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THE NITROGEN COMPOUND CONTENT OF SOME NATURAL MINERAL WATERS FROM BUKOVINA, ROMANIA,VERSUS THEIR BOTTLED FORM

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Abstract: *The purpose of this paper is to study the problem of water contamination by nitrogen compounds such as nitrates, nitrites and ammonium in three zones of interest: one drill river in Păltiniș reservoir and „Rău" and „Chiril" rivers flowing through Crucea village in Bukovina Area, Romania. The work direction was to investigate the contamination level in the rivers and to compare the obtained results with the levels found in the bottled form of the water originating from these rivers, given the obligatory drinking water standards. This issue occured during debates with the local society. After developing the study we can remark that the water contamination levels by nitrogen compounds in the water sources rivers in the three chosen zones of interest and in the bottled still spring water as well, are lower than the maximum allowable value, but not 0. Mention should be made that there are no efforts made during the industrial water conditioning process to reduce the levels of nitrate, nitrite and ammonium in the water to be consumed by the population.*

Keyword: *water, contamination level, nitrogen compounds, zones of interest, bottled still water*

1. Introduction

Under the conditions of life existence, in general, and the conditions of ongoing human activities, especially, the water in different hydrological formations presents a double importance. First of all, it is an environmental factor, respectively,a habitat of a variety of living organisms. On the other hand, for people water composes a medium widely used in different types of their economical activity, but the chief use of water is for consumption [1].
The quality is the main dimension of water and the subject of mineral water quality is particularly interesting due to concerns about the concept of natural mineral water, consumption benefits and the original purity of bottled mineral water, a subject about which there have been many speculations lately [2].For this purpose, water is drawn from various sources. In many areas,the surface water is only used after the removal of the pollutants through treatment processes.From among water contaminants particularly burdensome are inorganic nitrogen compounds.In aerobic waters nitrogen is mainly present as $N_2$and NO_3^-, and depending on environmental conditions it may also occur as N_2O, NH_3, NH_4^+, HNO_2, NO_2^-or HNO_3.Ammonium,nitrate and nitriteplay the most important role in biochemical processes [3].
Nitrogen is essential for all living things as it is a component of protein. However,

excessive concentrations of nitrate-nitrogen or nitrite-nitrogen in drinking water can be hazardous to health, especially for infants and pregnant women [4].The primary health hazard from drinking water with nitrate-nitrogen occurs when nitrate is transformed to nitrite in the digestive system [5]. The nitrite oxidizes the iron in the hemoglobin of the red blood cells to form methemoglobin, which lacks the oxygen-carrying ability of hemoglobin. This creates the condition known as methemoglobinemia (sometimes referred to as „blue baby syndrome”), when blood iron in hemoglobin (Fe^{2+}) is reduced to its oxidized form,Fe^{3+}, the blood lacks the ability to carry sufficient oxygen to the individual body cells causing the veins and skin to appear blue [6].

A possibility exists that nitrate can react with amines or amides in the body to form nitrosamine which is known to cause cancer. Nitrate must be converted to nitrite before nitrosamine can be formed. The magnitude of the cancer risk from nitrate in drinking water is not known [7].

The ammonium does not directly harm the human body in typical pH values (6,5 to 9,5) applied in drinking water treatment. However, it may form nitrite ions under oxidative conditions.Beside the possible nitrite formation, the other issue related to the presence of ammonium in drinking water is the decrease of the chlorination disinfection efficiency. The ammonium reacts with chlorine forming chloramines, and thus reducing the amount of the disinfectant available for microorganism inactivation. The less efficient disinfection may cause secondary water pollution in the distribution system. Moreover, the resulting chloramines cause the unpleasant smell, which may lead to customer complaints [8].

In the presented research, it is discussed the problem of water contamination with nitrogen compounds such as nitrates, nitrites and ammonium in three zones of interest: one drill river in Păltiniș reservoir and „Rău” and „Chiril” rivers flowing through Crucea village inBucovina Area, Romania.The aim of the work was to investigate the contamination level in the rivers and to compare the obtained results with the levels found in the bottled form of the water originating from these rivers, given the obligatory drinking water standards. This issue occured during talks with local society.

2. Materials and methods

2.1. Location of the research

For this study, there were selected a number of three rivers from two localities in Bucovina region, Romania. The selection criteria of these localities, Crucea and Paltinis, were linked to their location, geographically speaking, and to the specific anthropogenic activities conducted in the area. Subsequently, the three rivers wherefrom the water samples were drawn were chosen because they are the source of water for a big Romanian company with the domain of activity linked to water treatment and bottling, and whose main marketing strategy is the spread of information that nitrogen compounds are absent in the spring still water they commercialize.

Crucea is a village located in the Bistrita Valley, in Suceavacounty. The specific activities of the population inCrucea village is the ore exploitation, farming and logging.

The Paltinis natural mineral water deposit is situated on the eastern rim of the Calimani Mountains, at the southern limit of the Dorna Depression. The deposit is hosted in the magnesium limestones in the cristalline-mesozoic area of the Eastern Carpathians which sank westward under the thick stack of the Calimani mountain volcanic rocks.

2.2. Materials

The analysis of the nitrogen compounds content in the samples drawn from the three rivers and in the still spring water sample marketed by the company in question was performed using the HACH LANGE DR 3800 spectrophotometer and the LCK 353 kits.

2.3. Methods

To determine the *nitrite* content of the samples it was analysed a water volume of 2 ml. This volume was inserted into the kit vial, after the aluminum foil of the kit was unbent, followed by the stirring of the vial and an idle time of 10 minutes. After the specified time, the vial was placed in the spectrophotometer, wherein it was determined the amount of NO_2 contained in the test samples, at a λ =515 nm wavelength.

To determine the *nitrate* content of the samples it was analysed a water volume of 1 ml and 0,2 ml of A reagent. This volume was inserted into the kit vial, after the aluminum foil of the kit was unbent, followed by the strong stirring of the vial and an idle time of 15 minutes. After the specified time, the vial was placed in the spectrophotometer, wherein it was determined the amount of NO_3 contained in the test samples, at a λ = 345 nm wavelength.

To determine the *ammonium* content of the samples it was analysed a water volume of 0,2 ml. This volume was inserted into the kit vial, after the aluminum foil of the kit was unbent, followed by the stirring of the vial and an idle time of 15 minutes. After the specified time, the vial was placed in the spectrophotometer, wherein it was determined the amount of NH_4 contained in the test samples, at a λ = 690 nm wavelength.

3. Results and discussion

From the correlation of the results it can be easily observed that in all the four studied samples the nitrate amount was lower than the maximum allowable value. However, a fraction of the nitrate contained in the samples was transformed to nitrite, their amount in the analysed samples being half of the maximum allowable value.

In this context, it should be noted, however, that it were found certain quantities of nitrates and nitrites in the bottled still spring water sample marketed by the company in question, contrary to the commercials and the statements they broadcast in the media environment.

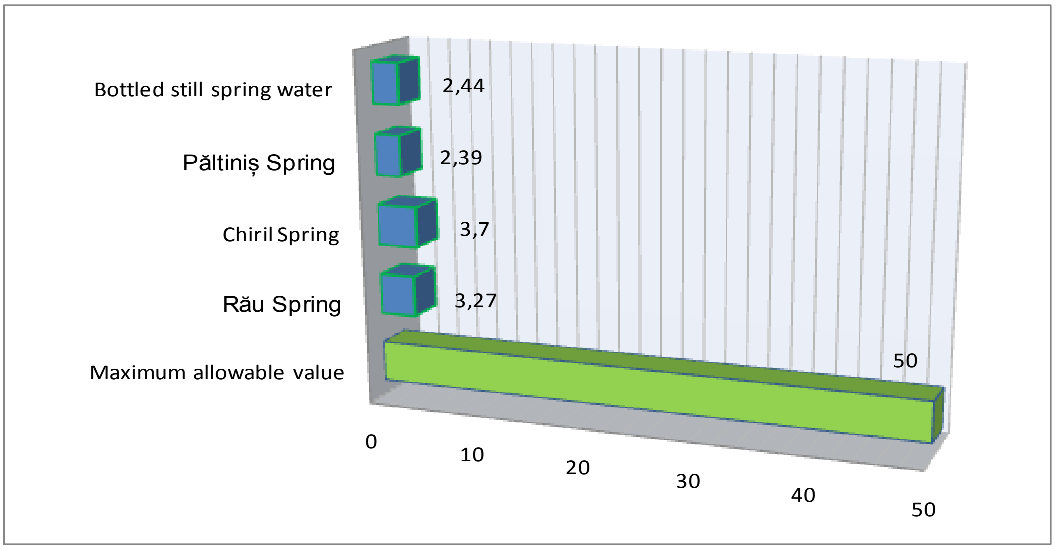

Fig. 1. The nitrate content (mg/l) in the water samples

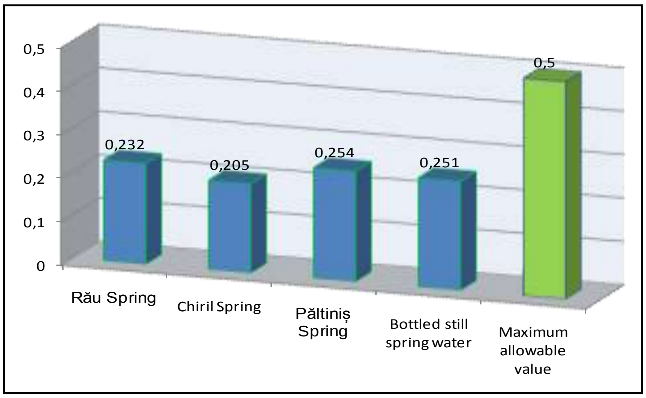

Fig. 2. The nitrite content (mg/l) in the water samples

The amount of nitrates and nitrites found in the bottled still spring water sample is almost equal to the amount of nitrate and nitrite contained in the samples taken from the source river of the company which commercialises it.

Table 1

The ammonium content (mg/l) in the water samples

	NH_4 (mg/l)
Rău Spring	0
Chiril Spring	0,014
Păltiniș Spring	0,011
Bottled still spring water	0,009
Maximum allowable value	0,5

Given that the maximum allowable value for ammonium ions in drinking water is 0,5 mg/l, the values obtained for the studied samples small, nonexistent in some cases (Rău Spring). This proves the purity of those sources in terms of domestic and industrial waste, which is not uncommon for mountain waters.

4. Conclusion

In conclusion we can remark that the water contamination levels with nitrogen compounds such as nitrates, nitrites and ammonium in the water sources rivers in the three chosen zones of interest and in the bottled still spring water as well,are lower than the maximum allowable value, but not 0. It can be noted that there are no efforts made during the industrial water conditioning process to reduce the levels of nitrate, nitrite and ammonium in the water to be consumed by the population.

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