J. Int. Environmental Application & Science, Vol. 14(2): 32-36 (2019)

Research Paper

Physical-chemical Characterization of Drinking Water around a mining Industrial Region in the North of Kosovo

Florent Dobroshi[1,*], Ilirjan Malollari[2], Krenar Dobroshi[3], Baki Hajrizi[4], Redi Buzo[5]

[1]University "Isa Boletini", Mitrovica, Kosovo; [2]Faculty of Natural Sciences, University of Tirana, Albania; [3]College of Medical Sciences, Rezonanca, Kosovo; [4]Municipal Assembly Mitrovica, Kosovo; [5]Department of Biology and Chemistry, Faculty of Human and Natural Sciences, University 'Fan S. Noli', Korca, Albania

Received April 14, 2019; Accepted June 26, 2019

Abstract: Zvecan is a mining industrial region in the north of Kosovo. In addition, other industrial sectors have developed. Unfortunately, the region is very much polluted. The source is industrial activity (exploitation of mineral resources and ferrous metallurgy, and other chemical industry). The present paper aims to investigate pollution level in Zvecan and raise public awareness. In the end recommendations regarding pollution monitoring process and other measures are made. Some water samples have been collected from 2014 to 2015 and analyzed. The results reported contaminated water. As it can be seen, the main purpose of this study was to identify physical and chemical characteristics of drinking water in some villages in the municipality of Zvecan. On the other hand, local authority needs to take urgent measures to improve situation and to offer for the exposed population living in the vicinity of the pollution source, other source of drinking water for personal and community usage.

***Keywords**: pollution, contamination, monitoring, mining, industry,*

Introduction

It is estimated that nearly half of Kosovo's mineral reserves, 49.7% is concentrated in the vicinity of Mitrovica, and so, in the past an intensive development of ferrous metallurgy has been the main industrial activity of the area, except other chemical plants and manufactures. Due to such a concentration industry which has used old facilities and outdated technology brought about this resulted situation.

Other reasons of this pollution have been also installation of such facilities in a relatively small area, caused a high rate of exploitation, wrong configuration of the terrain with wind rose, inadequate urban choice, etc., which has led to extremely high levels of water pollution.

Being the most common substance on earth, water is not only necessary for life, but also indispensable for development and sustainability in our planet. The role and importance of water is very large as physiological, hygienic, economic and ecological means of usage. According to specific reports the World Health Organization, every year, as a result of unsanitary water use, about 500 million people get sick.

In Kosovo, 44% of resident population are connected to the network pipeline for water supply, while 28% of them have sanitation, and some 62% of rural population used to get their water from unhygienic wells, being drilled close to the septic damps. Kosovo is the country in Europe with no perfect water supply network and sanitation.

Supplying the population with drinking water, poses very specific requirements and criteria, ranging from water quality, construction and purification technology, various operations of preparation, supervision and supply reservoirs to distribution customers. Therefore, continuous physical-chemical and bacteriological tests and analysis are more than necessary, even obligatory.

The presence of some chemical substances in drinking water is naturally imposed because they influence in certain amount the organoleptic and sensorial characteristics. Drinking water should be firstly clean, which means biological and bacteriological purity need to be ensured, then to be clear,

* *Corresponding: E-Mail: florent.dobroshi@uni-pr.edu; Tel: ++377 (0) 44/ 147627*

having a pleasant taste, and no smell and of course no fever, which ensure the refreshing taste. Above mentioned properties and desirable taste of the water are reflection of presence of some gases dissolved in water (oxygen and carbon dioxide) and small amount3 of calcium bicarbonate. The concentration of oxygen in water depends, not only by the temperature and partial pressure, but also from the degree of water pollution (WHO 2001; Voznaya, 1991). The presence of the reducing substances such as: ammonia, iron (II), nitrites and other substances, which being oxidized, can easily disrupt this balance, thereby diminishing the amount of dissolved oxygen, so that the concentration of dissolved oxygen can be related to the presence of various impurities in the water (Krasniqi & Nushi-Latifi, 2002; Oxfam Delagua, 1993; Vitaku *et al*., 2013).

One of the more important parameters which indicates the degree of purity of the water, is chemical oxygen consumption (GO) or oxidization, which shows the necessary amount of oxidizing reagent for oxidation of colloidal substances, belonging to the organic or inorganic structure. The greater value of GO's, the more water pollution we have, deriving in an urgent measure to be taken for its cleaning (Hernea & Tenche-Constantinescu, 2013) The products of the disintegration of organic substances under the influence of special bacteria, can produce to water an unpleasant odor, and make it unsuitable for drinking purpose.

Material and Methods

For this research work, samples have been taken in different sites, and analysed strictly for the indicators responsible for water quality. Sampling points have been located close to the water wells opened in some villages, and also taken in locations immediately after the so-called disk of "Trepca" mine.

Measurements have been performed for determining such parameters(Standard Methods, 1995; Catrangiu *et al.,* 2015; URL-1) as smell, colour, turbidity, temperature, pH value, chloride and thermo tolerant Coliform bacteria presence of faecal origin, employing an instrument such as "Portals Water Testing Kit", while other parameters like specific conductivity, consumption of $KMnO_4$, dry residue without filter, dry residue after filtration, suspended substances, nitrites, iron and manganese, which have been determined in the laboratories of the Regional Public Health Institute in Mitrovica.

Measuring the temperature, the amount of chlorine, turbidity and pH value was made on site, but the presence of thermo tolerant Coliform bacteria of faecal origin, was done in the special laboratory setup. Analyses of chlorine and pH value were performed in comparator, which is part of the instrumental device (Voznaya, 1991).

Water samples were taken with the clean container, but not sterile (part of the apparatus) (Voznaya, 1991). The vessel was rinsed several times with water that was taken for analysis. Comparator cells rinsed several times with water to be tested, filled with water and then to introduce the tablet right cell DPD - 1 for testing of chlorine, while the left cell comparator introduce phenol red tablet for testing pH value. Values of free chlorine residual and pH, was read during daylight, having the opportunity to compare the sample's colour with standard set of colours in the central part of comparator.

Total residual chlorine content has been analysed according to the standard procedure or protocol. Turbidity was determined in turbidity pipes, which were scalable from 2 to 5 TU. Their scaling was done on a logarithmic scale with higher critical values. The result was the value of the line that is closest to the water level.

Evaluation of electrical conductivity was done using the conductometer, while the the oxygen content, was evaluated by Winkler's bottle. Nitrites were defined in the Helligenit comparator, while other parameters were determined according to standard methods (URL-2; URL-3).

Results and Discussion

The experimental research has been performed for the characterization of the drinking water and its quality in some villages of the municipality of Zvecan, mainly to those water samples taken directly after the disk Trepca Mine, and the respective results of analysis are presented in the Tables 1-3.

In order to simplify the presentation of the results and not repeating values, we have been referred to the selected time for experiments. During the experiment is worth mentioning that all experiments were performed in the field conditions.

Table 1. Physical and chemical analysis of drinking water in village Mazhiq

Parameters	***Units***	***Standards***	***Actual Value***
Temperature	$^{o}K/^{o}C$	281.16 - 285 (8-12)	9
Wind		n.a	n.a
Taste		n.a	n.a
Blur	NTU	1.2 - 2.4	0.21
Color	Scale Co- Pt	10.0 - 20.0	n.a
Value of pH	pH	6.8 - 8.5/6.5 - 9.5	5.02
Wastage of $KMnO_4$	mg/l O_2	8*12**	2.16
Free Chlorine DPD1/DPD4	mg/l Cl_2	0.2 - 0.5	n.a
Chloride	mg/l Cl	200	230
Ammonia	mg/l N	0.1	0.03
Nitrites	mg/l N	0.005	0.006
Nitrates	mg/l N	10	0.8
Iron	mg/l Fe	0.3	n.a
Manganese	mg/l Mn	0.05	n.a
Residue after evaporation	mg/l	800 - 1000	n.a
Electrical conductivity	ms/cm	1500	315
Lead	mg/Pb	0.01	n.a
Sulphates	mg/SO_4	200	56.22
Hardness	dH	30	4.6
Phenol	mg/l	0.001	n.a
Detergents	mg/l	0.1	n.a

Table 2. Physical and chemical analysis of drinking water in the village Vllahi

Parameters	***Units***	***Standards***	***Actual Value***
Temperature	$^{O}K/^{O}C$	281.16 - 285 (8-12)	11.2
Wind		n.a	n.a
Taste		n.a	n.a
Blur	NTU	1.2 - 2.4	0.25
Color	Scale Co- Pt	10.0 - 20.0	n.a
Value of pH	pH	6.8 - 8.5/6.5 - 9.5	3.61
Wastage of $KMnO_4$	mg/l O_2	8*12**	3.67
Free Chlorine DPD1/DPD4	mg/l Cl_2	0.2 - 0.5	n.a
Chloride	mg/l Cl	200	270
Ammonia	mg/l N	0.1	0.04
Nitrites	mg/l N	0.005	0.017
Nitrates	mg/l N	10	8.6
Iron	mg/l Fe	0.3	n.a
Manganese	mg/l Mn	0.05	n.a
Residue after evaporation	mg/l	800 - 1000	n.a
Electrical conductivity	ms/cm	15000	860
Lead	mg/Pb	0.01	n.a
Sulphates	mg/SO_4	200	74.30
Hardness	dH	30	5.48
Phenol	mg/l	0.001	n.a
Detergents	mg/l	0.1	n.a

Table 3. Physical and chemical analysis of drinking water in village Zhazhë.

Parameters	***Units***	***Standards***	***Actual Value***
Temperature	$^{O}K/^{O}C$	281.16 - 285 (8-12)	6.5
Wind		n.a	n.a
Taste		n.a	n.a
Blur	NTU	1.2-2.4	0.10
Colour	Scale Co- Pt	10.0 - 20.0	n.a
Value of pH	pH	6.8 - 8.5/6.5 - 9.5	3.9
Wastage of KMnO4	mg/l O_2	8*12**	3.76
Free Chlorine DPD1/DPD4	mg/l Cl_2	0.2 - 0.5	n.a
Chloride	mg/l Cl	200	250
Ammonia	mg/l N	0.1	0.01
Nitrites	mg/l N	0.005	0.004
Nitrates	mg/l N	10	0.47
Iron	mg/l Fe	0.3	n.a
Manganese	mg/l Mn	0.05	n.a
Residue after evaporation	mg/l	800 - 1000	n.a
Electrical conductivity	ms/cm	15000	257
Lead	mg/Pb	0.01	n.a
Sulphates	mg/SO_4	200	64.7
Hardness	dH	30	2.35
Phenol	mg/l	0.001	n.a
Detergents	mg/l	0.1	n.a

Conclusion and Recommendation

Based on the physical and chemical analyses, it can be drawn this conclusion:

From all analysed samples of drinking water fountains and water wells, can be derived some results that most of them were characterized to be in normal range according to the allowed limits, but there was a case of sampling water which exceed the level of chemical contents and higher value of other physical indicators that the values of approved standards established by regulations of the country and international allowable values. This was the case of the water sample taken from wells drilled within the territory the village Crohn Mazhiq, which represent a high value for the nitrites ions to be 0.006 mg/l N, which is much higher than the recommended standard.

Except this case, all the analysed samples showed characteristics within the allowed limits and the water quality seems to be suitable for usage as drinking water, although no bacteriological characterization has been made to set the presence of the bacteria colonies.

Considering the water as a universal solvent, it can be distinguished that in all water samples analysed, there is a high value of acidity with a low pH, indicating the fact that Trepca mine minerals affected groundwater, increasing its acidity (lower the pH value).

This phenomenon has been observed only in this region of Kosovo, which is the most impacted area from Trepca mines and its mineral industry.

References

Catrangiu A, Niculescu D, Lucaciu I, Chifiriuc C, Mihaescu G. 2015.Virulence Factors of Gram Negative Bacteria Isolated from Natural Aquatic Ecosystems, *J. Environ. Protec & Ecol.,* **16** (1) 33-39.

Hernea C, Tenche-Constantinescu AM. 2013. Variability of Groundwater Quality Parameters from Periurban Area of Timisoara (Romania). *J. Environ. Protec & Ecol.*, **14** (1), 63-70.

Krasniqi S, Nushi-Latifi B. 2002) *Scientific Conference on Technical and Technological Sustainable Development and Environment* 203-207, Prishtina.

Oxfam Delagua, Portable Water Testing Kit, User's Manual Revised and updated 3rd ed., 1993.

Standard Methods for the Examination of Water and Wastewater, 506-508 A, 16 Ed. 1995.

URL-1. https://www.engineeringtoolbox.com/thermal-conductivity-d_429.htmlThermal Conductivity of some common Materials. Engineeringtoolbox.com. Retrieved on 2011-11-22

URL-2 https://webbook.nist.gov/cgi/cbook.cgi?ID=C7732185&Mask=FFFF&Units=SIJump up to: Water in Linstrom, P.J.; Mallard, W.G. (Eds.) *NIST Chemistry WebBook, NIST Standard Reference Database Number 69*. National Institute of Standards and Technology, Gaithersburg MD. http://webbook.nist.gov (Retrieved 2014-06-01)

URL-3 Water Linstrom, P.J.; Mallard, W.G. (eds.) *NIST Chemistry WebBook, NIST Standard Reference Database Number 69*. National Institute of Standards and Technology, Gaithersburg MD. http://webbook.nist.gov (Retrieved 2014-06-01)

Vitaku A, Baruti B, Malollari I, Shala F. (2013). Impact of Polluted Acidic Waters Discharged from Trepca Pb–Zn Mines, Kosovo, on the Pollution of Cross-border Rivers in the Region. *J. Environ. Protec & Ecol*, **14**, (1), 29-34.

Voznaya NF. 1991. Chemistry of water and microbiology. Mir, Publishers, Moscow, 127.

World Health Organization (WHO). 2001. *International Standards for drinking water*, 3rd edition., Geneva.