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THE ECOTOXICITY INFLUENCE OF NITRITE AND NITRATE ABOUT ENVIRONMENT

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Abstract
In this study were analyzed water samples in terms of the content of nitrites, nitrates, ammonia collected from Ialomita river. The human or animal concentrations determine the accumulation of nitrogenous substances, represented by dejection wastewater and many other categories of waste from human activities. On land, the balance between NO_3^- and NH_4^+ is achieved when NO_3 reaches about 150 mg N/g, and in fallow areas balance is 24 mg N/g. The most amounts of nitrogen accumulates in plants. Some plants contain about 500 times more nitrogen than soil reserves.
Non-metals and anorganic anions are pollutants that cause environmental problems because they are used in large quantities as anions (nitrates and phosphates). The nitrate fertilizers are used extensively in the agriculture. During the growing, many fertilizers applied are absorbed by plant roots, and when growth ceases, nitrates released during the decomposition of plants go into the ground and can enrich adjacent watercourses. Increasing the amount of nitrogen causes algae populations flowering effect, called eutrophication, that often leads to the destruction of microorganisms by oxygen released from algal tissue death. The nitrite content is reduced significantly after wastewater treatment with 31,81% and nitrate content decreases with 31,45%. The water samples from Ialomita river demonstrates that, after performing wastewater treatment, the content of nitrates and nitrites is below the acceptable limits of law namely 10 mg/l for nitrates and 0,009 mg/l for nitrites.

Keywords: nitrogenous substances, wastewater, pollutant, nitrifying bacteria, spectrophotometry

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1. INTRODUCTION

The intensification of the agriculture has led in some cases to the use of nitrogen fertilizers in amounts disproportionate to the needs of the plants (Atlas R.M. and Bartha R., 1987). This has been criticized by environmentalists. To find a reconciling solution, it was recommended expanding crop legumes (Manea L., Alexandrescu D., 2013). In practice, this could not solve because the human, animal and poultry populations is feeding in principle with cereal grains. The last two are the main sources of animal protein.
Nitrate fertilizers are characterized by their great mobility. From their reduction, is obtained toxic products to humans and warm-blooded animals (Piper I.L., Gerba C.P., Brusseau M.L., 1996; Calancea L., 2002).
The nitrification process can be controlled by inhibiting products, that is containing many harmful micro-organisms. The opposite process of the nitrification, is the denitrification (Maier R.M.; Piper I.L.; Gerba C.P., 2000; Rockets R., 2007). In some circumstances, the process has a positive character, and in some cases, it has a negative character, due the particularly harmful microorganisms (Zhang, Y., Love, N. and Edwards, M., 2009; www.hc-sc.gc.ca/ewh-semt/consult/_2012/nitrite-nitrite /draft-ebauche-eng.php).
The existence of life on earth is closely related to the interactions within the synthesis of photosynthesis and nitrogen assimilation of nitrate and ammonia. Both take place almost simultaneously. In the absence of the favorable conditions of life, most commonly plants are prone to stress. The children and the young animals health are dependent of food preparation and nitrate content of plants.

Methemoglobinemia and cancer are easily predictable (Sanchez-Echaniz J., Benito-Fernandez J. and Mintegui-Raso S., 2001; Manea L., Manea I., 2009).
Exceeding the maximum allowable limit for nitrate in drinking water in the EU = 50 parts per million (ppm) can cause blue baby syndrome disease (blue) or methemoglobinemia to children and young animal. This toxic effect is favored by the fact that the infants ingest milk mixed with water contaminated with nitrates during the first months of life, that reach in the stomach, where exist the anaerobic organisms (Mensinga T.T., Speijers G.J.A. and Meulenbelt J., 2003). Health implications of exposure to environmental nitrogenous compounds (Ward, M.H. et al , 2003).
The importance of nitrites and nitrates is quite high, because they contain nitrogen, an essential element for plants and animals. They are part of the natural cycle of nitrogen. (http://www.bio-elite.co.za/cms/index.php?page=ammonia-nitrite-and-nitrate)
Nitrogen is reduced to ammonia by nitrogen-fixing bacteria. It is an element used by plants to produce vital molecules. Nitrifying bacteria consume ammonia and convert it into two steps through an intermediate nitrate to nitrite (Bitton G., 1999; Walker C.H., Hopkin, S.P., Sibly R.M. Peakall D.B., 2006).

2. MATERIAL AND METHODS

2.1. Samples

The materials used in the study are the water samples. The water harvesting is done in clear glass containers with ground glass stopper or cork. If the water source is chlorinated, it is inserted into the collection container one milliliter of a 0.1% strength solution of sodium thiosulfate at 100 ml of water to neutralize the chlorine. For the chemical analysis is collected between 2 and 4 liters of water.
The water samples are taken from the area upstream and downstream, from the waterfront and from the water center.

2.2. Preservation of water samples

In four hours by collecting, the sample is preserved with 4 ml of H_2SO_4 (sulphuric acid) in proportion of 1 to 3 per liter to determine nitrites and nitrates.

2.3. Methods and reagents

The working method used in the analysis of water samples is spectrophotometry.
The spectrophotometry is a quantitative measurement of the reflection or transmission properties of a material according to the wavelength.
The concept is simple: the determine the reflection and transmission involves a careful analysis of the geometric and spectral measurement conditions. It is maintained the national scales of reflectance and transmission in the ultraviolet, visible and infrared spectral regions close (from 250 nm to 2500 nm).
As a method for determining the element concentration in the sample, is the calibration method: several solutions of known concentration samples (three or more solutions of different concentrations) were measured to draw a calibration curve of concentration according to the absorbance; the absorbance of an unknown sample is determined by extrapolation from the calibration curve. The standard sample is prepared so that its concentration include the unknown sample concentration value.

Table 1. The concentration of nitrites and nitrates in water sources analyzed

Specification	Ialomita River		The zootechnic wastewaters	The potable water
	upstream of the water treatment plant	downstream of the water treatment plant		
Nitrate (mg/l)	12,4	8,5	24,1	7,4
Nitrite (mg/l)	0,11	0,075	0,13	0,065

For the analysis, it is used the DR 2800 spectrophotometer. It is a visual spectrophotometer with a wavelength range from 340 to 900 mm. The instrument comes with a full set of application programs and multilingual support.

3. RESULTS AND DISCUTION

3.1. The aquatic system toxicity

In the freshwater areas or in the areas close to the estuary, nitrates can reach high levels and it can cause the death of the fishes.

Although the nitrates are less toxic than the ammonia, to a level of 30 ppm nitrate, they can inhibit growth, they affect the immune system and they can cause stress in some aquatic species.

In the most cases of the nitrate excess concentrations in aquatic systems, the main source of nitrate is represented by surface runoff from agricultural areas where nitrate was used as fertilizer excessively. This is called eutrophication and it can lead to the algal blooms. Besides that can lead to lack of oxygen in the water and to dead areas, these blooms of algae can cause changes in the ecosystem function, favoring some groups of the organisms more than others. As a result, because the nitrate is a component of total dissolved solids, they are widely used as an indicator of water quality. (Table 1)

After the analysis of water samples in the Ialomita river downstream of Targoviste, resulted the toxic concentrations presented in Table 2.

From these results it is observed that after the water treatment of Ialomita river, the low concentrations of nitrite and nitrate were between the maximum allowed limits in the potable water (10 mg/l for nitrates and 0,009 mg/l for nitrites).

The nitrite concentration in Ialomita river downstream of Targoviste, between 06.03.2012 and 21.05.2013 has exceeded the maximum permissible concentration limit, according to Order 161/2006. Maximum permissible concentration of nitrite for the 4th grade quality river is 0,3 mg/L. Minimum value obtained from the analysis of river water samples was 0.086 mg/l, and the maximum value was 1,154 mg/l (Figure 1).

The nitrates concentration in Ialomita river downstream of Targoviste, between 06.03.2012 and 21.05.2013 were within the maximum permissible concentration limits according to the Order 161/2006 (ORDIN nr. 161/16 februarie 2006). Maximum permissible concentration of nitrates in water quality flowing IV is 11,2 mg/l, and the concentrations obtained from the of the water samples from the river Ialomiţa is between 1,121 mg/l and 4,595 mg/l (Figure 2).

Table 2 The concentration of contaminants during monitoring (mg/l)

The water flow	The collecting date	$N\text{-}NO_2$ NO_2^-	$N\text{-}NO_3^-$ NO_3^-	$N\text{-}NH_4^+$ NH_4^+	Total N
Ialomiţa river downstram of Targoviste	06.03.2012	0,086	1,944	2,538	5,982
	25.04.2012	1,121	1,121	1,436	3,286
	29.05.2012	1,121	1,121	1,436	3,286
	13.06.2012	0,086	4,595	1,016	2,139
	16.07.2012	0,241	3,038	1,794	5,776
	23.08.2012	0,627	3,591	6,371	10,570
	19.09.2012	0,820	6,336	10,375	17,915
	22.10.2012	0,655	4,043	7,914	13,883
	23.11.2012	0,874	4,559	7,900	13,887
	20.12.2012	0,987	3,038	6,375	10,542
	22.01.2013	1,121	3,038	6,371	5,779
	23.02.2013	1,154	1,354	2,533	2,139
	21.03.2013	1,212	1,114	1,463	2,682
	22.04.2013	0,857	1,121	1,799	3,422
	21.05.2013	0,820	1,121	1,794	3,557

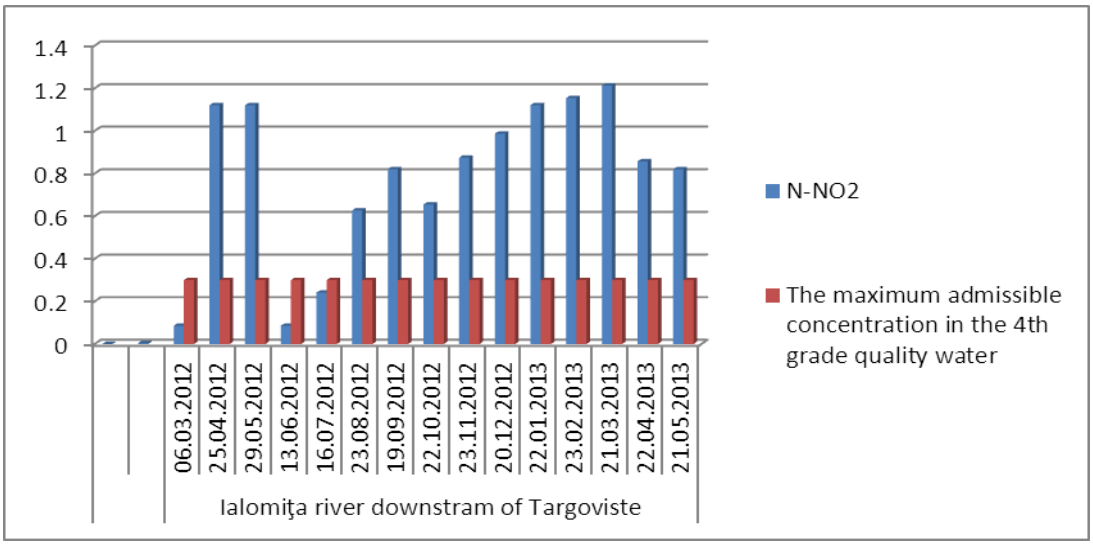

Fig. 1. The nitrites concentration in Ialomita river downstream of Targoviste

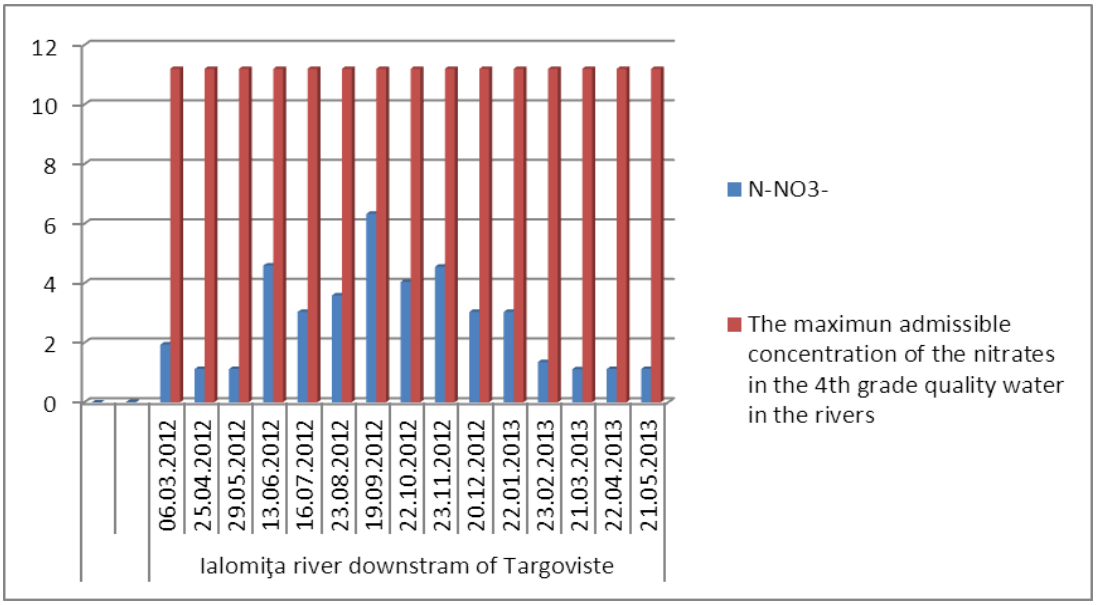

Fig. 2. The nitrates concentration in Ialomita river downstream of Targoviste

The oxidation of the nitrites in nitrates is more dynamic than the oxidation of NH_3 and NH^+_4 into NO_2. The formed nitrates can easily move to the other places where they can deposit.

The ecological significance of this process has a major importance. On the agricultural lands, the equilibrium between NO_3^- and NH_4^+ realize when NO_3^- reach at 150 mg nitrogen/year and in the uncultivated areas, the equilibrium realize at 24 mg nitrogen/year.

The high activity of the denitrification process leads to a major loss of nitrogen from the environment. This has a destructive effect for an ecosystem with a limited content of nitrogen.

The increase in the intensity of denitrification processes, leads to an increase of the atmosphere content of NO_2. This has an effect of intensification and chemical reactions that contribute to ozone depletion, which has serious consequences to human health and to the environment.

During the nitrification process is generating nitrogen oxides, which get into the atmosphere. Because of this, the nitrification can be a source of atmospheric NO_2.

4. CONCLUSIONS

The most important process in nature which is a base of life on earth is nitrogen fixation, which occurs by physico-chemical and biologically way. The nitrification is the process of oxidation of ammonia which takes place into the atmosphere, lithosphere, hydrosphere, and stratosphere. It has some positive and negative aspects to human life and to animals.

Denitrification is the reduction of nitrate to ammoniacal nitrogen and molecular nitrogen and it ends the nitrogen cycle.

The agriculture has a high importance in the nitrogen cycle and the nitrogen cycle has a major ecological importance.

The recycle of organic residues through a proper technology will make possible a good purification of the environment. The nitrate assimilation by plants occurs mainly with the participation of specific enzymes - nitrate reductase and nitrite reductase.

The nitrifying bacteria doesn't have directly toxic effects to human and animal health.The sensibility to the nitrate and nitrite toxicity is different from one species to another. The fodder can contain a toxic quantity of nitrates in some conditions. The potable water can contain a toxic amount of nitrates, but this amount is different in some conditions.

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