THE WATER IN RURAL AREAS – STUDY ON NITRATE AND NITRITE CONTAMINATION OF FOUNTAIN WATER

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ABSTRACT

The reckless management of the last centuries, and especially the 20th century, as well as the human pollution factor, led to the degradation of the water quality in rural areas.

Chemical fertilizers and human waste are the main sources of nitrates and nitrites. Nitrate and nitrite salts are readily soluble in water and quickly get into the soil and groundwater, being assimilated by plants or retained in water from the well, which is usually used as drinking water.

The study presents the analysis of water from the wells from different counties in Romania, which proved that the water meets the requirements of national and international legislation.

INTRODUCTION

Nitrate (NO_3^-) and nitrite (NO_2^-) are two natural ions, ubiquitous in the environment, being produced by microbial oxidation of nitrogen in plants, soil or water. Nitrate is the most stable oxidized form of nitrogen; however it can be reduced to nitrite by microbial action. When nitrogen fertilizers are used to enrich soils, nitrates may be carried by rain, irrigation and other surface waters through the soil into groundwater and then flow to private wells. Human and animal wastes can also contribute to nitrate contamination of groundwater. Sources of nitrate that can enter in well include fertilizers, septic systems, animal feedlots, industrial waste, and food processing waste. Activities near the well can potentially contaminate the water supply. Nitrate and nitrite have some hazards for human. In living organisms nitrates and nitrites can lead to the emergence of compounds with major toxicological effects. The primary health hazard from drinking water with nitrate-nitrogen occurs when nitrate is transformed to nitrite in the digestive system. Most humans over one year of age have the ability to rapidly convert methemoglobin back to oxyhemoglobin; hence, the total amount of methemoglobin within red blood cells remains low in spite of relatively high levels of nitrate/nitrite uptake. However infants under six months of age (including pregnant and nursing mothers) may be at greater risk than the general population because the enzyme systems for reducing methemoglobin to oxyhemoglobin are incompletely developed and methemoglobinemia can occur. This also may happen in older individuals who have genetically impaired enzyme systems for metabolizing methemoglobin. A potential cancer risk from nitrate in drinking water and food has been reported. The possibility exists that nitrate can 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. The purpose of the present study was thus to determine the concentrations of nitrate and nitrite in water from the wells in different counties from Romania and to compare the nitrate and nitrite contents with standards levels.

MATERIAL AND METHOD

Quantitative determination of nitrates and nitrites requires a correct collection of the samples, sensitive equipment, measurements to be made immediately after harvest or as soon as possible (max. 24 h).

All aqueous solutions were prepared with ultra-pure water. The reagents used were of high analytical purity (purity ≥ 99%). The reagents used were purchased from Sigma-Alhrich Chemie GmbH, Merck.

Standard work solutions were prepared on the day of determination by taking the appropriate volumes from the stock solution after equilibration at room temperature using ultrapure water for dilution.

Sample collection: A total of 15 water samples from wells of Romania were randomly collected from five counties from Romania (Maramureş – sample 1, Sibiu – sample 2, Timiş – sample 3, Harghita – sample 4, Alba – sample 5) over a period of six months during the spring and summer seasons (from February to September) of the year 2016. All samples were collected in 1000 ml polythene bottles and carried to the laboratory. For each county three samples of water were taken.

Nitrate and nitrate were measured using spectrometric techniques. A molecular absorption spectrometric method (SR EN 26777:2002) is available for the determination of nitrites in potable water. The maximum permissible value for nitrites is 0,50 mg/l. For the determination of nitrates in potable water is used spectrometric method with sulfosalicylic acid (SR ISO 7890-3:2000). The maximum permissible value for nitrates is 50 mg/l.

RESULTS AND DISCUSSIONS

Nitrate and nitrite concentrations obtained from this study are summarized in table 1. For each sample an average of the obtained results was made and was shown in Table 1. The highest contents of nitrates and nitrites were showed 11,56 mg/l and 0,074 mg/l, respectively in only one sample from Harghita county. Nitrates and nitrites contents were low in water samples of Sibiu and Alba counties. All the samples were below the regulatory limits set for human consumption.

Table 1

The obtained concentrations for nitrites and nitrates

Physico-chemical indicators	Reference for analysis	Unit	Maximum permissible values	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Nitrites	**SR EN 26777:2002**	**mg/l**	**0,50**	**<0,016**	**<0,012**	**<0,027**	**<0,074**	**<0,012**
Nitrates	**SR ISO 7890-3:2000**	**mg/l**	**50**	**9,89**	**6,59**	**11,21**	**11,56**	**9,42**

CONCLUSIONS

Water resources control management can be important at these areas and it needs to apply some actions to reduce or remove nitrate from drinking water. It is necessary to monitor nitrate and nitrite in water. Therefore, domestic wells near potential point sources of contamination, such as livestock facilities or sewage disposal areas, should be tested at least once a year to monitor changes in nitrate concentration. Also, all drinking water supplies should be checked at least every two or three years to assure that significant increases in nitrate and nitrite are not occurring. Three methods such as distillation, reverse osmosis, and ion exchange are can be applied for removing nitrate from drinking water.

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