Physico-Chemical Properties of Water at Different Depths of Radoniqi Lake of Kosovo

Environment and Ecology

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Abstract

The aims of this study is to identify the most appropriate depths for getting water in the Lake of Radoniqi, Kosovo. We have analyzed physical and chemical indicators such as iron (Fe), aluminium (Al), manganese (Mg), ammonia, nitrites, nitrates etc. Also we have measured phosphorus ions at five levels of Radoniqi Lake. We have measured permaganat of potassium consumption, dissolved oxygen, turbidity and the bed smell aroma. Samples of water were analyzed in the physico-chemical laboratory of Filtration and Treatment Station for drinking water of Radoniqi, in Gjakova. Methods are using such as pH meters, conductivity turbidometrija, atomic absorption, classical spektrofotometrik methods, chemical analysis etc. The results obtained show that the water of the lake "Radoniqi" have a good quality in the level four and five. The removal of water bed aroma is accomplished through treatment with activated carbon in Gjakova Water Treatment and Filtration Station.

1. Introduction

The Radoniqi Lake is built to collect drinking water near the Gjakova region in western of Kosovo. The lLake is placed on a surface approximately 580 hectares and has a length of about 5 km and with a width 2 km. The altitude is from 402 to 456.4 m. The amount of accumulated water is estimated approximately 117x106 m^3 and with a maximum depth of 52 m.

Figure 1. Satellite view of the Radoniqi Lake

The main supplier of Radoniqi Lake is the River of Lumbardha, Deçan and the Ratishta agai stream. River of Lumbardha has an annual average flow of 5 m3 / s and comprised largely of water from nearby sources. The water lake of Radoniqi is used for irrigation in agricultural lands and to supply drinking water to about 250,000 residents in the area of Gjakova, Rahoveci and in a part of the Prizren municipality.

In the Radoniqi lake water are dissolved and it contains different materials, which affect drinking water quality. All these materials can be separated into physical, chemical and microbiological.

Figure 2. Filtration station

Figure 3. Equipment the activated carbon dosage

2. The aim and the objectives

The aims of this study is to determine the physico-chemical and organoleptic parameters of lake water at different depths in order to optimize water treatment methods before crossing the water network. This paper presents the results of the determination of physico-chemical parameters of water in five levels of artificial Radoniq lake in order to choose the most appropriate level after treatment necessary to prepare for drinks.

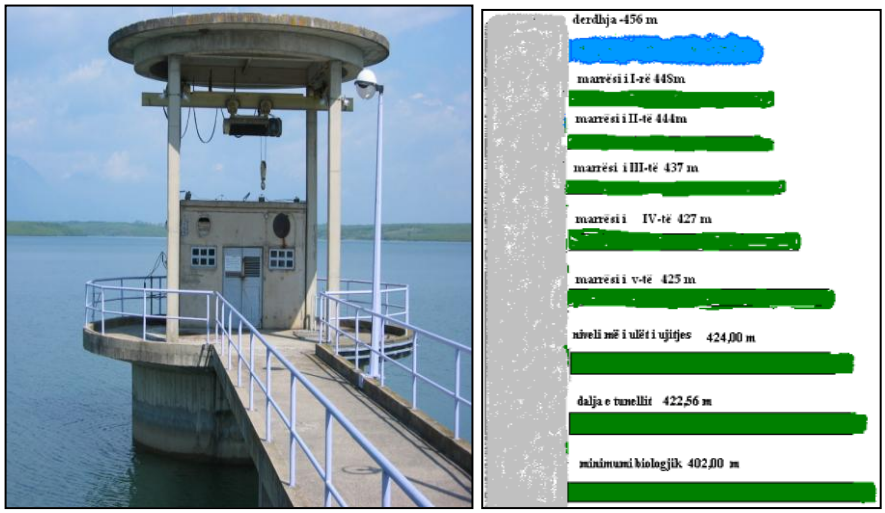

Figure 4. Tower-water level of the lake recipient 'Radoniq'

3. Material and methods

Samples of water were taken at diferent levels of depth and are defined physico-chemical parameters such as: iron, manganese, ammonia, nitrites, nitrates, phosphates, aluminum etc. We have also analyzed the spending of permanganate potassium, dissolved oxygen, turbidity etc. Water samples are analyzed in the physico-chemical laboratory of Radoniqi Station.

4. Results and conclusions

Results of physico-chemical analysis of untreated water and treated water are provided in the following tables (1, 1.1. and 1.2) during november 2011 period.

Table 1. Data on physical-chemical indicators of "Radoniqi" lake water

The parameters	Units	Level I	Level II	Level III	Level IV	Level V
The water temperature	^{0}C	8.9	9.5	8.3	7.9	7.7
Aroma	-	-	+(1)	+(1)	-	-
Taste	-	-	-	-	-	-
Turbidity	NTU	2.1	2.0	1.9	1.7	1.65
Color	Co-Pt-rate	-	-	-	-	-
pH		7.62	7.64	7.66	7.68	7.69
SO_4^{-2}	mg/dm^3	21	21	22	23	23
m-alkaline		23.0	23.0	23.5	24.0	24.0
Total hardness	^{0}dH	7.0	7.14	7.14	7.28	7.36
Electric permeability	μ/cm	229	234	231	239	242
The dry residue	mg/dm^3	137.4	140.4	138.6	143.4	145.2
O_2	mg/dm^3	11.2	11.1	10.99	10.86	10.85
Cl^-	mg/dm^3	6.38	6.02	6.02	5.67	5.31
$KMnO_4$	mg/dm^3	5.37	5.12	4.74	4.58	4.58
NH_4^+	mg/dm^3 NH_4^+	0.14	0.13	0.13	0.11	0.10
NO_3	mg/dm^3	0.13	0.13	0.12	0.11	0.11
NO_2	mg/dm^3	0.007	0.007	0.006	0.005	0.005
Fe	mg/dm^3	0.035	0.03	0.025	0.02	0.02
Mn	mg/dm^3	0.034	0.037	0.038	0.049	0.05
PO_4^-	mg/dm^3	0.09	0.08	0.09	0.07	0.07
Al	mg/dm^3	0.053	0.045	0.044	0.42	0.42

The data show that temperatures decrease with increasing of water depth from 8.9 ^{0}C in the first level to 7.7 ^{0}C in the fifth level. Smell is present at the second and third level. turbidity of water decreases with increasing water depth. Values of pH and $SO4^{-2}$ ngelen the same for all five levels of the lake. It is observed a tendency of increased alkaline and total hardness with increasing of water depth. Dissolved oxygen and the presence of chloride ions tend to decrease with increasing of lake depth. There is also a trend of decreasing values from the first to the fifth level of ammonium ions, NOx, PO^{4-} and Fe and Mn elements.

Table 1.1 Results of physico-chemical analysis of the Radoniqi lake water for level III

The parameters	Units	Max values permitted	Before treatment	After treatment
The water temperature	^{0}C	8-12	8.3	9.4
Aroma	-	-	+ (1)	+(1)
Taste	-	+	-	weak
Turbidity	NTU	1,2-2,4	1.9	0.28
Color	Co-Pt-rate	10*-20*	-	-
pH		6,8-8,5	6.66	7.60
SO_4^{-2}	mg/dm^3	200	22	23
m-alkaline		-	23.5	22.5
Total hardness	^{0}dH	30	7.14	7.14
Electric permeability	µ/cm	500-1500	231	227
The dry residue	mg/dm^3	1000	138.6	136.2
O_2	mg/dm^3	<5	10.99	11.4
Cl^-	mg/dm^3	200-250	6.02	6.02
$KMnO_4$	mg/dm^3	8-12	4.74	3.16
NH_4^+	mg/dm^3 NH_4^+	0,10	0.13	0.072
NO_3	mg/dm^3	10	0.12	0.093
NO_2	mg/dm^3	0,005	0.006	0.003
Fe	mg/dm^3	0,3	0.025	0.04
Mn	mg/dm^3	0,05	0.038	0.05
PO_4^-	mg/dm^3	3,0	0.09	0.06
Al	mg/dm^3	0,2	0.044	0.08

The results presented in table 1.1 show that the physico-chemical parameters of the third level water after treatment are very good offering a product with very good quality.

Table 1.2. Results of physico-chemical analyzes of Radoniqi lake water for levels IV and V

The parameters	Units	Max values permitted	Before treatment		After treatment
			Level IV	Level V	
The water temperature	^{0}C	8-12	7.8	7.6	8.3
Aroma	-	-	-	-	(0)
Taste	-		-	-	
Turbidity	NTU	1,2-2,4	1.75	1.60	0.23
Color	Co-Pt-rate	10*-20*			
pH		6,8-8,5	7.69	7.69	7.57
SO_4^{-2}	mg/dm^3	200	22.5	22.5	23.5
m-alkaline		-	23.5	23.5	22
Total hardness	^{0}dH	30	7.28	7.36	7.0
Electric permeability	µ/cm	500-1500	236	240	229
The dry residue	mg/dm^3	1000	141.6	144	137.4
O_2	mg/dm^3	<5	10.87	10.9	11.5
Cl^-	mg/dm^3	200-250	5.31	5.31	6.38
$KMnO_4$	mg/dm^3	8-12	4.42	4.42	3.16
NH_4^+	mg/dm^3 NH_4^+	0,10	0.11	0.11	0.07
NO_3	mg/dm^3	10	0.108	0.108	0.09
NO_2	mg/dm^3	0,005	0.005	0.005	0.003
Fe	mg/dm^3	0,3	0.02	0.2	0.04
Mn	mg/dm^3	0,05	0.051	0.050	0.04
PO_4^-	mg/dm^3	3,0	0.073	0.072	0.05
Al	mg/dm^3	0,2	0.041	0.041	0.09

Results of physico-chemical analysis of untreated water and treated water are provided in the following tables (2, 2.1. and 2.2) during December2011 period.

Table 2. Data on physical-chemical indicators of "Radoniqi" lake water (December 2011)

The parameters	Units	Level I	Level II	Level III	Level IV	Level V
The water temperature	^0C	8.9	9.5	8.3	7.9	7.7
Aroma	-	+	+	+	+	+
Taste	-	-	-	-	-	-
Turbidity	NTU	2.3	2.5	2.34	2.3	2.15
Color	Co-Pt-rate	-	-	-	-	-
pH		7.65	7.66	7.66	7.69	7.69
SO_4^{-2}	mg/dm^3	22	22	22	23	23
m-alkaline		23.5	23.5	23.5	24.0	24.0
Total hardness	^0dH	7.0	7.14	7.14	7.28	7.36
Electric permeability	µ/cm	233	238	241	244	249
The dry residue	mg/dm^3	139.8	142.8	144.6	146.4	149.4
O_2	mg/dm^3	11.5	11.3	11.1	10.98	10.91
Cl^-	mg/dm^3	6.73	6.38	6.38	6.02	5.67
$KMnO_4$	mg/dm^3	5.68	5.37	5.056	4.74	5.12
NH_4^+	mg/dm^3 NH_4^+	0.15	0.14	0.14	0.12	0.12
NO_3	mg/dm^3	0.15	0.15	0.14	0.13	0.12
NO_2	mg/dm^3	0.008	0.008	0.007	0.006	0.006
Fe	mg/dm^3	0.038	0.035	0.027	0.024	0.024
Mn	mg/dm^3	0.036	0.038	0.039	0.051	0.051
PO_4^-	mg/dm^3	0.09	0.09	0.09	0.08	0.07
Al	mg/dm^3	0.054	0.049	0.046	0.044	0.043

Table 2.1. Results of physico-chemical analyzes of Radoniqi lake water for levels IV and V

The parameters	Units	Max values permitted	Before treatment		After treatment
			Level IV	Level V	
The water temperature	^0C	8-12	7.9	7.7	8.0
Aroma	-	-	+	+	+
Taste	-	-	+	+	+
Turbidity	NTU	1,2-2,4	2.3	2.15	0.21
Color	Co-Pt-rate	10*-20*	-	-	-
pH		6,8-8,5	7.69	7.69	7.59
SO_4^{-2}	mg/dm^3	200	23	23	23.5
m-alkaline		-	24.0	24.0	22.5
Total hardness	^0dH	30	7.28	7.36	7.28
Electric permeability	µ/cm	500-1500	244	249	239
The dry residue	mg/dm^3	1000	146.4	149.4	143.4
O_2	mg/dm^3	<5	10.98	10.91	11.6
Cl^-	mg/dm^3	200-250	4.74	5.12	6.52
$KMnO_4$	mg/dm^3	8-12	0.12	0.12	3.31
NH_4^+	mg/dm^3 NH_4^+	0,10	0.13	0.12	0.072
NO_3	mg/dm^3	10	0.006	0.006	0.092
NO_2	mg/dm^3	0,005	0.024	0.024	0.003
Fe	mg/dm^3	0,3	0.051	0.051	0.042
Mn	mg/dm^3	0,05	0.08	0.07	0.041
PO_4^-	mg/dm^3	3,0	0.044	0.043	0.06
Al	mg/dm^3	0,2	0.041	0.041	0.09

Table 2.2. Data of physico chemical water parameters before and after activated carbon treatment

The parameters	Units	Standards	Before Active Carbon treatment		After Active Carbon treatment 10g AC/m^3
			Lake water	After physico-chemical treatment	
The water temperature	^0C	8-12	6,4	7,8	7,8
Aroma	-	-	+	+	-
Taste	-	-	-	+	-
Turbidity	NTU	1,2-2,4	2,68	0,22	0,22
Color	Co-Pt-rate	10*-20*	pa	pa	pa
pH	mg/dm^3	6,8-8,5	7,98	7,81	7,68
$KMNO_4$	mg/dm^3	8-12	4,42	3,16	3,47
m-alkaline		-	23,5	23	22,5
Cl^-	mg/dm^3	200-250	4,60	5,32	5,67
NH_4^+	mg/dm^3	0,1	0,1	0,01	0,009
NO_3	mg/dm^3	0,005	0,005	0,003	0,002
NO_2	mg/dm^3	10	1,48	0,85	0,83
$KMnO_4$	mg/dm^3	0,3	0,29	0,04	0,02
Mn	mg/dm^3	0,05	0,07	0,01	0,004
The dry residue	mg/dm^3	800-1000	122,4	126,6	125,4
Total hardness	^0G	30	6,86	7,91	7,56
O_2	mg/dm^3	<5	11,8	10,9	10,6
CO_2	mg/dm^3	-	5,17	5,06	4,95
SO_4^{-2}	mg/dm^3	200	18	16	16

The data presented above show that bad aroma is presence in five levels of water lake. The removal of water bed aroma is is accomplished through treatment with activated carbon in Gjakova Water Treatment and Filtration Station.

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