

## Studies Regarding the Ground Water Pollution in a Rural Area

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**Abstract:** The papers presents studies regarding the pollution of the ground water, in a rural area. Samples of drinking water from 10 wells have been analyzed in order to evaluate if their quality was affected as result of farming activities. We find out that the water from some of the wells in polluted, the values of some of the quality parameters being higher than the maximum addmitted values.

**Keywords:** ground water, rural area, pollution, drinking water quality parameters

### 1. Introduction

The ground water in rural areas can be polluted as a result of farming activities. The quality of the drinking water drawn in wells can be affected especially for those wells that are placed in the valleys, and at insufficient distance from the stables.

An important source of pollution of the ground water with nitrates is the excessive use of nitrate fertilizers. As result of the leaching process the nitrates infiltrate into the soil and concentrate in the ground water. In the water, the nitrate undergoes chemical and biochemical processes and nitrite and ammonium are formed. Drinking polluted water can cause health problems, generating diseases such as gastric cancer [1-7].

The removal of pollutants from drinking water is complicated and expensive. For the individual family wells in rural areas, the pollution prevention represents the only solution.

### 2. Experimental

The water samples have been collected from 10 wells in a rural area in Banat in april 2005. The wells are placed along one street, on a distance of 300 m. The first well (sample 1) is placed on the hill and the last one (sample 10) in the valley (swamp area); the height difference is of about 400 m.

The analysis of the quality parameters was carried out according to the legislation [8].

The concentrations of sodium, potassium, calcium, magnesium, nickel, lead, iron, manganese and zinc ions have been determined by atomic absorption spectrophotometry using a VARIAN SpectrAA 110 spectrophotometer.

The concentration of chloride has been determined by  $\text{AgNO}_3$  titration, using  $\text{K}_2\text{CrO}_4$  as indicator.

Nitrite, nitrate, ammonium and phosphate concentrations have been determined by UV-VIS spectrophotometric method using a Carry 50 spectrophotometer.

The pH and conductivity measurements have been carried out on a Denver Instrument 250 conductometer.

The COD-Mn has been determined by  $\text{KMnO}_4$  titration.

The turbidity of the water samples has been determined using a Hanna LP 2000 turbidimeter.

The residue at  $105^\circ\text{C}$  has been determined weighing the residue resulted after water evaporation and drying at  $105^\circ\text{C}$ ; a Denver analytical balance has been used.

### 3. Results and discussion

The values obtained for the quality parameters were compared to the maximum addmitted values for drinking water. The maximum addmitted values (those specified in the legislation) are indicated in the figures with "11".

In figure 1 is presented the concentration of sodium and potassium ions in the water samples. One notice that for all the samples the concentration of sodium ions is under the maximum addmitted value. The concentration of potassium ions is under the maximum addmitted value only for sample 5, in all other samples it is higher than the maximum addmitted value.

Figure 2 shows that the samples have various concentrations of calcium ions (maximum addmitted value is not specified in the legislation) and that the concentration of magnezium ions is higher than the maximum addmitted value in samples 1, 4 and 9.

The concentration of nickel ions was found to be under the detection limit of the spectrophotometer for samples 3, 5, 6, 7, 8 and 10. For the other samples the values are under the maximum addmitted value of  $50 \mu\text{g/L}$ , as follows: 1 – 0.013; 2 – 0.050; 4 – 0.002 and 9 – 0.003  $\mu\text{g/L}$ .

Figure 3 illustrates the concentrations of lead and zinc ions in the water samples. The lead ions concentration is higher than the maximum addmitted value for samples 1, 2 and 3. The zinc ions concentration is under the detection limit of the spectrophotometer for samples 3, 6, 7 and 8 and the maximum addmitted value is not specified in the legislation.

The values for the concentration of iron ions are under the detection limit of the spectrophotometer for samples 1, 2, 3, 5, 6, 8 and 10. For the other samples the values are under the maximum admitted value of 200  $\mu\text{g/L}$ : 4 – 0.039; 7 – 0.410 and 9 – 0.079  $\mu\text{g/L}$ .

The values for the concentration of manganese ions are under the detection limit of the spectrophotometer for all the water samples (maximum admitted value 50  $\mu\text{g/L}$ ).

Figure 4 shows the values obtained for the concentrations of chloride and phosphate ions. The samples have various concentrations of chloride ions (maximum admitted value is not specified in the legislation) and the concentration of phosphate ions is much smaller than the maximum admitted value for all the samples.

In Figure 5 are illustrated the concentrations of nitrite and nitrate ions. The values of nitrite ions concentration are higher than the maximum admitted value for samples 7, 8 and 9. The concentration of nitrite ions is higher than the maximum admitted value only for sample 3.

The values for the concentration of ammonium ions are under the detection limit of the method for all the samples, except for two of them: 7 – 0.4 mg/L and 8 – 11 mg/L; the maximum admitted value is 0.5 mg/L.

In figure 6 are presented the values of COD-Mn and turbidity of the water samples. One may notice that the values of COD-Mn are higher than the maximum admitted value for samples 3, 4, 7, 8 and 9. The values of the turbidity are under the maximum admitted value for all the samples.

The values for the residue at 105°C are under the maximum admitted value of 1500 mg/L for all the samples: samples 1, 3, 4, 5, 7, 8, 9 and 10 – 5 mg/L; samples 2 and 6 – 10 mg/L.

Figure 7 shows the pH and conductivity values of the samples. The pH values are under the maximum admitted value for all the samples. The samples have various conductivity values; the maximum admitted value is not specified in the legislation.

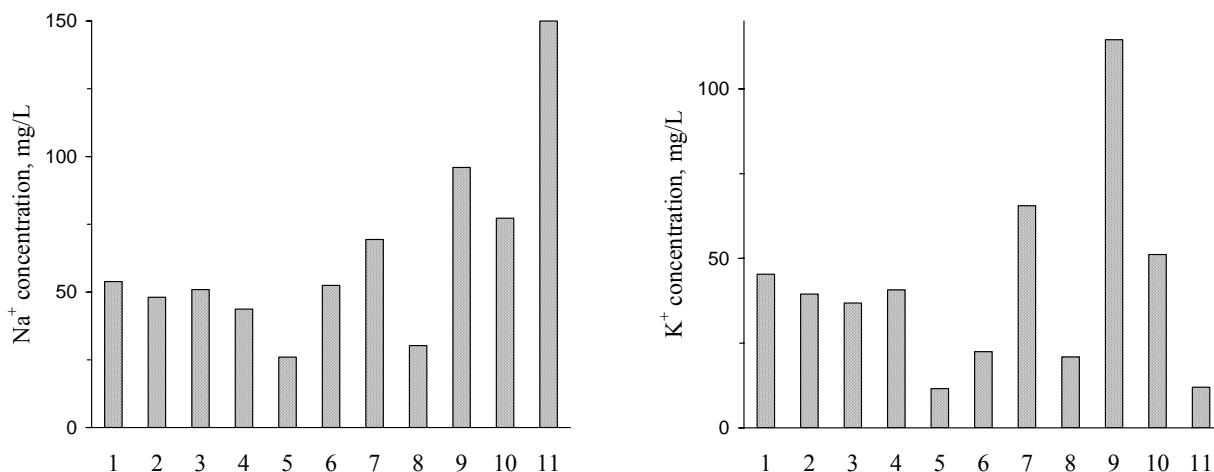


Fig. 1. The concentrations of sodium and potassium ions in the water samples

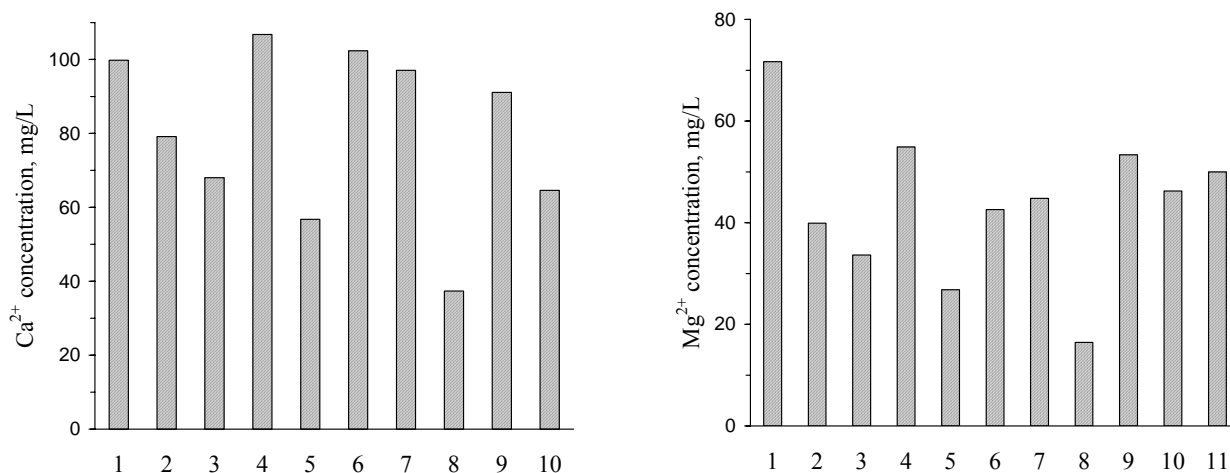


Fig. 2. The concentrations of calcium and magnesium ions in the water samples

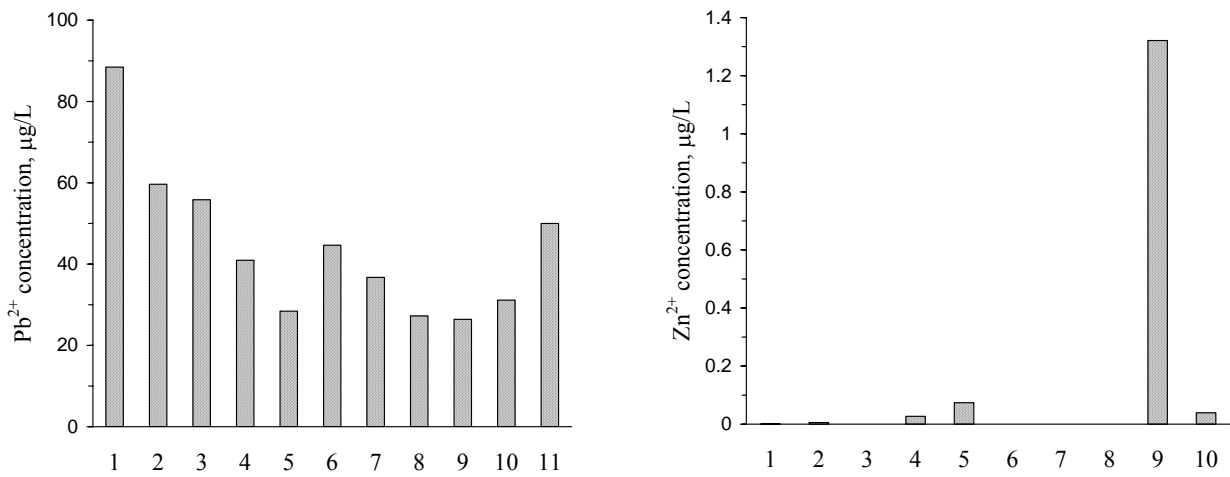


Fig. 3. The concentrations of lead and zinc ions in the water samples

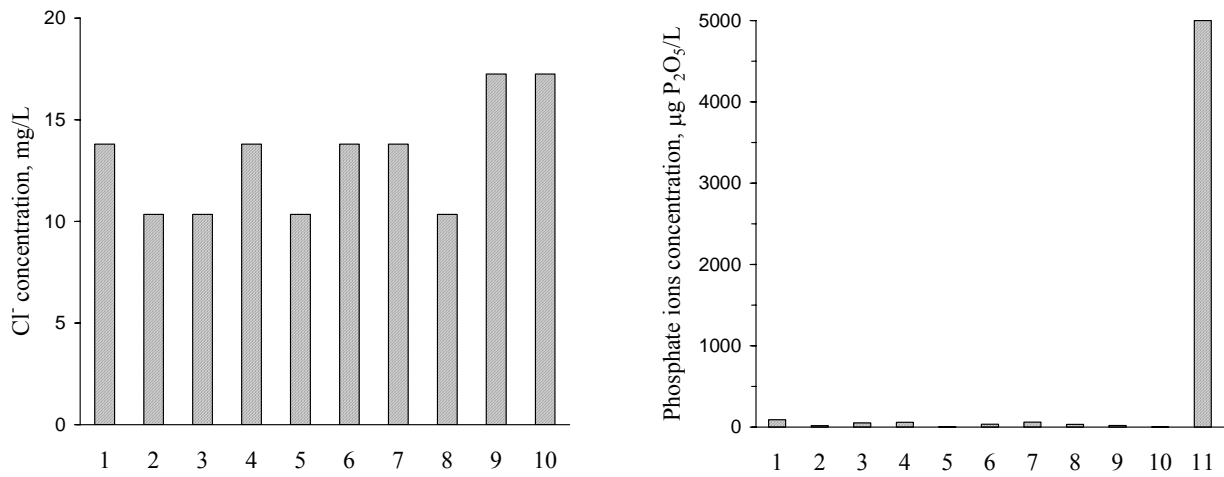


Fig. 4. The concentrations of chloride and phosphate ions in the water samples

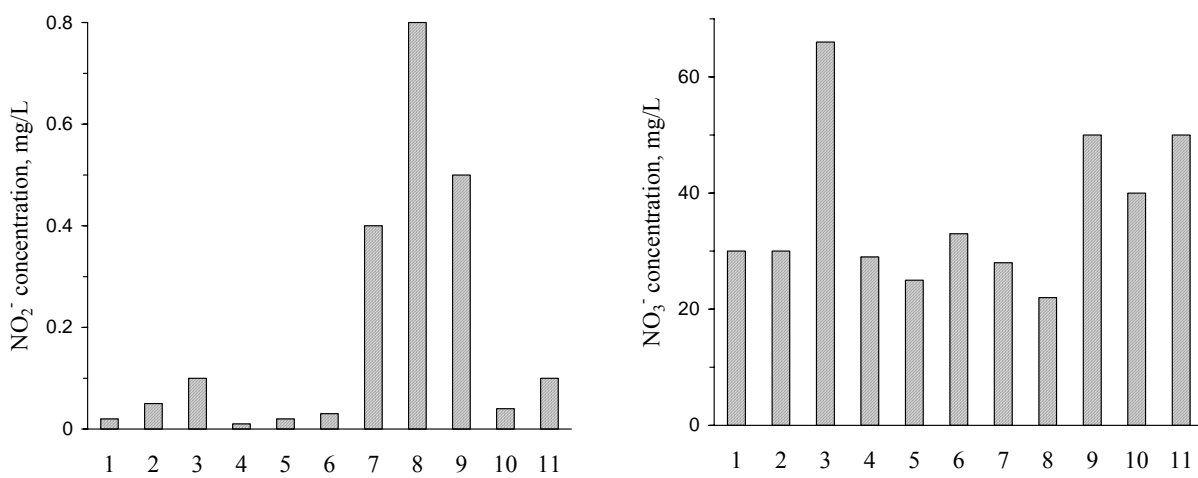


Fig. 5. The concentrations of nitrite and nitrate ions in the water samples

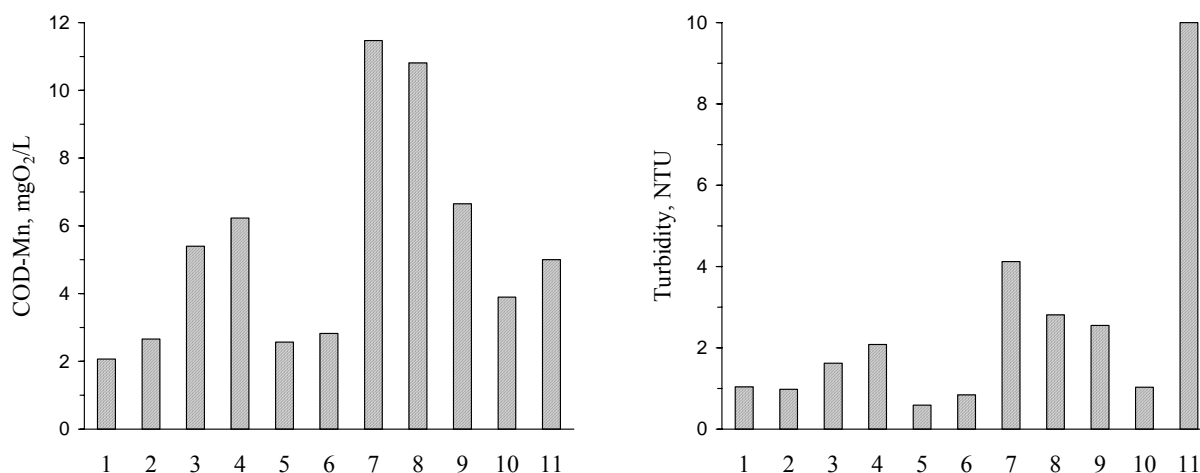


Fig. 6. The values of COD-Mn and turbidity of the water samples

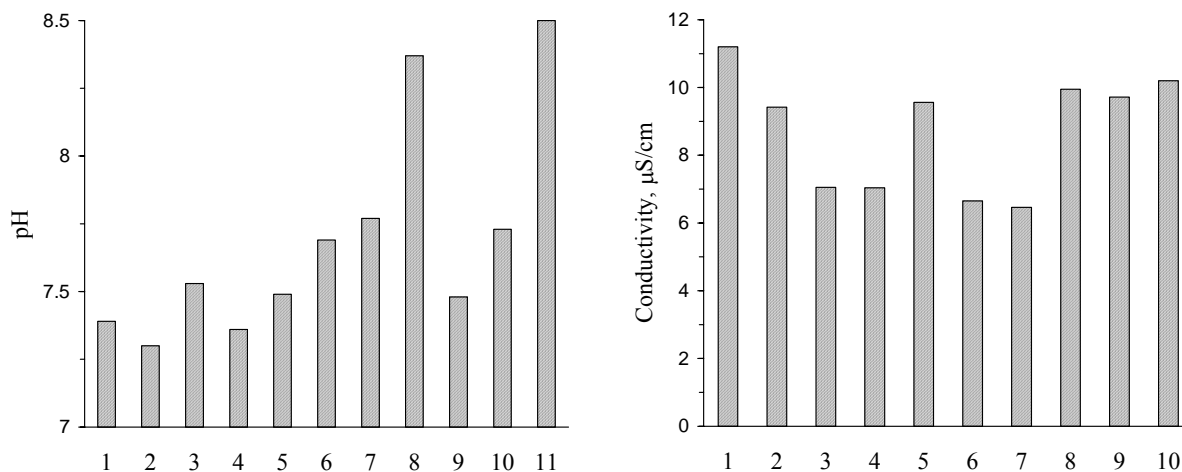


Fig. 7. The values of pH and conductivity of the water samples

#### 4. Conclusions

The papers presents studies regarding the pollution of the ground water drawn in wells, in a rural area. Samples of drinking water from 10 wells have been analyzed in order to evaluate if their quality was affected as result of farming activities.

Following the evaluation of the drinking water quality parameters one can conclude that the water from wells 1, 2, 3, 4, 5 and 6 is not polluted. These wells are placed on the hill and at sufficient distance from the stables.

The water from wells 7, 8, 9 and 10 can be considered as polluted because some of the quality parameters such as: nitrite, potassium, magnezium, ammonium concentrations and COD-Mn have values higher than the maximum admited values. These wells are placed in the valley, near to the stables and in yards that are not covered in concrete,

which allows the pollutants to infiltrate more rapidly in the ground water.

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