Survey of the Impact from Different Factors on the Quality of Groundwater in Istog Region-Kosovo

Geosciences and Technology

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Abstract

Recent decades beside of rashly growth of population are also accompanied by an increase in demand for water. If we add to this industrialization, urbanization and technological development, the impact is increased, causing water deficit and ground water contamination. Groundwater research and regular monitoring of drinking water in our country increases the need for new water resources and to study the possibilities of using this water for the needs of population's, but additionally it's necessary to increase as well the awareness of the importance for protecting these resources from the impacts of different factors. The purpose of this paper is to provide quantitative and physical-chemical data to determine the quality of ground water and use it as drinking water in Istog region because of: high density of these wells in this area, the scope for agricultural field, water source potential, and non-proper utilization of ground water. Referent points in the Istog region, area where research of resources is done, are evidence of the high quality of ground water. Measurements made at 24 points give different results.

1. Introduction

Historically the quantity and quality of water available is one vital factor in determining its welfare. Whole civilizations have disappeared due to lack of water as a result of climate change. Increasing numbers of population, as well as industrialization, urbanization and technological development have increase the demand for water and also cause its deficit by increasing the chances of groundwater contamination.

In the absence of research of groundwater and regular monitoring and increasing demand for drinking water in the country has increased the need for increase research studies for new water sources with the possibility of using them for the needs of the population. These researches have created conditions for the continuous research knowledge for good quality water that can be used for drinks and activities in agriculture and industry. Also awareness of the population rises about the importance of protecting these resources from the impacts of the activities that they carry them around.

The purpose of this paper was that through research to provide quantitative data on physic-chemical determination of the quality of groundwater and the possibility of their use. For the study we selected two underground water bodies near Istog (figure 1 and 2) due to: -high density of wells in this area, and agricultural field alignment, pre tendency of water source in Istog, and illegal use of groundwater respectable.

2. Material and methods

Material used for water samples were taken into 24 wells at different depths from ground level distributed in Istog area and from two springs of the rivers Istog and Vrella the same area. Much of the population of this area is using these water resources for water supply and other needs of the majority of the area.

In place of water sampling was measured directly the temperatures of water and air (°C), pH, free CO_2, gas content and electrical conductivity of water by conduct meter. While in the laboratory were determined other water properties.

Sampling was done by equipment SEBA, type KLL's which by ribbon meter measures the depth of the underground water from the surface as well as the depth of the water sample taken for analysis.

According to this principle in the bottom bar meter are placed special opened containers on both sides on the bottom and top connected with pizometer, which at the first moment of contact with water give the signal of arrival of the groundwater level and the value recorded on tape reading meter. From this moment we continue with the release of the vessel at the one meter in depth then with the hit the upper part, container filled with water closed on both sides.

During the sampling time intervals was respected from sampling to the analyses. The sample is placed immediately in portable refrigerator that provides instant cooling of sample and period of stay is 4 hours. If a refrigerator and ice are not in good condition then the transport time to the laboratory should not exceed 2 hours. The sample should be kept in the dark.

For physico-chemical analysis the time between sampling and conducting the analysis if was not made conservation should be as short as possible. In this case the Taster pocket device is used to collect water samples and test the groundwater (pH, temperature, electrical conductivity).

The favorite type of bottle is made of glass or polyethylene, depending on the requirements of setting parameters.

3. Results and discution

The base hydro geochemical data are chemical analyses of water. They determine the chemical composition of substances of water dissolved gases and dissociated and undissociated substances in groundwater.

The results of physical-chemical analysis of water obtained during the study of groundwater in wells Istog region are presented in tables 1, 2 and 3, where most of the allowed indicator limits in these tables refer to the drinking water according Directive EU of 98/83.

Table 1. The results of physical-chemical indicators of water spring in the Istog region.

Indicators	**Symbol**	**Unit**	**SpringDrini**	**GPP-7A**	**GPP-10A**	**Spring Istog**	**GPP-22A**	**GPP-26A**	**GPP-30A**	**Spring Vrella**
Terrain										
Aquifer			dolomit	aluvia	aluvia	dolomite	aluvial	dolomit	aluvial	dolomit
H-Ion concentration	pH		7.86	-	7.18	8.09	6.90	7.03	6.45	7.75
Temperature	T	°C	12.6	-	16.2	14.5	20.9	20.0	19.0	13.1
Electrical conductivity	X	µS/cm	950	-	860	440	590	1.360	1.000	670
Laboratory										
H- Ion concentration	pH	1-14	7.70	7.36	7.45	8.07	7.09	7.07	7.50	7.71
Electrical conductivity	X	µS/cm	253	1.294	844	280	545	1339	925	273
Substances dissoluble in water	TDS	mg/l	126	647^{x}	420	140	277	670^{x}	462	137
Alkaline	$CaCO_3$	mg/l	18.2	55.6	63.0	19.6	32.1	56.9	53.5	20
Total hardness	F_t	d°H	15.04	70.42	38.10	16.30	26.10	48.62	48.11	16.5
Ca-Ion	Ca^{2+}	mg/l	52.12	165.39	96.23	55.13	54.13	46.11	184.40	58.13
Mg-Ion	Mg^{2+}	mg/l	4.86	70.48	34.02	6.07	30.38	89.92	4.25	4.86
Na-Ion	Na^{2+}	mg/l	-	-	-	-	-			-
K-Ion	K^{+}	mg/l	-	-	-	-	-			
Fe-Ion	Fe^{2+}	mg/l	0.34	-	0.19	0.05	-	0.03	0.06	0.05
Bicarbonates	HCO^{-}_3	mg/l	170.8	442.3	506.3	161.7	292.8	463	481.9	189.1
Chloride	Cl^{-}		10.00	5.1	19.6	13.8	18.8	41.0	134.0	2.5
Sulphates	SO_4^{2-}	mg/l	5.56	138.80	13.71	0.80	7.71	212.00	12.66	0.30
Ammonium	NH_4^{+}	mg/l	0.31	0.34	0.64	0.29	0.56	0.31	0.30	0.29
Ortho phosphates	PO_4-P	mg/l	0.02	0.15	3.55		0.00	0.02	0.07	0.06
Nitrates	NO_3^{-}	mg/l	3.30	96.00^{x}	1.20	3.30	2.00	15	62.00^{x}	0.30
Nitrites	NO_2^{-}	mg/l	0.10	0.09	0.09	0.02	0.16	0.16	0.02	
Chemical Oxygen Demand	COD	mg/l	4.60	24.50	22.80	3.00	5.30	7.80	6.50	2.9
Biochemical Oxygen Demand	BOD	mg/l	1.20	3.50	13.30	1.00	1.30	0.60	-	1.3
Total organic carbon	TOC	mg/l	1.40	7.50	10.60	1.20	1.60	2.40	2.00	0.9
The sum of cations		mgek/l	3.01	14.05	7.61	3.25	5.20	9.70	9.55	3.30
The sum of anions		mgek/l	3.02	11.83	9.20	3.11	5.52	13.40	12.94	3.18
Type of water			Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Mg-HCO_3	Ca-HCO_3	Ca-HCO_3

Table 2. The results of physical-chemical indicators of distance wells water in the Istog region.

Indicators	Symbol	Unit	GPP-33A	GPP-34A	GPP-35A	GPP-40A	GPP-48A	GPP-51A	GPP-59A	GPP-63A
Terrain										
Aquifer			aluvial	aluvial	dolomite	Alluvia	dolomite	aluvial	aluvial	Aluvial
H-Ion concentration	pH	1-14	6.97	7.26	7.13	7.50	6.87	7.12	7.15	8.01
Temperature	T	°C	18.0	13.1	22.1	18.2	20	14.6	16.6	18.0
Electrical conductivity	EC	μS/cm	930	670	540	640	350	8.00	940	160
Laboratory										
H-Ion concentrate	pH	1-14	7.62	-	7.86	7.92	6.77	6.96	7.49	7.83
Electrical conductivity	X	μS/cm	365	-	411	475	329	822	817	130
Substances dissoluble in water	TDS	mg/l	183	-	206	238	165	411	408	165
Alkaline	$CaCO_3$	mg/l	27.9	-	28.3	18.2	20.4	63.5	52.3	11.2
Total hardness	F_t	d^oH	21.55	-	22.05	23.55	17.54	27.11	47.61	8.01
Ca-Ion	Ca^{2+}	mg/l	78.18	106.25	78.18	70.16	29.06	72.29	58.13	14.03
Mg-Ion	Mg^{2+}	mg/l	4.86	7.29	6.07	14.58	24.91	21.95	80.2	10.93
Na-Ion	Na^{2+}	mg/l	-	-		-	-			
K-Ion	Mg^{2+}	mg/l	-	-		-	-			
Fe-Ion	Fe^{2+}	mg/l	0.05	0.12	0.05	0.05	0.07	4.55$^{\times}$	0.05	0.09
Bicarbonates	HCO^-_3	mg/l	259.3	320.3	262.3	179.9	195.2	524.6	494.1	24.4
Chloride	Cl^-		2.8	8.5	5.1	19.2	5.7	72.1	19.3	6.9
Sulphates	SO_4^{2-}	mg/l	0.26	2.18	1.33	16.26	3.16	9.90	20.26	3.33
Ammonium	NH_4^+	mg/l	0.39	0.42	0.48	0.43	0.29	27.64$^{\times}$	0.41	0.39
Ortho phosphates	PO_4-P	mg/l	0.07	0.05	0.07	0.07	0.02	1.96	0.05	0.06
Nitrates	NO_3^-	mg/l	0.30	19.00	17.80	52.50$^{\times}$	-		30.50$^{\times}$	4.60
Nitrites	NO_2^-	mg/l	-	0.02	-	0.06	0.02	0.06	-	0.03
Chemical Oxygen Demand	COD	mg/l	56	50	42.50	33.50	26.40	9.00	10.50	13.20
Biochemical Oxygen Demand	BOD	mg/l	26.20$^{\times}$	23.40$^{\times}$	20.00$^{\times}$	15.80$^{\times}$	12.40$^{\times}$	20.00$^{\times}$	4.90	7.80$^{\times}$
Total organic carbon	TOC	mg/l	17.60	15.60	13.30	10.50	8.30	14.20	3.20	3.50
The sum of cations		mgek/l	4.30	5.91	4.40	4.70	3.50	5.58	9.50	1.60
The sum of anions		mgek/l	4.34	5.84	4.76	4.68	3.43	10.84	9.56	0.74
Type of water			Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	$MgHCO_3$	$MgHCO_3$

Table 3. The results of physical-chemical indicators of wells water in the Istog region.

Indicators	Symbol	Unit	GPP-65A	GPP-70A	GPP-72A	GPP-82A	GPP-86	GPP- 91	GPP- 95	GPP-102A
Terrain										
Aquifer			aluvial	aluvial	aluvial	alluvial	aluvial	aluvial	aluvial	aluvial
H-Ion concentration	pH	1-14	7.29	6.36	7.02	7.04	7.29	7.49	7.16	7.18
Temperature	T	°C	21.9	19.7	23.3	16.9	23.3	15.7	18.1	18.9
Electrical conductivity	EC	μS/cm	610	670	710	7.00	1.180	1.270	1.710	1.000
Laboratory										
H-Ion concentration	Ph	1-14	7.62	6.58	7.60	7.42	7.86	7.25	6.91	7.50
Electrical conductivity	X	μS/cm	431	533	587	625	1.620	667	1.381	746
Substances dissoluble in water	TDS	mg/l	216	267	393	312	810	333	690	372
Alkaline	$CaCO_3$	mg/l	28.9	17.2	40.1	31.8	84.9	55.5	103.9	283.8
Total hardness	F_t	d^oH	25.06	29.60	127.57	16.11	46.20	36.15	60.14	36.50
Ca-Ion	Ca^{2+}	mg/l	70.16	63.15	64.15	29.6	54.12	100.48	240.96	120.00
Mg-Ion	Mg^{2+}	mg/l	18.22	33.14	6.44	21.87	167.69	12.20	60.35	15.80
Na-Ion	Na^{2+}	mg/l	-	-	-	-	-	-	-	-
K-Ion	Mg^{2+}	mg/l	-	-	-	-	-	-	-	-
Fe-Ion	Fe^{2+}	mg/l	0.38	0.12	0.35	0.18	0.35	0.07	5.28$^{\times}$	-
Bicarbonates	HCO^-_3	mg/l	219.0	186.0	375.2	295.8	771.7	305.0	126.0	344.8
Chloride	Cl^-		23.0	31.0	11.0	38.0	121.0	27.8	36.6	13.6
Sulphates	SO_4^{2-}	mg/l	0.05	95.62	15.05	19.46	1.31	54.77	431.30	-
Ammonium	NH_4^+	mg/l	3.17	0.35	0.47	0.37	0.22	0.55	15.57$^{\times}$	0.59
Ortho phosphates	PO_4-P	mg/l	0.04	0.01	0.05	0.08	0.13	0.00	0.12	0.05
Nitrates	NO_3^-	mg/l	0.50	0.80	1.80	40.50$^{\times}$	230.0$^{\times}$	20.80	-	56
Nitrites	NO_2^-	mg/l	0.02	0.10	0.07	0.10	0.16	0.13	0.13	0.00
Chemical Oxygen Demand	COD	mg/l	27.80	1.80	4.20	5.90	15.60	8.10	11.50	3.60
Biochemical Oxygen Demand	BOD	mg/l	25.80$^{\times}$	0.40	1.80	2.70	0.80	1.70	2.50	2.50
Total organic carbon	TOC	mg/l	20.20	0.50	1.30	1.80	4.80	1.20	1.80	1.60
The sum of cations			5.01	5.88	3.74	3.26	16.51	6.02	17.18	7.29
The sum of anions			4.25	5.93	6.80	6.98	19.81	7.26	30.79	6.96
Type of water			Ca-HCO_3	Ca-HCO_3	Ca-HCO_3	Mg-HCO	Mg-HCO	Ca-HCO_3	Ca-HCO_3	Ca-HCO_3

$^{\times}$- Exceeded values.

4. Conclusions and recommendation

With drinking water supply in Kosovo there exists potential risks, assuming that in the near future the amount of water will remain the same or slightly improved but it would be insufficient. Particularly those of rural areas and small remote can be most affected by water shortages.

Wastewater mistreatment in Kosovo poses a potential risk to groundwater and drinking, and nature in general. Some of industrial wastes are causing long-term damage to the environment.

Based on the results obtained in this paper for groundwater second area of the water body Istog, we can conclude that these are affected by anthropogenic impacts and water quality is declining. Landmarks of water resources in Istog are a testimony to the high quality of groundwater in this area. The measurements made at 24 points yield different results compared to benchmarks, evaluation of pollution in the wells is an indicator of the presence of water pollutants.

In this case the presence of increased ammonium in the sample is presented in sample GPP-40A in table 2 with the value of 27.64 mg/dm^3, while there is little of nitrites 0.06mg/dm^3 tells us that we are dealing with a source of pollution that occurred at near spring rishtas. From the table 2 samples PSS 40A also shows the presence of nitrates in the water in value of 52.50 mg/dm^3NO_3^- that indicates a contamination from a distant source of pollution. In table 1 as well as GPP-7A samples presented with a highe value of 96 mg/dm^3NO_3^-.

In Table 2, the presence of organic matter results in high value and reaches a value of 26.20mg/dm^3, which appear as a result of municipal pollution, detergents and pesticides.

Most of the contaminated wells appear more in areas where farming and agriculture is more concentrated. In recent years these areas has started to supply of drinking water from the city water supply has influenced Istog decrease maintenance and quality control of water wells. However in many villages around Istog use these waters for drinking, irrigation, domestic and livestock.

The results show that nitrogen is present in groundwater and that it is recommended to monitor the content of nitrogen in all waters.

In order to protect groundwater from heterogeneous impacts the relevant institution must develop the long-term strategy for the management of groundwater and surface water in this area.

To include people in organized drainage systems in the municipality of Istog and build plant for wastewater treatment in order to reduce further pollution impacts on groundwater.

With new technologies in the field of water will be provided:

-expansion of natural water resource,
-reduction of water demand,
-achieving high efficiency in water use.

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