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Shahrood River water quality assessment and the possibility of using it for drinking and agriculture

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Abstract: The aim of this study is to evaluate the water quality of Shahrood River (Qaemshahr area, Mazandaran province) and its suitability for irrigation and drinking uses. For this purpose, 15 water samples were collected. The concentration of major anions and cautions along with TDS, COD and NO_3^- parameters were measured by means of standard methods. Hydro chemical results were graphically analyzed by using selected graphs such as Piper, Wailcox, and Schoeller and Gibbs diagrams. Based on Piper diagram, it is revealed that hydro chemical type of the most water samples is calcic bicarbonate. The main natural process controlling the chemistry of water in the study area is apparently rock weathering. Considering salinity and sodium content and taking into account the Schoeller diagram, it is revealed that Shahrood river water is suitable for agricultural use whereas based on the Wilcox classification, except for the samples collected close to the sea, the river water may be used safely for irrigation of agricultural lands.

Key words: Water quality; Shahrood River; Suitability

1. Introduction

Water in all human activities and control the physical, chemical and biological environment plays a significant role. The crucial matter is not found in nature in pure form, but always with some salt and suspended solids and dissolved gases that cause the composition of each region is changed (Bellos and Sawidis, 2005). Depending on human needs groundwater and surface water used for various purposes. What is an activity that is dependent on the quality of water and its chemical composition? Unfortunately, there are several sources of water pollution due to the chemical quality of the resources (surface and underground) and because it has greatly reduced the use of water in various uses (such as agriculture or domestic) and check its quality be carefully evaluated.

In this study, we investigated the chemical composition of water thirty, as one of the major rivers in the province, the quality of drinking water and agriculture have also been investigated. The river goes over thirty years, in terms of quality and ecological status was worse than the other Caspian rivers have been attributable to the discharge of industrial effluents and urban runoff hospital and into the river. Mazandaran down The river catchment area of approximately 461 square kilometers, which is about 119 km and the average slope is equal to 0.0133 square kilometers (Alley, 2000).

2. Materials and methods

To analyze and evaluate the quality and feasibility of C water for drinking and agricultural water use by river, 15 water samples along the river from source (Par Chinak village) to the mouth of the River (site of the Caspian Sea) and the input of contaminants and access roads were harvested. Sampling according to catchment rainfall season, in January 1390 was conducted on two consecutive days. Immediately water samples for measurement of physicochemical parameters, Mazandaran Regional Water Company were transferred to the laboratory. The concentration of sodium ions and potassium by flame spectrometry and the concentration of sulfate and nitrate ions by spectrophotometry and the concentration of calcium, magnesium, chloride and carbonate and bicarbonate were measured by titration method. And Ec sample pH by pH meter ELE in the sample were measured and recorded. Physicochemical parameters measured values are shown in Table 1.

According to Table 1, the pH, the only constant in the metropolitan area Ghaemshahr River Crossing Station No. 5 is slightly reduced. Bicarbonate ions, pH water control (Jang et al., 2011). Given that the source of this river, rock outcrops combined with Marnie, this is normal and high pH because the water composition (in terms of pH) is in the alkaline range. TDS and EC were as expected from the source to the mouth of the river, should increase due to the proximity to the sea and combine with it. We must also increase calcium levels in the river outlet. Dissolution of calcite and calcium can also increase the TDS (Jang et al., 2011).

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Table 1: The values of the measured parameters

stations	PH	Ec	TH	TDS	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$HCO3^{-}$	CL^{-}	SO4—	COD	$No3^{-}$
		(µmohs/cm)	mg/l (CaCO3)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
1	7.9	533	245	343	80	10.8	6.9	1.95	247.5	17.75	4.8	7.2	9.2
2	7.9	520	235	334	78	9.6	9.2	1.95	268.4	17.75	4.8	5.4	7.5
3	7.9	574	255	369	84	10.8	11.5	1.95	298.9	17.75	4.8	4.4	11.9
4	7.8	678	290	452	98	10.8	25.3	2.34	329.4	42.6	9.6	5	8.4
5	7.4	777	310	505	100	14.4	32.2	2.73	335.5	49.7	28.8	5.3	15.4
6	7.8	773	305	502	102	12	34.5	2.73	335.5	49.7	28.8	5.5	12.3
7	7.8	775	305	504	102	12	34.5	2.73	341.6	49.7	24	5.8	15.4
8	7.9	796	310	517	100	13.2	39.1	2.73	359.9	53.25	14.4	6.3	11
9	7.9	789	295	513	100	10.8	41.4	2.73	347.7	60.35	9.6	7.6	12.7
10	7.9	926	305	602	104	10.8	69	3.51	353.8	106.5	9.6	8.2	8.4
11	8	964	330	627	112	12	66.7	3.51	372.1	102.95	19.2	8.8	11.4
12	8	982	325	638	98	19.2	73.6	3.51	366	106.5	28.8	10.5	8.8
13	7.9	1035	315	673	106	12	87.4	4.29	372.1	124.25	24	12.2	14.5
14	7.9	1115	300	715	100	12	112.9	4.29	366	159.75	14.4	13.5	6.2
15	7.9	2580	300	1729	114	13.2	432.4	4.68	311.1	621.25	144	15.6	9.7

The increase in calcium, increasing the total hardness of water is justified. The (COD) in all parts of the Ontario Drinking Water Quality Standard 2002 (ODWS) so that the amount due on the first station poultry units near the river, greatly enhanced and the station No. 2 to the sea also shows upward. Nitrate concentration in water is one of the key indicators of the impact of urban activities on the quality of surface water (Bellos and Sawidis 2005). C is the concentration of nitrate in river water samples from urban areas (Six weeks), more than other areas because of the urban sewage discharge (hospital) into the river. However, the nitrate concentration is lower than the WHO standard.

Amounts of other anions and cations (Na, K, Cl, SO_4) generally increases with distance from the source and relative proximity to the estuary.

To identify the natural processes that control chemical composition of the river water C. (1970) Gibbs was used. The model used is the ratio of ions and TDS. Due to the location of water samples on Gibbs diagram (Fig 1), the main controller 14 primary water chemistry, weathering of rocks (the interaction of water with rocks) and the final sample (C is the junction of the river with the Caspian Sea) evaporation was determined that this conclusion due to weather conditions and wet stones and the corresponding region.

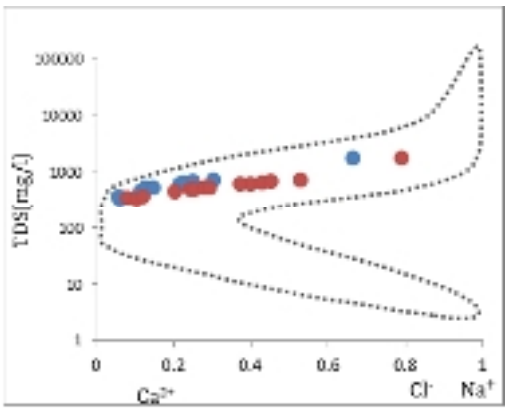

Fig. 1: The location of river water samples on Gibbs chart

3. Typing hydro chemical water samples

Hydro chemical faces in this study to determine the type and water samples were analyzed from Piper diagram (Piper, 1944). In this diagram, the type of water based on the concentration of anions and cautions concentration is determined based on priority water faces. The results obtained (Fig. 2) and are based on the chart type C water faces Bykrbnath and the calcic and only 15 stations where water from the river to the sea, the water typefaces KIrvrh and it is sodic.

4. Water quality assessment use Drinking

Usually possible to determine the use of water (surface or underground) for drinking from Schoeller diagram (Schoeller, 1955) is used. The semi-logarithmic scale diagram given in terms of speed, ease of comparison and display a large number of samples, displaying ions concentration in milligrams per liter, of special importance (conjoined et al. 1389). This chart is based on the quality of the original concentration of cautions and anions such as: Ca + 2, Mg + 2, Na +, Cl-, SO42-, HCO3- and TDS parameters are evaluated. According to Table 2 and class standings Schuler to drinking, the greater the pH of the samples are in good to moderate. 25% of the water due to high levels of chlorine (Cl) and sodium (Na), and 30% of the amount of sulfate (SO4-), and 21% of the samples due to high hardness (TH) in Groups are unpleasant completely inappropriate finds.

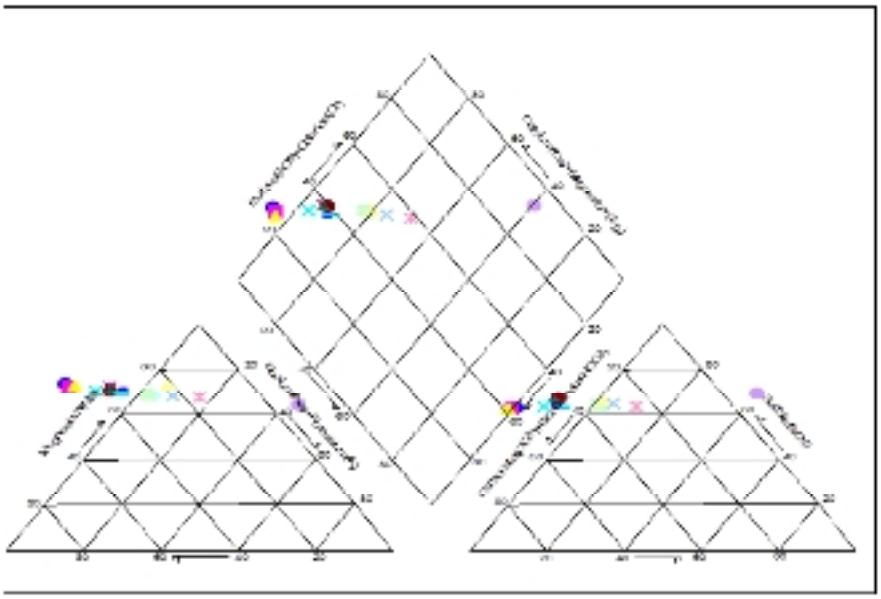

Fig. 2: Piper diagram for river water samples

Table 2: Percent each of the total range of classes for Schuler classification

Water Classification	SO_4	Cl	Na	pH	TH	TDS
Good	39.13	39.13	39.13	30.43	8.7	21.74
Acceptable	17.39	21.74	17.39	34.78	43.48	30.43
Average	13.04	13.04	17.39	34.78	26.09	13.04
Unsuitable	26.09	17.39	17.39	0	17.39	26.09
Quite unpleasant	4.35	8.7	8.7	0	4.35	8.7
Non-potable	0	0	0	0.01	0	0

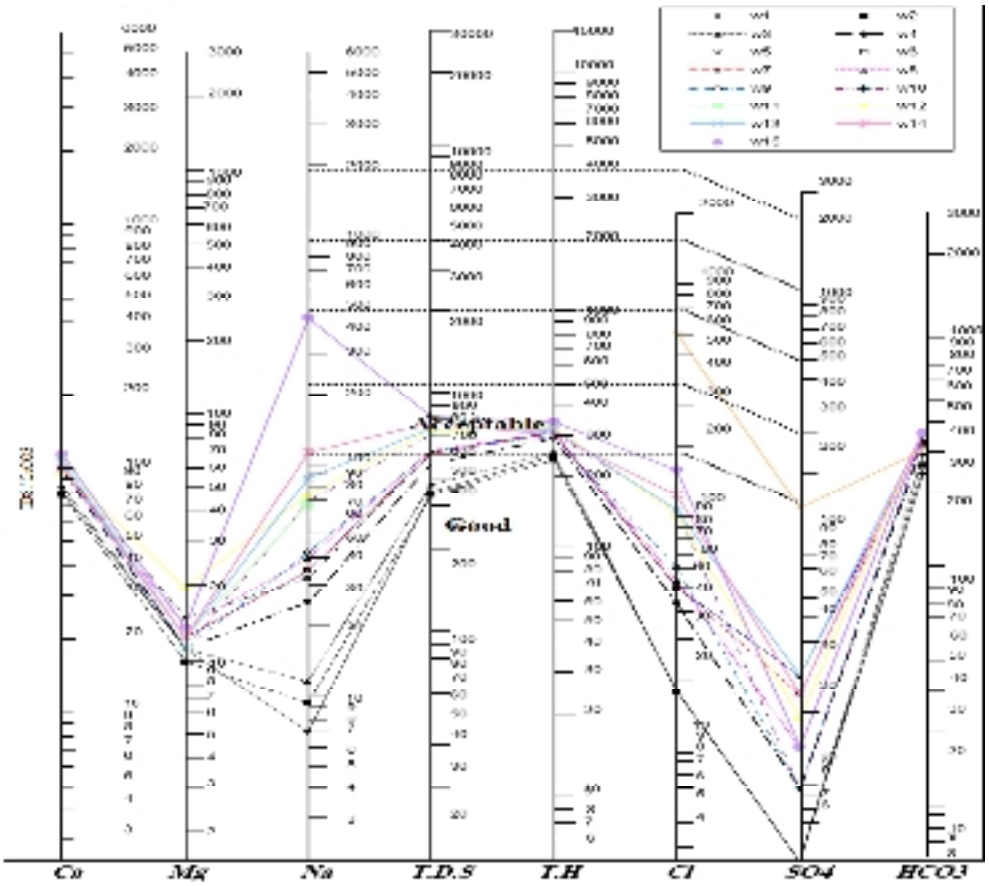

Fig. 3: Diagram Schuler for drinking water samples for evaluation

5. Assess the quality of the river water is used in agriculture:

The CD is used to determine the quality of the river water is used in agriculture (irrigation), the classification method Vlykaks (Wilcox, 1955) was used (Increasing the osmotic pressure). According to the classification of all the good Wilcox EC waters less than 250 micromhos cm and placed in C1S1, water well water in C2S2, C2S1, C1S2, C3S3 waters middle class and C3S2, C2S3, C1S3, C3S1, and the waters are unsuitable.

Of calcium in the water to increase water infiltration into the soil and irrigation water, the calcium content is higher, is more appropriate. Also there sodium in water, soil permeability increases (Alley, 2000). The results obtained (Table 3 and Fig. 4) more than 68% fall in the category C2-S1 Wilcox diagram (for agriculture) and only one point (which was statistically accounted for 6% of the sample and at station No. 15 (in the river to the sea), is suitable for agriculture water quality does not count.

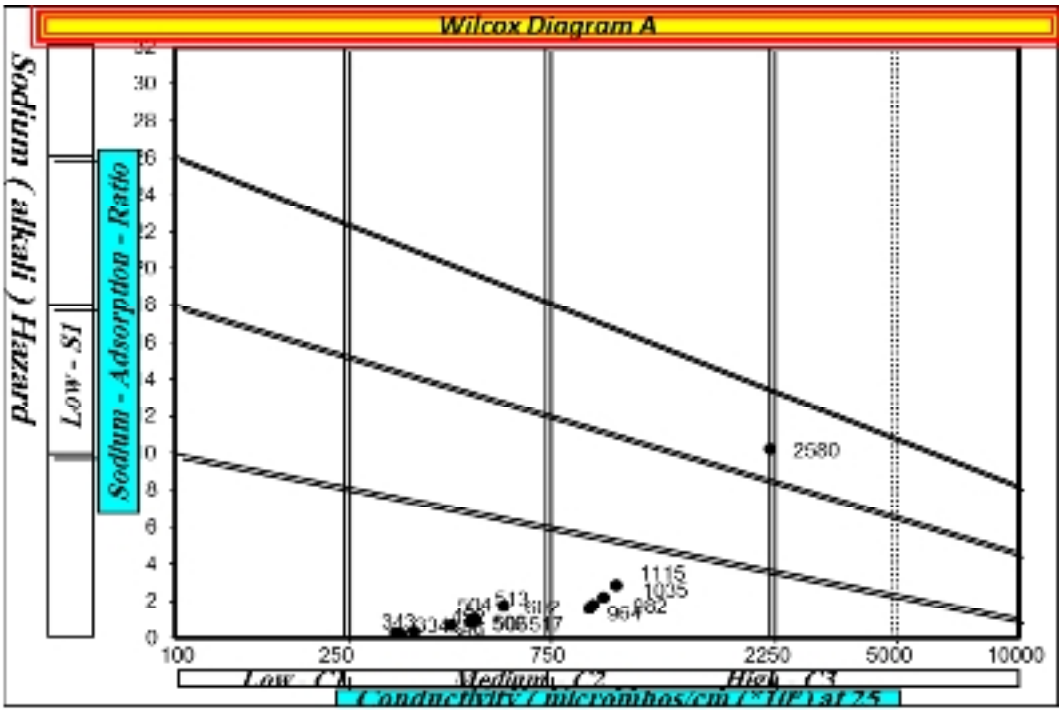

Fig. 4: Wilcox diagram for evaluation of water resources for agriculture

Table 3: Classification of water quality for agriculture

Percent of samples water	Type of water for agriculture	Category Water
68	A little salty - suitable for agriculture	C2-S1
26	Salty - usable for agriculture	C3-S1
6	Very Salty - unsuitable for agriculture	C4-S3

6. Conclusion

According to the results of the data, the increasing trend, evident in almost all measured parameters; Dissolved organic carbon (COD) in all parts of the Ontario Drinking Water Quality Standard 2002 (ODWS), and nitrate (No3-) in urban areas (Vice City, streams) due to increased sewage and hospital gives. The river's water level is quite difficult. According to the outcrops of carbonate units, type C is water Bykrbnath calcic and processes controlling chemical weathering of rocks and the river's water are evaporated. C is for drinking water, due to high levels of chloride, sulfate, dissolved organic carbon and water hardness, water from the river inappropriate but can be used to irrigate farmland.

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