STUDYING THE IMPACT OF THE MINING EXPLOITATIONS ON THE WATER QUALITY IN MĂTĂSARI TOWN, OF GORJ COUNTY

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Abstract
The gravity of the water pollution problems is clearly perceived by the man when he participates personally to the water utilisation. This paper presents the study of the impact of the mining exploitations on the water quality in town Mătăsari of GORJ county.
The water supply of the consumers of Mătăsari area of Gorj county is made from the Tismana – Godineşti system, a system which also supplies the entire mining basin of Jilţ. In case of the pollution of the waters coming from satisfying the household needs or from the public institutions, a mechanical-biological purification station was built for purifying the used waters, before evacuating them in Jilţ stream. An important contribution to the pollution of the surface waters of Jilţ hydrographical basin belongs to the industrial activities developing in Jilţ mining basin. In 2012, there were determinations of the quality indicators for the waters evacuated by the two mining exploitations, North Jilţ and South Jilţ, according to the valid STAS. The analysed indicators were the ones specific to the residual waters and for the waters resulted from dewatering. The waters resulted from the mining activities have a series of negative effects on the waters, by: stopping the flow of Jilţ stream by the contribution of the evacuations from the career, the waters coming from the precipitations and the infiltrations into the layer, changing the relations between the aquifers by changing the flowing system of the underground waters or the appearance of new supplies or drains and the appearance of new aquifers due to the low working rates.

Keywords: used, mining, indicator, purification, residual, natural

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1. INTRODUCTION

In Gorj county, the impact of the mining industry on the environmental factors is the subject of numerous researches in the environmental protection field (Fodor et al,2001;Popa et al,2001; Gămăneci et al,2013; Căpăţînă et al,2013; Căpăţînă et al,2009;Racoceanu et al,2007;Racoceanu et al,2006; ; Căpăţînă,2011)The hydrology of the area is mainly determined by Jilţ stream, placed on the east side, towards which a series of valleys converge.

Jilţ is the right affluent of Jiu, belonging to the category of rivers from the south group of the country.

The Valley of Jilţuri is found in the subunit called Motru Piedmont, a part of the Getic Highland.

From the administrative perspective, the hydrographical basin of Jilţ occupies the towns of Mătăsari, Drăgoteşti, Slivileşti, Bolboşi, Borăscu, Negomir, Văgiuleşti, Samarineşti and Turceni.

Jilţ stream crosses Mătăsari town, from north-west to south-east. It presents a sinuous flow and it joins Jiu river in the proximity of Turceni town.

The anthropic pollution sources present a special importance and they are the main cause of the contamination of Jilţ stream.

The main pollution sources of Jilţ stream are the following:

- the used residual waters resulted from satisfying the household water needs – personal and collective lodgements;
- used residual waters resulted from satisfying the water needs from the public institutions;
- the used waters and the industrial ones coming from the economic activities in the area.

The water supply of the consumers in Mătăsari area is made from the Tismana-Godineşti system which also supplies the entire mining basin of Jilț. The water source is Tismana river, having a system of catchment, sand-removing, treatment at the Godineşti station which may provide a maximum flow of 200 L/s.

In case of pollution of the waters coming from satisfying the household needs or from the public institutions, a mechanical-biological purification station for purifying the used waters was provided and built, before their evacuation in Jilț stream.

An important contribution to the pollution of the surface waters of the hydrographical basin of Jilț belongs to the mining activities developed in the mining basin of Jilț.

The industrial activities in the area are mainly represented by the two career exploitations, North Jilț and South Jilț. Even if it has its own installations for the residual waters purification, they have an important contribution to the pollution of Jilț stream, by evacuating residual waters coming from the administrative headquarters, and also by evacuating technological waters coming from dewatering.

The used residual waters coming from the administrative headquarters of the two careers are prepared in their own installations represented by an Imhoff decanter for the North Jilț career and a dry well for the South Jilț career, and then they are evacuated in Jilț stream.

The technological waters of the careers, the dewatering ones and the pluvial ones, are collected in jumpers where they are evacuated, by means of the pumping stations, to guard channels, then to Jilț stream.

However, it is considered that the exploitation activity of lignite has a reduced influence on the surface waters quality by:

- the reduced volume of the waters coming from precipitations and exfiltrations, therefore their evacuation is made by intermittences;
- their reduced charge of polluters;
- the existence of reduced sources of residual waters.

The effects on the quality of the surface waters of Mătăsari area are due especially to the evacuation in Jilț stream of waters charged with different polluters, waters coming from the mining activities**.**

2. MATERIAL AND METHOD

In this sense, physical-chemical analyses were accomplished on the waters evacuated by the two mining exploitations in the area, North Jilț and Sourth Jilț. The indicators analysed for the residual waters were: the pH, $CBO_{5,}$ the settled waste, chlorides, sulphates, total nitrogen, total phosphor and matters in suspension. The pH was determined by using the instrumental method by means of a pH-meter (Ogaki et al,2003). CBO5 and the chlorides were determined volume-metrically (Ogaki et al,2003). Determinations: the content of total nitrogen, of the phosphates, of the sulphates and of the iron was accomplished spectrum-metrically (Ogaki et al,2003). The settled waste and the matters in suspension were determined gravimetrically (Ogaki et al,2003).

3. RESULTS AND DISCUSSION

The interpretation of the results was accomplished according to the stipulations of the Normative NTPA001/2002 (NTPA001/2002) regarding the establishment of the charging limits of polluters of the used industrial and urban waters at the evaluation in natural receivers .The results regarding the values of the indicators monitored during the year 2012 are shown in table number 1 and 2.

By accomplishing an analysis of the monitored indicators, it is found that their values depend on the provenience of the used waters. This is obvious, especially when the same indicator was determined for the two categories of used waters.

The pH of the two categories of used waters coming from the two career mining exploitations presents values specific to a neutral to weakly alkaline reaction framing them in the admitted limits.

Table 1. The quality indicators for waters evacuated by North Jilț

Indicator	Water Category M-menage A-dewatering	North Jilț February	May	August	November
pH	M	7,5	7,3	7,5	6,5
	A	7,5	7,5	7	7,5
Total matters in suspension mg/L	M	45	42	44	45
	A	46	45	48	52
CBO5 mg/L	M	8,9	8,2	9,1	8,8
	A	-	-	-	-
Total dissolved solids mg/L	M	127	134	153	145
	A	522	281	358	320
Chlorides mg/L	M	8,5	9,2	6,4	7,9
	A	8,7	9,1	7,2	11,3
Sulphates mg/L	M	68,5	61,1	82,4	64,5
	A	261,0	210,4	221,5	246,2
Total nitrogen mg/L	M	1,3	1,5	1,4	1,2
	A	-	-	-	-
Total phosphor mg/L	M	0,52	0,51	0,58	0,51
	A	-	-	-	-
Total iron ionic mg/L	M	-	-	-	-
	A	0,66	0,61	0,45	0,36

Table 2. The quality indicators for waters evacuated by South Jilț

Indicator	Water category M-menage A-dewatering	South Jilț February	May	August	November
pH	M	7,3	7,6	7,5	7,4
	A	7,4	7,5	7,1	7,5
Total matters in suspension mg/L	M	45	42	44	45
	A	46	45	48	52
CBO5 mg/L	M	8,9	8,2	9,1	8,8
	A	-	-	-	-
Total dissolved solids mg/L	M	127	134	153	145
	A	522	281	358	320
Chlorides mg/L	M	8,5	9,2	6,4	7,9
	A	8,7	9,1	7,2	11,3
Sulphates mg/L	M	68,5	61,1	82,4	64,5
	A	261,0	210,4	221,5	246,2
Total nitrogen mg/L	M	1,3	1,5	1,4	1,2
	A	-	-	-	-
Total phosphor mg/L	M	0,52	0,51	0,58	0,51
	A	-	-	-	-
Total iron ionic mg/L	M	-	-	-	-
	A	0,66	0,61	0,45	0,36

The total matters in suspension represent the indicator whose values overdrew all the cases and for both of the water categories, the maximum admitted concentration which is presented in Figure 1.
Therefore, in case of the residual water, the values were 17% for the lowest concentration and 28.5 % for the highest one, over the limit admitted by NTPA 001/2002.

Higher values were registered in case of the water resulted from dewatering. In this case, the lowest concentration was 25.7 above the admitted limit, and the highest one was about 77% above this limit.
The registered values of CBO5 for the residual water evacuated by the two mining units are placed under the maximum admitted concentration. These values represented

between about 33% and 37.6% of the admitted limit, indicating a low organic charge of the evacuated waters.
By analysing the values obtained for the total dissolved solids in case of the two water categories, we may notice that higher values were registered in case of the career waters, but without overdrawing the admitted limit presented in Figure 2.
Thus, the concentrations of the total dissolved solids of the waters resulted from dewatering registered values which were contained between 14% and 32,6% of the maximum admitted concentration. Higher concentrations appeared in case of the waters coming from South Jilț career.
In case of the residual waters, the concentrations of the total dissolved solids represented between 6.3 and 7.6 % of the maximum admitted concentration.
By comparing the values of the two water categories, it is found that the ones coming from dewatering present a higher mineralisation degree depending on the geology of the layers in the area.
The chlorides present concentrations whose values are placed far under the admitted limit for the two water categories.

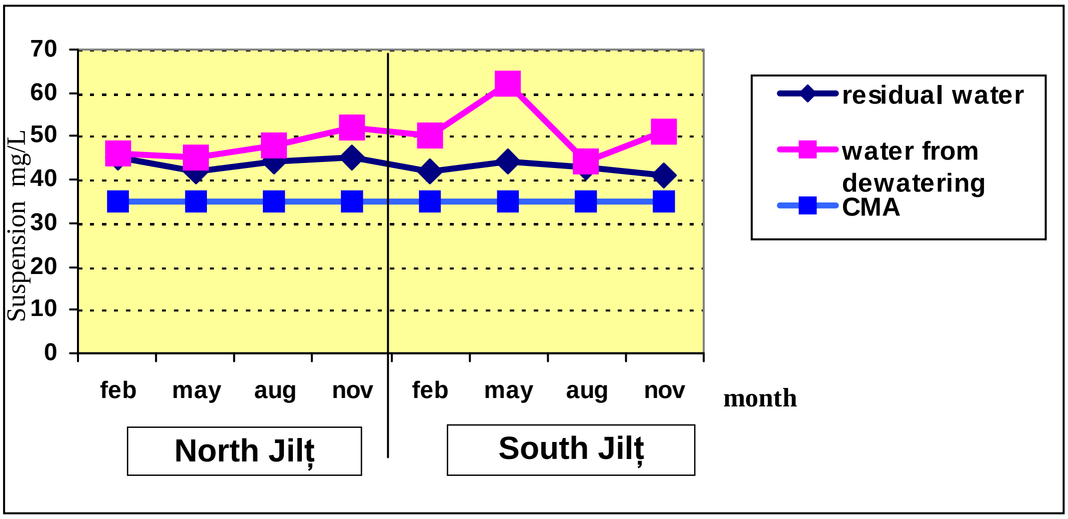

Figure 1. Variation of the total matters in suspension in the evacuated water

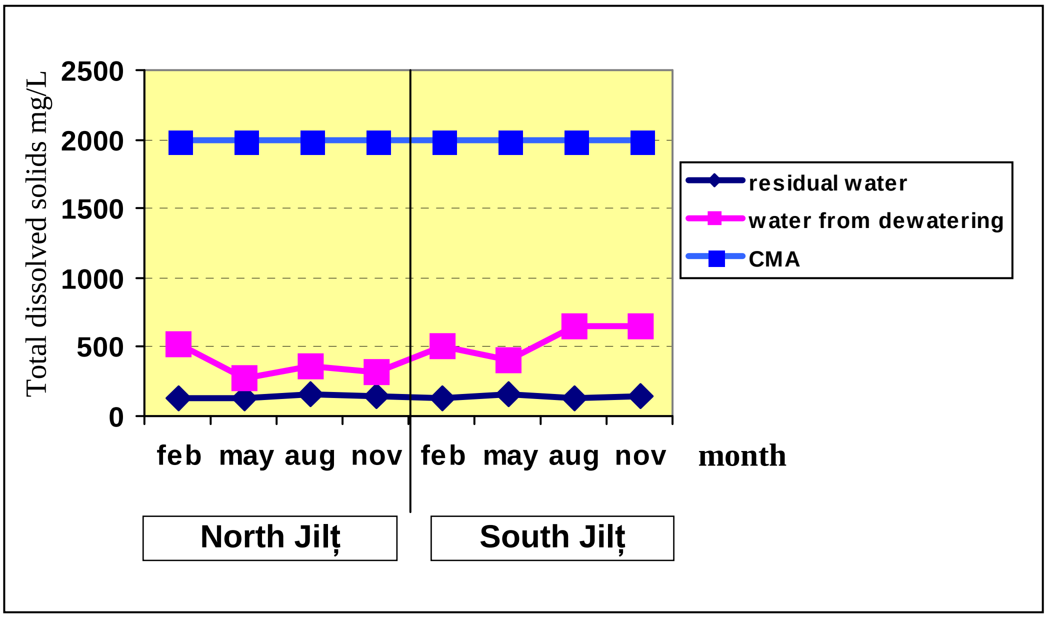

Figure 2. Variation of the total dissolved solids in the evacuated water

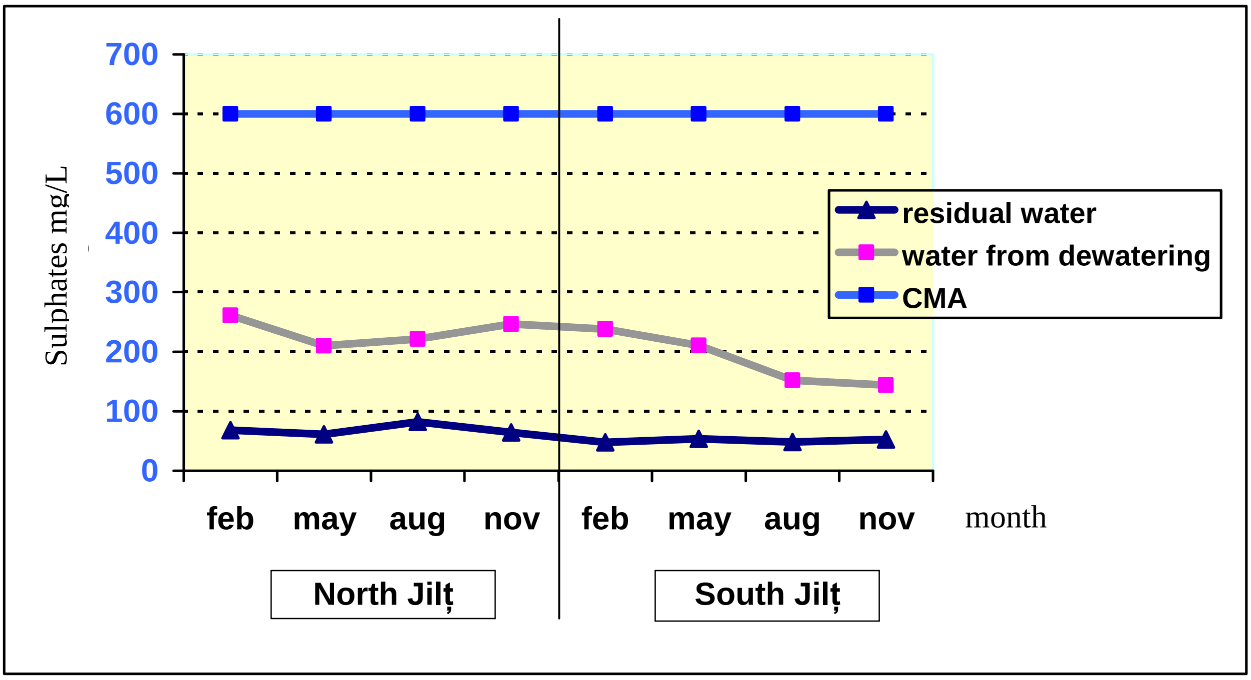

Fig.3 Variation of the sulphates in the evacuated water

For the residual water, the chloride concentrations had values representing between 1,28% and 2% of the maximum admitted concentration.
In case of the water from dewatering, the concentrations oscillated between 1.4% and 3.2% of the admitted limit.
In case of the sulphates which was presented in Figure 3, the differences between the values registered for the two water categories are obvious, meaning that the water coming from dewatering presented much higher concentrations, without crossing though the limit imposed by the valid regulations.
Thus, the values registered for the career water are placed with 76% for the lowest one, respectively with 56.5% for the highest one, under the maximum admitted concentration.
In case of the residual water, the lowest sulphate concentration was about 92% under the admitted limit, and the highest one of about 86% was under this limit.
In the present case, the total nitrogen was determined only from the residual waters of the two mining units, as there is the possibility to charge them over the admitted limit.
By analysing the concentrations regarding the presence of the total nitrogen in the used water and by comparing them to the maximum admitted concentration, it is found that there were no overdrawing. The two career values registered in the residual water present very close values representing between 12% and 19% of the maximum admitted concentration.
The fact that the phosphor constitutes a serious problem is also the limit imposed for the evacuation of the used waters in natural receivers, of 1,0 mg/L. Like nitrogen, phosphor is often present in the used residual waters.
For the used residual water evacuated by the two mining units in Mătăsari area, the obtained values are always placed under the maximum admitted concentration. The lowest total phosphor content in the water represented half of the admitted limit value, and the highest value represented 58% of C.M.A.
For the two mining units, the phenol concentrations were measured only in the waters coming from dewatering, waters that reach to Jilț stream, and then to Jiu river.
The maximum admitted concentration for phenols in the used waters evacuated in the natural receivers is 0,3 mg/L.

By analyzing the obtained values, it is found that these are placed under the maximum admitted concentration. Only one concentration was placed at the same level as the admitted limit and the other concentrations represent between 40% and about 93% of CMA.

Iron may appear in the surface waters over the admitted limits, in case of waters coming from the coal exploitations, as they have a high content of this element.

In the current case, by the authorization of water household, the iron limit when evacuating in Jilț stream was settled at 0.5 mg/L.

If we analyse the values obtained for iron and we report them to the limit imposed by the regulation document, it is found that there were cases of overdrawing this limit. Thus, the water resulted from dewatering, in case of North Jilț career, presented overdrawing of the imposed limit which were placed 20%, respectively 32% above this limit.

The other measured values were placed under the imposed limit and they represented between 38% and 90% of this limit.

Based on the presented facts, referring to the quality of the waters resulted from the daily mining activities, we may appreciate that they have a series of negative effects on the waters, namely:

- the flow increase of Jiț stream, by the contribution of the evacuations from the career, the waters coming from the precipitations and infiltrations into the layer;
- changes of the water quality of Jilț stream by evacuations of used waters;
- changing the relations between aquifers by changing the flowing system of the underground waters or the appearance of new supplies or drains;
- the disappearance of existing aquifers and the appearance of new aquifers, due to the low working shares;
- changing the physical-chemical balance of the underground waters produced by the activities of excavation, transport, deposit etc.

Measures for improving the quality of the used waters in Mătăsari Town

The first measure for improving the quality of the used water is the corresponding functioning of the purification station. This could mean the providing of the oxygen necessary for the functioning in good conditions of the blowers basins, the place where the damaging processes of the organic substances occur by means of the aerobe microorganisms.

Another measure could be the settlement of an own laboratory for monitoring the quality of the used water before the evacuation in the emissary.

The nitrogen of the entry flow of an installation treating the municipal residual waters is mostly present as organic ammonium (urea, proteins, etc) and ammonium nitrogen. The exact relation between the two parameters depends on different factors, including the length of the draining network, the place where the change of the organic nitrogen into NH_4- N starts. The ammonification process continues in the installation treating the residual waters so that most of the nitrogen in the entry flow of the blowers basin appears as NH_4- N.

During the stage of biological treatment, the ammoniacal nitrogen (NH_4- N) is changed by means of the added oxygen into nitrite nitrogen (NO_2-N) and then into nitrate nitrogen (NO_3-N).

Once it is stopped because of the lack of oxygen or of other factors, the nitrification process may last a few days until it is established again. In case of overdrawing the values of total nitrogen and of total phosphor and in the conditions of a corresponding functioning, it is imposed, as a measure, to introduce the tertiary purification step which is supposed to remove the excessive compounds.

The tertiary purification technology keeps (Ianculescu et al, 2001; Negulescu et al, 1978) from the used waters, especially the nitrogen and phosphor compounds, but also other impurities whose chemical and biological structure does not allow them to be kept and removed into a regular purification station.

Another measure that could contribute to the improvement of the water quality, both of the surface ones and of the residual ones, consists of the corresponding administration of the

residual waste in the town. Their selective collection could lead to a significant reduction of different types of waste in the water. Thus, the organic ones, if they were collected separately and submitted to the composting, the quantity of organic substances in the water would be significantly reduced.
Also, by the selective collection of waste, we could avoid their deposit on the water shores or in the channels of the intermittent flows.
The connection of the entire population in the area to the draining system constitutes another measure that could contribute to the improvement of the water quality. Many households that are not collected to the draining system in the area discharge their residual waters into Jilț stream, contributing thus to its pollution.
In order to avoid the losses of gross used water which, once it gets to the soil, may produce the impurity of the surface or underground waters, it is imposed to check and rehabilitate the draining network and also the covering of all the visiting homes.
An efficient evaluation of the purification installations needs their permanent control by means of physical-chemical analyses.
The purpose of the analyses is to supply information on the impurity degree of the used water, of the installation efficiency and also of their influence on the natural receiver.

4. CONCLUSIONS

The quality of the surface waters of Mătăsari town is obviously affected by the household, social and economic activities in the area.
♦ From satisfying the household and social-cultural water needs, it results used residual waters, and from the daily mining activity, waters from dewatering and residual waters, and all of them get to the surface waters in the area.
♦ The two categories of used waters affect differently the quality of the surface waters in the area.
♦ In case of the waters resulted from dewatering, even if there was no overdrawing of the specific analysed indicators, they may influence especially the mineralisation system of the natural receiver.

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