesses are place at nitrates concentration up then 46 mg/l [21]. The presence in the drinking water of the nitrites in big concentration can make low blood pressures at people [22].

Norms at World Health Organisation (OMS) and Low no. 458/8 July 2002 modify by Low 311/2005 regard quality of drinking water consider that the maxim concentration acceptable for nitrate is 50 mg/l. For nitrite the maxim concentration acceptable is 0.5 mg/l.

The maxim concentration admissible (CMA) for ammonia in drinking water in the lows is 0.5 mg/l.

## 2. Experimental

The studies follow the evaluation of the nitrogen inorganic compounds concentration in water from different height, in urbane and rural medium. In this context, we followed-up:

- the analysis of the sample form different sources from deep water and the results interpretations;
- the evaluation of the nitrogen inorganic compounds distribution in local sources from deep water in Timisoara;
- the evaluation of the nitrogen inorganic compounds distribution in local sources from deep water in rural localities from Timis district.

In this purpose it has been analysed 30 samples from Timisoara city and 136 samples from rural locality from Timis district, in year 2005.

Nitrate determination from water was made with phenol disulphuric acid, what make with nitrate derived nitro sulphuric what have yellow colour. Intensity of colour it is measured by spectrophotometer, at wavelength about 410 nm for concentration until 10 mg NO<sub>3</sub><sup>-</sup>/dm<sup>3</sup> and at wavelength about 480 nm for concentration between 10 and 100 mg NO<sub>3</sub><sup>-</sup>/dm<sup>3</sup>. For concentration bigger then 100 mg NO<sub>3</sub><sup>-</sup>/dm<sup>3</sup> we dilute the sample [23-25].

For nitrite determination we used the reaction with sulphanilamide. The principle is the reaction of nitrite with sulphanilamide in acid medium (pH =1.9) when result a salt : diazonic what, with N -(1 - naphtil) - etilendiamine make one nitric compound with pink colour. The concentration of this compound can be measured by spectrophotometer method at wavelength 540 nm [23, 24, 26].

The determination of ammonia ion from water it was done with Nessler reactive (potassium tetra iodine mercurial), in basic medium. That is the iodide amido-oxi-dimercuric form what has the yellow colour, orange or red. This complex can be measured by spectrophotometer method [23, 24, 27].

For this determination we used the UV-Vis Varian Cary 50spectrophotometer.

### 3. Results and discussion

#### 3.1. Studies regarding the variation of ammonia ions concentration

The experimental results regarding the variability of ammonia ions concentration from deep water is showed in table.

TABLE 1. The distribution of ammonia ionic concentration in water samples ( $\text{mg NH}_4^+/\text{dm}^3$ ) distribute on the deep of drillings, in Timis County.

No.	Locality name	Samples no.	H (m)	Value interval $\text{mg NH}_4^+/\text{dm}^3$	CMA $\text{mg NH}_4^+/\text{dm}^3$
1	Timișoara	30	> 100	0.0-4.16	0.5
2	Albina	3	5-10	0.46-1.98	0.5
3	Cărpiniș	1		1.40	0.5
4	Cenei	1		1.15	0.5
5	Chevereșul Mare	1	>100	1.89	0.5
6	Crai Nou	1	40-70	1.76	0.5
7	Cruceni	3	> 100	1.05-1.19	0.5
8	Denta	2		0.89-0.96	0.5
9	Diniaș	2	70-100 > 100	1.71 1.23	0.5
10	Dracșina	2	5-10	0.40-0.49	0.5
11	Fibiș	1	5-10	0.18	0.5
12	Gătaia	4	> 100	0.26-1.50	0.5
13	Giulvăz	3	>100	0.9-1.57	0.5
14	Ionel	6 21	70-100 > 100	0.68-1.53 0.01-9.4	0.5
15	Ivanda	4 4	10-40 > 100	0.21-0.68 0.23-0.86	0.5
16	Izvin	1	> 100	0.09	0.5
17	Lățunaș	8 5	5-10 10-40	0.0-0.09 0.0-1.06	0.5
18	Moșnița Nouă	1	5-10	0.61	0.5
19	Otelec	15 9	40-70 70-100	0.31-1.88 0.29-1.49	0.5
20	Peciu Nou	2	> 100	0.82-1.10	0.5
21	Pustiniș	2 6 11	40-70 70-100 > 100	1.07-1.55 0.73-1.55 0.61-1.04	0.5
22	Răuți	1 1	40-70 70-100	1.78 0.95	0.5
23	Rovinița Mare	3	> 100	0.36-0.42	0.5
24	Sânmatrin Maghiar	4	70-100	0.75-0.95	0.5
25	Uivar	4 4	70-100 > 100	0.76-1.58 0.31-1.13	0.5

The experimental results allow the establishing of the ammonia ion concentration in deep water from different part of soil. From this part results the fact that it can be estimated the number of the drillings where the concentration of ammonia have biggest value then the maxim limit admitted by the legislation. This value is showed in the Table 2 and in the Figure 2.

TABLE 2. The variation of the drillings number correlated with the ammonia concentration in water.

	Concentration of $\text{NH}_4^+$ below CMA	Concentration of $\text{NH}_4^+$ over CMA
% drilling in urban medium	51.9 %	48.1 %
% drilling in rural medium	14.6%	85.4 %

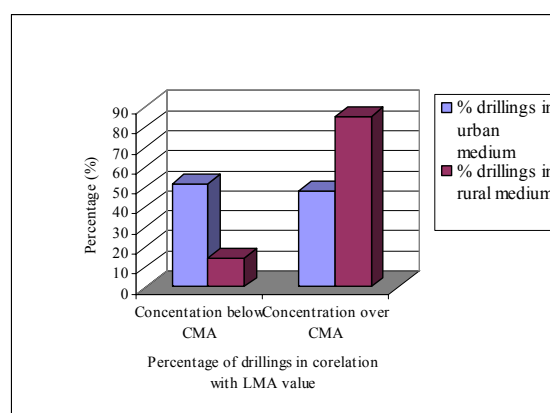


Figure 2. The variation of the drillings percentage correlated with the ammonia concentration

From this data it can be observed that the number of drilling polluted with ammonium ions is big, in rural medium number of drilling who have concentration over the maxim concentration admitted 85 %. It must to be found one method to remove this ion from drinking water. In case of new born child it must to find another source of water, because of the toxic potential of this element.

#### 3.2. Studies regarding the variation of concentration in nitrite ions

In Table 3 is presented the variation of the nitrite ions concentration in the analysed water sources.

From the experimental data it can be calculated the number of drillings what have the quantity of nitrite ions over the CMA establish by legislation. This value is presented in Table 4 and in Figure 3.

TABLE 3. The distribution of nitrite ionic concentration in water samples ( $\text{mg NO}_2^-/\text{dm}^3$ ) distribute on the deep of drillings, in Timis County.

No.	Locality name	Samples no.	H (m)	Value interval $\text{mg NO}_2^-/\text{dm}^3$	CMA $\text{mg NO}_2^-/\text{dm}^3$
1	Timișoara	30	> 100	0.0–0.034	0.5
2	Albina	3	5–10	0.007–1.98	0.5
3	Cărpiniș	1		0.0	0.5
4	Cenei	1		0.002	0.5
5	Chevereșul Mare	1	> 100	0.009	0.5
6	Crai Nou	1	40-70	0.015	0.5
7	Cruceni	3	> 100	0.018-0.02	0.5
8	Denta	2		0.0-1.2	0.5
9	Diniaș	1	70-100	0.079	0.5
		1	> 100	0.037	0.5
10	Drațeșina	2	5-10	0.167-0.604	0.5
11	Fibiș	1	5-10	0.01	0.5
12	Gătaia	4	> 100	0.003-0.017	0.5
13	Giulvăz	3	>100	0.006-0.012	0.5
14	Ionel	6	70-100	0.018-0.11	0.5
		21	> 100	0.009-2.385	0.5
15	Ivanda	4	10-40	0.009-3.11	0.5
		4	> 100	0.028-0.088	0.5
16	Izvin	1	> 100	0.009	0.5
17	Lățunaș	8	5-10	0.02-0.05	0.5
		5	10-40	0.02-0.15	0.5
18	Moșnița Nouă	1	5-10	0.10	0.5
19	Otelec	15	40-70	0.009-2.412	0.5
		9	70-100	0.01-0.187	0.5
20	Peciu Nou	2	> 100	0.0-0.065	0.5
21	Pustiniș	2	40-70	0.011-0.027	0.5
		6	70-100	0.01-0.134	0.5
		11	> 100	0.01-0.058	0.5
22	Răuți	1	40-70	0.037	0.5
		1	70-100	0.019	0.5
23	Rovinița Mare	3	> 100	0.0-0.002	0.5
24	Sânmatrin Maghiar	4	70-100	0.019-0.033	0.5
25	Uivar	4	70-100	0.0-0.22	0.5
		4	> 100	0.0-2.21	0.5

TABLE 4. The variation of the drillings number correlated with the nitrite concentration in water

	Concentration of $\text{NO}_2^-$ below CMA	Concentration of $\text{NO}_2^-$ over CMA
% drilling in urban medium	100 %	0 %
% drilling in rural medium	94.3%	5.7 %

From the experimental data showed it can be take out one fact the number of drilling with quantity of nitrites ions what are over the maximum concentration admitted is small, that fact is because this ions are instable in water.

### 3.3. Studies regarding the variation of nitrate ions concentration

Variability of nitrates ions concentration in deep water studied is showed in Table 5.

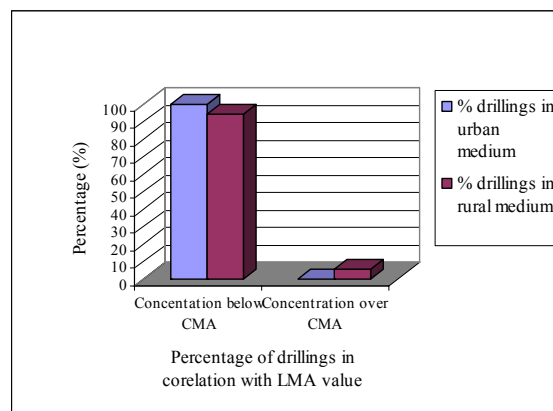


Figure 3. The variation of the drillings percentage correlated with the nitrites concentration

TABLE 5. The distribution of nitrate ionic concentration in water samples ( $\text{mg NO}_3^-/\text{dm}^3$ ) distribute on the deep of drillings, in Timis County.

No.	Locality name	Samples no.	H (m)	Value interval $\text{mg NO}_3^-/\text{dm}^3$	CMA $\text{mg NO}_3^-/\text{dm}^3$
1	Timișoara	30	> 100	0.0–0.034	50
2	Albina	3	5–10	0.007–1.98	50
3	Cărpiniș	1		0.0	50
4	Cenei	1		0.002	50
5	Chevereșul Mare	1	> 100	0.009	50
6	Crai Nou	1	40-70	0.015	50
7	Cruceni	3	> 100	0.018-0.02	50
8	Denta	2		0.0-1.2	50
9	Diniaș	1	70-100	0.079	50
		1	> 100	0.037	50
10	Drațeșina	2	5-10	0.167-0.604	50
11	Fibiș	1	5-10	0.01	50
12	Gătaia	4	> 100	0.003-0.017	50
13	Giulvăz	3	>100	0.006-0.012	50
14	Ionel	6	70-100	0.018-0.11	50
		21	> 100	0.009-2.385	50
15	Ivanda	4	10-40	0.009-3.11	50
		4	> 100	0.028-0.088	50
16	Izvin	1	> 100	0.009	50
17	Lățunaș	8	5-10	0.02-0.05	50
		5	10-40	0.02-0.15	50
18	Moșnița Nouă	1	5-10	0.10	50
19	Otelec	15	40-70	0.009-2.412	50
		9	70-100	0.01-0.187	50
20	Peciu Nou	2	> 100	0.0-0.065	50
21	Pustiniș	2	40-70	0.011-0.027	50
		6	70-100	0.01-0.134	50
		11	> 100	0.01-0.058	50
22	Răuți	1	40-70	0.037	50
		1	70-100	0.019	50
23	Rovinița Mare	3	> 100	0.0-0.002	50
24	Sânmatrin Maghiar	4	70-100	0.019-0.033	50
25	Uivar	4	70-100	0.0-0.22	50
		4	> 100	0.0-2.21	50

TABLE 6. The variation of the drillings number correlated with the nitrate concentration in water

	Concentration of $\text{NO}_3^-$ below LMA	Concentration of $\text{NO}_3^-$ over LMA
% drilling in urban medium	92.6 %	7.4 %
% drilling in rural medium	92.7%	7.3 %

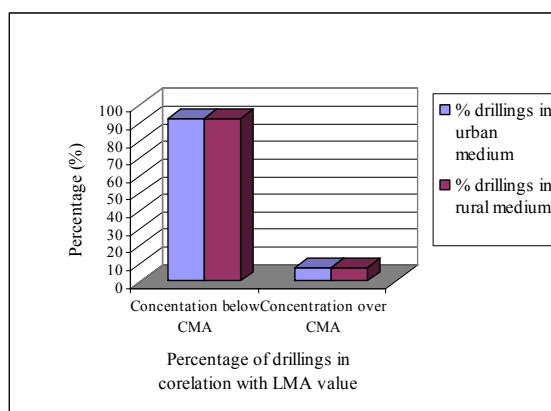


Figure 4. The variation of the drillings percentage correlated with the nitrates concentration

The figure shows an equal number of drilling what have the concentration over the maximum concentration admitted in urban and rural medium.

#### 4. Conclusions

The studies made for establish the concentration of nitrogen inorganic compounds in the drilling, in Timis County, allow the characterisation of the deep water in drinking scope.

118 samples from deep water source show quantity of ammonia ions over maximum concentration admitted by sanitary norm.

The number of 7 sources by water shows concentration of nitrite ions over concentration maximum admitted in drinking water.

11 from deep water sources show the concentration of nitrate ions over concentration maximum admitted by the sanitary legislation.

This study notice high quantity of nitrate, nitrite and ammonia in drinking water. This fact is an important risk factor for human health. It must be found some protection measurements for coat of water used as drinking water, for prevention of his degradation and study the possibility to remove these ions form water.

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