MONITORING OF THE NITROGEN REGIME IN THE GROUNDWATER FROM THE WEST PART OF THE BAIA MARE CITY

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ABSTRACT. - In the west part of Baia Mare - the residence of Maramureş county, nearby from the triad of the mining tailings dumps – Săsar, Aurul and Remin, practicing an subsistence agriculture, on land subjected to anthropogenic impact for decades. Furthermore, these lands are crossed by pipelines of the hydro-transport of the flotation tailings from the preparation plants to the tailing ponds. In this area, very long time exploited, the quality of groundwater of course, is affected. The monitoring of the nitrogen regime of these waters, was induced by the implementation of an agricultural research, on an experimental plot, located near the tailing ponds. This paper refers to the nitrogen regime of groundwater from two wells, located upstream and downstream from the agricultural experimental plot.

Keywords: nitrogen regim, groundwater, tailing pond, agriculture.

1. INTRODUCTION

Maramureş County is known, among others, due to its underground riches, especially those non-ferrous and of the gold. The mining and the ore preparation plants have grown spectacular in the communism period. Become unprofitable in the last decades of the twentieth century, the Romanian state subsidizes very strong this sector, for then - under the terms of accession to EU structures - the mining perimeters from Maramureş county were reduced its activity and enter in conservation.

Baia Mare has inherited, due to intensive mining activities in this area, three mine tailings deposits: Săsar - in conservation since the early `80, Remin and Aurul - in operation. These tailings ponds are located on the estate of the villages Săsar and Bozânta Mare and were constructed by removing from the agricultural circuit some private areas.

Reinstatement in rights of the properties after 1989, the development of the residential areas and strong migration from urban to rural areas has led to the development of subsistence agriculture in the vicinity of the tailings dams, in the west part of Baia Mare. But these plots have undergone decades of the human impact: the industrial roads to access to the tailings dams, technological accidents on the tailings

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pipeline route on the dumps and of the air pollution, due to the handling free of the dust particles.

The quality of the groundwater from the vicinity of tailings ponds Remin and Aurul was and is constantly monitored by self-monitoring programs. These self-monitoring programs highlight the changes of the concentrations of metals, due to the waste composition of the mining tailings of the ponds.

Agricultural development in this area attracted also, increase greater amounts of the synthetic fertilizers and various types of pesticides. As a result, it is requires a new coordinated, to prevent the pollution with nitrates of groundwater in this area, sufficiently assaulted of the industrial activities.

2. MATERIALS AND METHOD

This paper refers to the nitrogen regime of groundwater; monitored in two hydro-observation wells, located upstream and downstream of the experimental plot, on the estate of Săsar village (see Fig. 1).

This area includes areas used as agricultural land, situated on each side of a road industrial access to the tailings ponds from the west part of Baia Mare. Some of these areas are located from about 1.5 m of old pipelines, used for transport the waste mining.

Due to lack of the protective forest drapes, the prevailing winds carry the dust from the dumps surface, on the agricultural land from their vicinity.

Organization of the agricultural experience in controlled system and monitoring of the nitrogen regime of the soil, imposed the monitoring of the quality of groundwater in this area, to framing the concentrations of the nitrates and ammonium, in the concentrations allowed by the Romanian legislation in force.

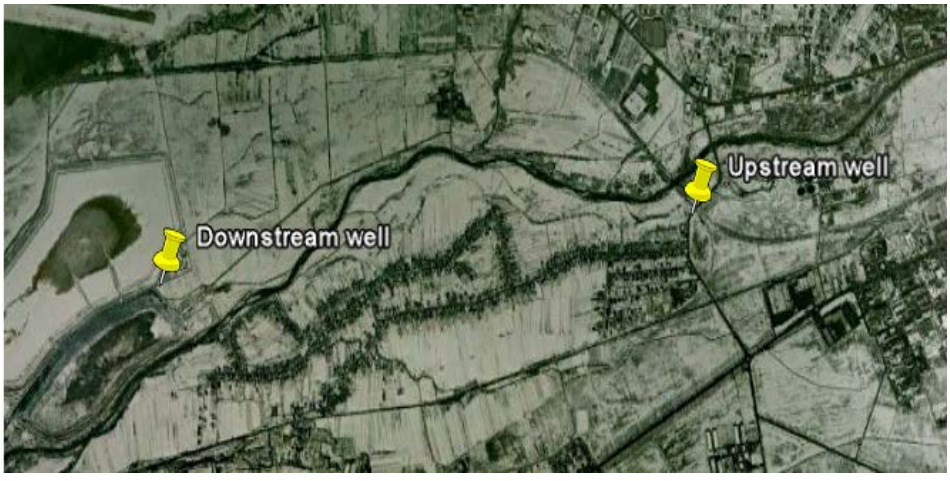

Fig. 1. ***The location of the hydro-observation wells***

These underground waters are part from the body groundwater ROSO12. For this groundwater body there are threshold values legislated for the parameters mentioned above, according with the Order no. 137/2009. In this Order are approved the threshold values, for some chemical parameters of the groundwater bodies in Romania.

Table 1. ***Extract from Annex Order no. 137/2009***

Groundwater body	NH_4 (mg/l)	Cl (mg/l)	SO_4 (mg/l)	As (mg/l)	Cd (mg/l)	Pb (mg/l)	NO_2 (mg/l)	PO_4 (mg/l)
ROSO12	2.9	250	250	-	-	0.03	0.5	0.5

The groundwater samples were collected during 2011, during April, July and October, respecting the sampling rules from the standard *ISO 5667-11:2009 - Water quality. Sampling Part 11- General Guidelines for Groundwater Sampling.*

Determination of the nitrogen regime consisted in the determination of the concentration values of ammonium, nitrite and nitrates of the taken samples. These analytical determinations were performed in the laboratory, by molecular absorption spectrophotometer technique and in accordance with analytical standards in force. For analysis we used a molecular absorption spectrophotometer, type Agilent 8453, verified and calibrated metrological.

2.1. pH of the underground water

This indicator was determined electrochemically, using a laboratory pH-meter, WTW - type InoLab 730, verified and calibrated metrological. The pH values obtained are shown in figure 2 and were compared with maximum values imposed by Law no. 458 of 2002; here are approved the maximum values regarding the quality indicators of the drinking water.

We can remark the acidic pH of the water in the wells located downstream of the agricultural experimental area, in nearby of the tailings ponds.

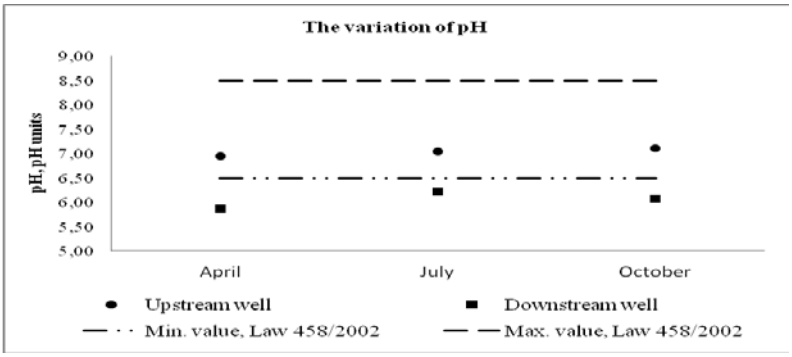

Fig. 2. ***The pH variation of the underground waters, in section upstream of the experimental area***

2.2. Ammonium indicator of the underground water

The chemical analysis of ammonium indicator was made in accordance with the standard in force:
SR ISO 7150-1:2001 - Water quality. Determination of ammonium. Part 1: Manual spectrometric method.

The variation of ammonium concentration is shown in figure 3.

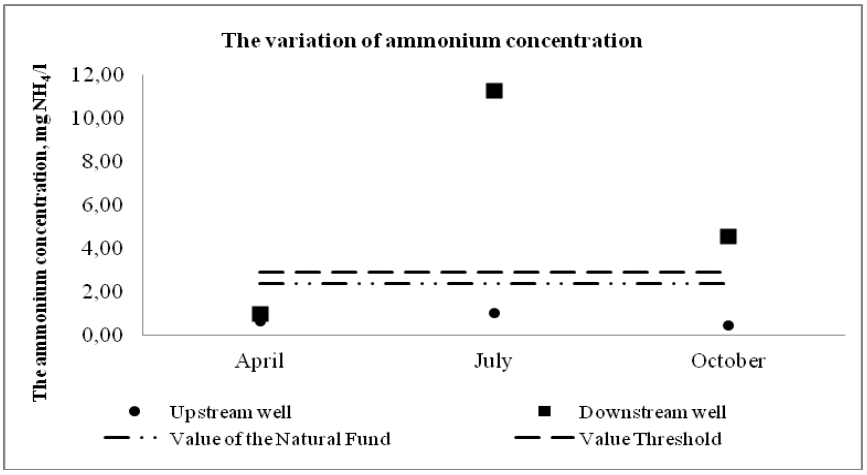

Fig. 3. ***The variation of the ammonium concentration of the underground waters, in section upstream of the experimental area***

Figure 3 shows that the values were almost constant of the ammonium concentrations in the well located upstream from the cultivated land. In July 2011, in well situated in section downstream from the cultivated land, is distinguished a large increase in ammonium concentration, exceeding of the natural value and, also the threshold value (from Table 1). In October 2011, the indicator remains at high values, but less of 2.47 times compared to that of July 2011.

2.3. Nitrates indicator of the underground water

The chemical analysis of nitrates indicator was made in accordance with the standard in force: SR ISO 7890-3:2000 – Water quality. Determination of nitrates. Part 1: Manual Spectrometric Method.

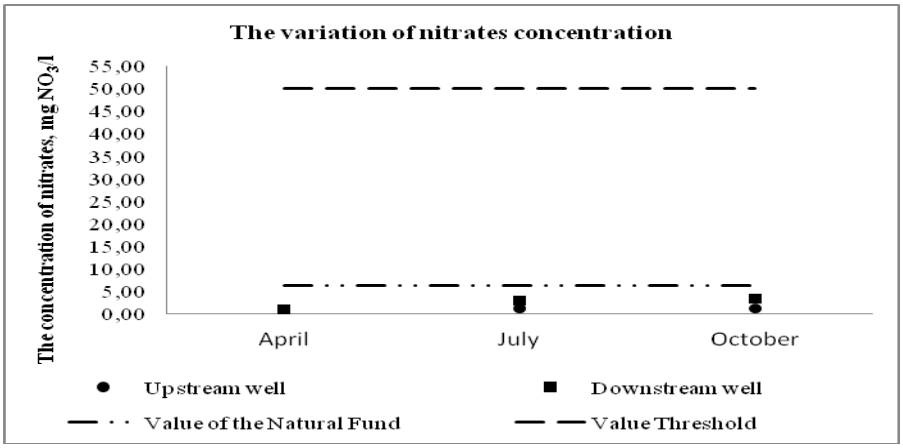

Fig. 4. ***The variation of the nitrates concentration of the underground waters, on section upstream of the experimental area***

As it can be observed in Figure 4, the nitrates concentrations does not exceed the maximum value allowed by Law of drinking water, of 50 mg NO_3/l.

2.4. Nitrites indicator of the underground water

The chemical analyses for nitrites from water were performed in accordance with standard SR EN 26777 / 2002 + C91/2006 – Water quality. Determination of nitrite. Molecular absorption spectrometric method.

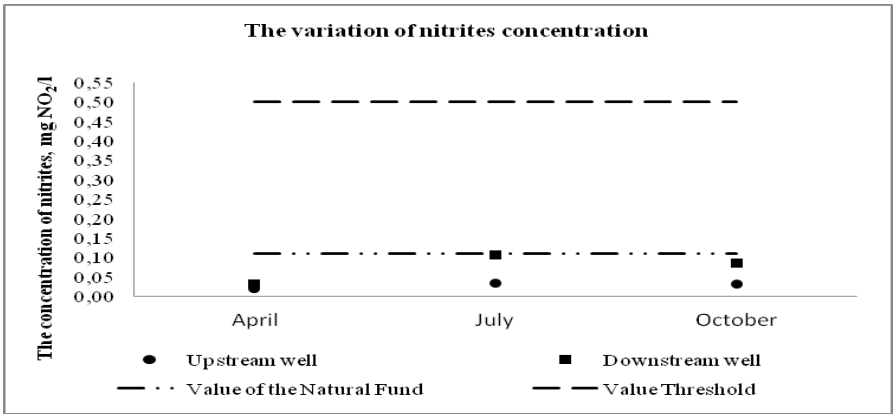

Fig. 5. ***The variation of nitrites concentration of the underground waters, in section upstream of the experimental area***

As it can be observed in figure 5, the nitrite concentrations do not exceed the imposed value of 0.50 mg NO_2/l; but, in July 2011, in the well located downstream of agricultural land, the value determined almost achieve the value of the natural limit.

3. CONCLUSIONS

For this studied area and from data presented, we conclude the following:

- from the analyzed indicators of the nitrogen regime, only the concentration of ammonium exceeded the value of the threshold, permitted by Order 137/2009, in the well located downstream of the agricultural land, as a result probably, of the chemical nature of the fertilizers used for fertilization by different owners in these area;

- the nitrates indicator have not exceed the maximum amount allowed by Law drinking water; thus highlighting that, this area is not part of nitrate vulnerable zones due to agricultural activities;

- in July 2011, the nitrite indicator in the well located downstream, presented the concentrations near the natural limit; after that, in October 2011 returns at lower value than the limit established by Order 137/2009;

- during the monitoring period, groundwater nitrogen regime followed the natural cycle of the nitrogen; during the summer time, the processes of bio-oxidation of ammonium led to higher levels of nitrites;

- the acidic pH of the groundwater from the well located downstream of agricultural land, demonstrate the historic influence of the ex-filtrations and the bio-leaching process of the mining tailings dams nearby, in an identical manner with the pH of soils studied from this area (Muntean and Rusu, 2011).

REFERENCES

1. Muntean A., Rusu T., (2011), *Regimul de azot în solurile arabile aflate sub influenţa sterilelor din depozitele de deşeuri miniere perimetrale zonei urbane Baia Mare*, Buletin UASVM Agricultura, 68(2)/2011, (Electronic ISSN 1843-5386), p. 101-107
2. *** (2000), *Directiva Cadru privind Apa* 2000/60/CE;
3. *** (2000), *SR ISO 7890-3:2000 – Calitatea apei. Determinarea continutului de azotati. Partea 3: Metoda spectrometrica cu acid sulfosalicilic*
4. *** (2001), *SR ISO 7150-1:2001 – Calitatea apei. Determinarea cotinutului de amoniu. Partea 1: Metoda spectrometrica manuala*.
5. *** (2002), *Legea nr. 458 din 8 iulie 2002 privind calitatea apei potabile*, publicata in Monitorul Oficial nr. 552 din 29 iulie 2002;
6. *** (2006), *SR EN 26777:2002/C91:2006 – Calitatea apei. Determinarea continutului de nitriti. Metoda prin spectrometrie de absorbtie moleculara*
7. *** (2009), Ordinul 137 din 26 februarie 2009 privind aprobarea valorilor de prag pentru corpurile de ape subterane din Romania , publicat in Monitorul Oficial nr. 170 din 18 martie 2009
8. http://www.googleearth.com
9. http://www.rowater.ro/dasomes/Draft%20Plan%20Management/Planul%20de%20Management%20al%20spatiului%20hidrografic%20SomesTisa/