THE QUALITY OF GROUND WATER FROM DOLJ COUNTY

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Abstract

The European Directive 60/2000/EC on the establishing of a communitarian action framework on water policy impose measures for improving water quality and the distribution of pressured and pressure free underground waters. Regarding this point of view, within Dolj County there were localised the following underground water reservoirs: ground water reservoir from Danube terraces and lowland; ground water reservoir from Jiu River terraces and lowland; deep groundwater reservoir from Pliocene formations; Romanian reservoir; Dacian reservoir; deep ground water reservoir from Sarmatian formations; deep groundwater reservoir from Pleistocene formations; Fratesti strata; Candesti strata; ground water reservoir from loessoid deposits of Leu-Rotunda Plateau.
Within 2008-2009 period there was researched the quality of these water bodies by analysing water samples from wells in order to establish wether they can be used as drinkable water. For this purpose there were analysed the main quality indicators of water according to 161/1602. 2006 Order Environment Ministry used for approving water quality in order to establish their ecological status.
After doing these analyses there resulted that most of the water bodies from Dolj District have a good quality excepting those from Jiu terraces and lowlands.

Key words: ground water, quality, salts, dry residue

The degradation of surface waters and ground water and finally of water from seas is one of the main factors of environment pollution. To this situation contributes the dispatching of sewage water originating from industry and towns that are not cleaned (Dumitru, M., 2010).

The distribution of fresh water in different zones of the planet is uneven, the most of it being imobilised within the polar ice from Antarctica and Arctica. The fresh water net of streams is the main source of drinkable water, directly from rivers or ground water.

There are several cases when a lot of drinkable water is contaminated by several chemicals or biological substances. According to W.H.O. (World Health Organisation) statistics, three people from five do not get acces to drinkable water and three persons from four do not have sanitary facilities.

Within rural communities, only 29% of populace can afford drinkable water without risk of contamination, the sanitation services are accesible for 13% of world population and 80% of diseases are originated in drinkable water.

This is why the knowing of water quality from underground has an outstanding importance. According to European Directive 60/2000/EC on the establishing a communitary working frame on water politics there was set up the reservoires with ground water with pressure or free of pressure underground:

- ground water reservoir from Danube terraces and lowland;
- ground water reservoir from Jiu River terraces and lowland;
- deep ground water reservoir from Pliocene formations
    - Romanian reservoir;
    - Dacian reservoir.
- deep ground water reservoir from Sarmatian formations;
- deep ground water reservoir from Pleistocene formations.
    - Fratesti strata;
    - Candesti strata.
- ground water reservoir from loessoid deposits of Leu-Rotunda Plateau.

MATERIAL AND METHOD

There were analysed ground water of low and high depth researching the following quality indicators: dry residue mg/l; Ca^{2+} and Mg^{2+}; total salinity ; SO^{-}_{4} and Cl^{-}; Ph; total Fe^{3+}; NH^{+}_{4}, NO_3^{-}; NO_2;Mn^{2+}.

The samples have been taken from ground water wells and deep drills for subterraneous water.

The samples have been taken using the multiparameter probe which has analyzed in place a series of indicators as pH, NH_4^+, NO_3^-, NO_2^- contents. The other analyses have been made at the Laboratory of Agrochemistry of Faculty of Agriculture Craiova.

The methods have been the ones allowed by 161/16.02.2006 Order of Environment Ministry that approved the norms for water quality classification in order to establish the ecological status of waters. Using these norms there was analyzed the quality of ground waters and deep ground waters from Dolj District in five ecological statuses from very good (I) to very bad (V).

RESULTS AND DISCUSSIONS

The ground water reservoir is a distinct volume of water belonging to a larger water reservoir. The ground water reservoir is named as one or more layers of rocks with a certain porosity to permit a significant flow of ground water or a catching of large underground water quantities.

Next we will present the chemical analyses of ground water reservoires and underground waters from Dolj County.

1) The Ground water reservoir from Danube terraces and lowland.

The low land and Danube terraces are the most important reservoir of underground waters as regard the distribution of ground water reservoires and water resources. They are quaternary formations that belong to Superior Pleistocene, the ground water layer being under 15-20 m, seldom at 5-20 m. Most of ground water from Danube terraces and lowland are good as quality being drinkable, with a dry residue of 250-800 mg/l yet on the direction of underground flow these waters enriches in salts and dry residue. They are of bicarbonated – calcium and bicarbonate-sodium types.

The water reaction is neutral (pH = 7-7.5) in comparison with CMA 6.5-9.5. The nitrogen compounds, NO^-_2, NO^-_3, NH^+_4 are under the CMA values. Within the zone there have been identified wells where the nitrates content from ground water has overcome the CMA, at Poiana Mare (1) 584 mg/l, Caraula (2) 290 and 549 mg/l, Ciupercenii Vechi (1) 427 mg/l, Fantanele 389 mg/l, Motatai (2) 334 mg/l and 277 mg/l, Ciupercenii Noi 219 mg/l.

In Plenita there were found three wells that overcame CMA for NH^+_4.

2) The ground water reservoir from Jiu terraces and lowland.

It comprises the Oltenia Plain, the Getic Plateau and Getic Carpathians; they are quaternary formations that belong to Superior Pleistocene. The ground water is located at different depths in function of the level of terrace level, 3-8 till 5-20 m. The dry residue is, ussually, in normal values, of 250-800 mg/l. The main indicators of water quality have had the following values:

pH = 7.0; NH^+_4=0; NO^-_3= 14,04; NO^-_2=0; Organic substance=4.25 mg/l; Cl^-=12.8 mg/l; Ca^{2+}=55.21 mg/l.

There were, also, identified 7 wells where CMA was overpassed by much:

- Simnicu de Jos 566 mg/l
- Farcas 251 mg/l
- Predesti 507 mg/l
- Melinesti 181 mg/l
- Podari 246-294 mg/l

A large part of these waters are at risk of nitrogen compounds pollution, especially within villages and in the lowland and inferior terrace of Jiu River, downward of Doljchim s.a. Craiova.

3. The deep underground waters of Pliocene formations

3.1. The Romanian water reservoir from Oltenia Region spreads unevenly towards South being limmited by Cerat, Horezu Poeneri, Segarcea places and Eastward by Bechet, Dabuleni and Corabia.

The aquiverous layers are composed of sands and do not comply with the drinkable requirements having a dry residue ≥ 1,000 mg/l, NH^+_4 > 10 mg/l (table 1) – drill 1, overpassing CMA with NH^+_4.

As regard the chemical matter, the underground waters that belon to the dacian reservoir comply with the drinkable requirements having total mineralisation till 1 g/l and total salts under 30 german degrees yet, seldom, the NH^+_4 content overpass the CMA.

Whether the water catchements extends for supplying new communities, the Dacian reserves are reliable.

3) Sarmatian underground water reservoires

They are encountered in all Jiu Water Enterprise perimeter under Pliocene deposits. Where Jiu River interfere with Danube, at Gighera, there are mentioned mineralised horizons from where there were obtained sulphurous, waters, with iod, brome, chlorine-sodium waters with concentrations of 19300 mg/l Na and 130 g/l H_2S.

4). The Pleistocene, deep underground waters

The Fratesti underground water spreads beneath Leu-Rotunda Plateau and, on smaller surface, with Salcuta-Dranic Plateau. The Fratesti reservoir has an almost continously horizon of pebbles and sands with islands of gravel; at the superior part there appear sands with concretions. The cover of the Fratesti strata is composed of a thick layer of clay that protect it of potential pollution.

We present below, in the second table, the chemical analysis of three drills from Fratesti/Redea, Gioroc, Zanoaga, one drill from Candesti (Orodel) and one drill from Leu-Rotunda Plateau.

Table1

The main quality indicators of ground water from Romanian and Dacian reservoires (F2 and F3)

Quality indicator	Drill 1 Isalnita (Romanian)	Drill 2 Melinesti (Dacian)	Drill 3 Tiu (Dacian)
pH	7.54	7.45	6.7
Organic matter	5.4		
Total salts	22.18		
Ca^{2+}mg/l	87.9	90.5	37.2
Mg^{2+} mg/l	19.5	17.9	14.8
NH^{+}_{4} mg/l	21.46	16.4	7.31
NO^{-}_{3} mg/l	6.44	5.07	11.4
NO^{-}_{2} mg/l	0.091	0.048	0.021
SO^{-}_{4} mg/l	105.1	12.3	14.0
Cl^{-} mg/l	30.5	46.8	34.1
Dry residue mg/l	469	459	251
Total iron mg/l	0.341	0.554	0.247
Mn^{2+} mg/l	0.062	0.075	0.057

Table 2

The main quality indicators of waters from Fratesti, Candesti underground water, and loessoid deposits from Leu-Rotunda Plateau

Quality indicator	Drill 1 Redea	Drill 2 Gioroc	Drill 3 Zanoaga	Drill 4 Orodel	Drill 5 Leu-Rotunda
Dry residue mg/l	7.43	7.0	6.9	7.18	7.31
Ca^{2+}mg/l	713		1242	817	687
Mg^{2+} mg/l	117	95.3	167.3	172.8	126.3
NH^{+}_{4} mg/l	30.7	24.8	38.8	28.4	27.2
NO^{-}_{3} mg/l	0.455	0	0.046	0.139	0.08
NO^{-}_{2} mg/l	61.6	45.7	84.1	29.1	56.7
SO^{-}_{4} mg/l	0.03	0	0.085	0.027	0.054
Cl^{-} mg/l	45.9		88.3	62.0	47.3
Fe^{2+}mg/l	46.1	17.4	53.6	45.8	48.7
Mn^{2+}mg/l	0.105		0.072	0.059	0.084
Na^{+}mg/l	0.035		<0.03	0.051	0.046
K^{+}mg/l		19.7	4	48.8	46.6
Total salts mg/l		19.7		6.4	1.1

The Candesti underground waters

This reservoir is spreading between Desnatui – Jiu and Jiu – Olt as well as near Getic Piedmont. The thickness of the layers increases from west to east, exceptin the Danube Lowland and the confluence zone between Jiu and Danube where they were removed by erosion. The underground waters of this reservoir comply with the drinkable water requirements havin a total mineralisation of 450-950 mg/l. It represents an important source of drinkable and industrial water for communities between Jiu and Olt (table 2).

5) The underground waters from loessoid deposits from Leu-Rotunda Plateau

It only spreads between Jiu and Olt, the depth varying between 5-10 m. Due to fine constitution of loessoid deposits, the volume of this reservoir is low. Nevertheless, the importance of this reservoir is high because it is the main fresh water source of nearby inhabitants eventhough these waters are polluted by nitrates that mekes them not drinkable.

CONCLUSIONS

Within Dolj County there are encountered the following underground water reservores: ground water reservoir from Danube terraces and lowland; ground water reservoir from Jiu River terraces and lowland; deep ground water reservoir from Pliocene formations: Romanian reservoir, Dacian reservoir; deep ground water reservoir from Sarmatian formations; deep ground water reservoir from Pleistocene formations: Fratesti strata, Candesti strata; ground water reservoir from loessoid deposits of Leu-Rotunda Plateau.

The ground water of Danube terraces and lowland have a good quality being of bicarbonated-calcium and bicarbonated-sodium type with some exceptions. The ground water from Jiu lowland and terraces have a certain risk because of industrial wastes, especially from Doljchim s.a. The deep ground water from Pleistocene formations comply with the drinkable requirements. The ground water of Sarmatian formations have a high mineralisation being sulphurous, iodurous, bromeouros or chlorine-sodium content. The Pleistocene ground water from Fratesti and Candesti comply with the drinkable requirements having a high importance for communities between Olt and Jiu.

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