Effects of Chemical Wastes on Drinking Water Quality, Case Study of Taleghan River, Iran

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Abstract

Taleghan water basin is located in north of Iran. The influence of chemical wastes on the quality of regional surface water has been taken in to consideration in this study. Accordingly, sampling was done from 6 local streams in the study area. In order to consider the effect of flow quantity on the amount of different parameters, sampling was done in four months (October 2008, January, April, and July in 2009). The concentrations of major anions and cations were determined. The chemical characteristics of water compositions on the basis of major ion concentrations were evaluated on a Schoeller and Piper diagram. Accordingly, the dominant type of water in these four months is considered to be Ca – HCO_3 (calcium – bicarbonate type). Regarding Schoeller diagram, despite relatively high concentration of calcium, the current status of local surface water is acceptable for drinking purposes. By commencing chemical excavation with designed capacity in near future, the chemicals will come in to contact with air and water resulting in dissolution, especially in surface water which, in turn, increases the concentration of heavy metals in surface water. Considering consequent uses of this water including drinking, irrigation, industrial, etc. precautions must be taken in to consideration.

Keywords: Surface Water Pollution, Chemical Wastes, Drinking Water, Taleghan River

1. Introduction

Locating in 150 kilometer of Tehran North West, Talegan region is a pretty high area in the heart of the Alborz Chain.

Naturally more than twenty small and big rivers and their branches form the surface water in Talegan region and their joining to the main Talegan River construct one of the main branches of Shahrood River as well as the agricultural water for Qazvin’s plain lands.

Despite increased awareness of the potential threats to the environment, there are many areas around the world where pollution from wastewater, agricultural activities is still taking place [1, 2, 3, 4, 5].

Effects of agricultural pesticides and chemical fertilizers Expansion of cities, towns and villages become more densely populated wastewater to increase production always impact environmental quality [6, 7, 8.9.10,11].

The location of Taleghan River in Iran is shown in figure 1.

The objective of this study is to investigate the possibility of adverse effects of wastewater around the mentioned study area on the surface water quality.

Fig. 1: Location map of Taleghan in Iran

2. Methods

This study comprises catchment of Taleghan River .Site visits and review of the existing data was the first step followed by identifying major source of pollution and collecting its qualitative parameters and data analysis.

Therefore site visits were made in order to recognize sampling stations.Wastewater entering the rivers were likely places. Accordingly, 6 point were defined as stations all around the study area .

Accordingly parameters like major Anions (bicarbonate, sulfate, chloride) and major cations (Na, K, Ca, Mg) were taken in to consideration.

In order to consider the effect of flow quantity on the amount of different parameters, sampling was done in sampling was done in four months October 2008, January, April, and July in 2009 when the local streams had the minimum and maximum flow rate respectively and one month in each season.

For sample collection, 1000 cc polyethylene bottles were rinsed three times with the river water before being filled. The water samples for analysis of metals were immediately acidified with 1% Merck quality nitric acid.

For analysis of anions, another bottle was filled in each station in the same manner but not acidified. Anion concentrations has been measured using HACH DR/2000 in the hydro chemical laboratory of Tehran University, cations also were measured there using ICP-MS according to EPA – 3005 method.

3. Results and discussion

The results of major anions and cations analysis of the samples collected in four months (October 2008, January, April, and July in 2009) are presented in Tables 1, 2, 3 and 4.

	UTM		Sulfate SO_4^{2-}	Bicarbonate HCO_3^-	Potassium K^+	Calcium Ca^{2+}	Magnesium Mg^{2+}	Sodium Na^+
Stations	**X**	**Y**	**mg / l**	**mg / l**	**M1.4g / l**	**mg / l**	**mg / l**	**mg / l**
S1	3610480	05059160	194.1	222	1.4	138.3	14.59	21.62
S2	3610927	05054325	207.5	183	2	88	37.69	21.16
S3	3610963	05052928	230.6	2007.4	2	27	41.34	20.7
S4	3610550	05050867	186.4	201.4	1.4	106.2	26.75	13.34
S5	3610215	05046380	235.5	170.08	2	122.2	47.42	41.17
S6	3610007	05044880	204.2	201.3	2	82.16	31.61	42.55

Table 1: Results of physical and chemical characteristics of surface water samples
(Sampling: October 2008)

	UTM		Sulfate SO_4^{2-}	Bicarbonate HCO_3^-	Potassium K^+	Calcium Ca^{2+}	Magnesium Mg^{2+}	Sodium Na^+
Stations	**X**	**Y**	**mg / l**	**mg / l**	**mg / l**	**mg / l**	**mg / l**	**mg / l**
S1	3610480	05059160	144.1	201.3	1.6	122.2	24.32	17.25
S2	3610927	05054325	240.5	189.1	1.2	140.3	24.32	14.49
S3	3610963	05052928	153.7	152.5	1.2	124.2	20.67	20.24
S4	3610550	05050867	144.1	219.6	1.2	104.2	30.4	19.78
S5	3610215	05046380	144.1	237.9	1.6	114.2	33.83	38.67
S6	3610007	05044880	96.06	231.8	1.2	92.18	44.99	40.25

Table 2: Results of physical and chemical characteristics of surface water samples
(Sampling: January 2009)

	UTM		Sulfate SO_4^{2-}	Bicarbonate HCO_3^-	Potassium K^+	Calcium Ca^{2+}	Magnesium Mg^{2+}	Sodium Na^+
Stations	**X**	**Y**	**mg / l**	**mg / l**	**mg / l**	**mg / l**	**mg / l**	**mg / l**
S1	3610480	05059160	221.1	163.2	0.4	74.1	21.39	9.87
S2	3610927	05054325	224.1	162	0.4	72.14	20.67	10.35
S3	3610963	05052928	299.9	156	0.4	64.12	18.84	11.27
S4	3610550	05050867	220.9	162	0.4	70.14	20.06	11.27
S5	3610215	05046380	258.7	168	0.4	64.12	14.59	16.79
S6	3610007	05044880	253.8	183	0.4	55.11	21.28	16.56

Table 3: Results of physical and chemical characteristics of surface water samples
(Sampling: April 2009)

	UTM		Sulfate SO_4^{2-}	Bicarbonate HCO_3^-	Potassium K^+	Calcium Ca^{2+}	Magnesium Mg^{2+}	Sodium Na^+
Stations	**X**	**Y**	**mg / l**	**mg / l**	**mg / l**	**mg / l**	**mg / l**	**mg / l**
S1	3610480	05059160	96.06	126	0.4	76.5	6.68	10.35
S2	3610927	05054325	98.9	126	0.4	82.16	2.43	10.35
S3	3610963	05052928	69.1	126	0.4	70.14	4.86	10.07
S4	3610550	05050867	53.1	132	0.4	71.14	1.82	11.5
S5	3610215	05046380	111.3	132	0.4	80.16	9.72	20.7
S6	3610007	05044880	111.3	132	0.4	80.16	9.72	20.7

Table 4: Results of physical and chemical characteristics of surface water samples
(Sampling: July 2009)

Comparison between the results of tables relating to collected samples October 2008, January, April, and July in 2009 Indicates that the change concentration of most parameters in Seasons the year, when the flow rate is in its maximum state or minimum .

3.1. Quality of waters

The chemical characteristics of water compositions on the basis of major ion concentrations were evaluated on a Schoeller and Piper diagram (Fig.2, 3, 4, 5, 6, 7, 8 & 9). By evaluating the concentration of major elements, it is seen that the dominant type of water in the region is considered to be Ca – HCO_3 (calcium – bicarbonate type). A strong convergence between the results in October 2008, January, April, and July in 2009 is also observed. Regarding Schoeller diagram, despite relatively high concentration of calcium, the current status of local surface water in four months is acceptable for drinking purposes.

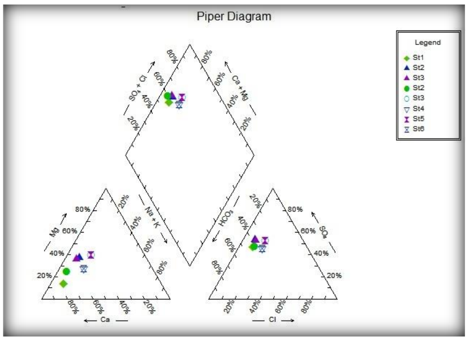

Fig. 2: Piper diagram showing the chemical compositions of surface water (October 2008)

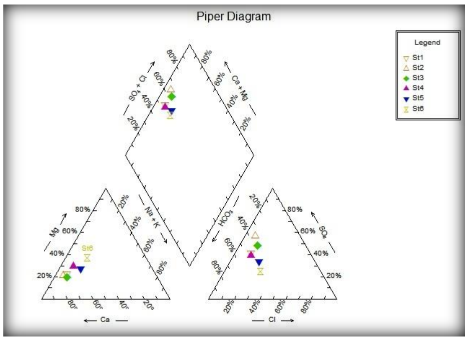

Fig. 3: Piper diagram showing the chemical compositions of surface water (January 2009)

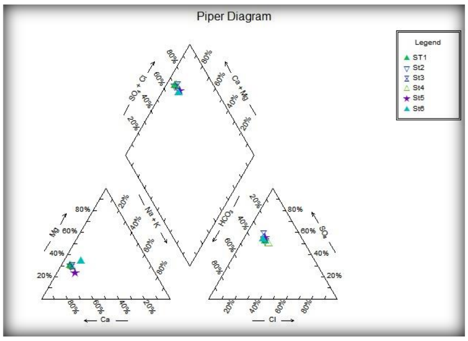

Fig. 4: Piper diagram showing the chemical compositions of surface water (April 2009)

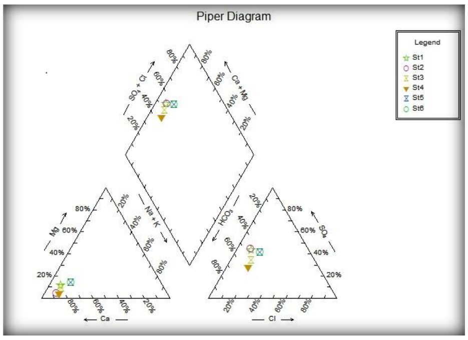

Fig 5: Piper diagram showing the chemical compositions of surface water (July 2009)

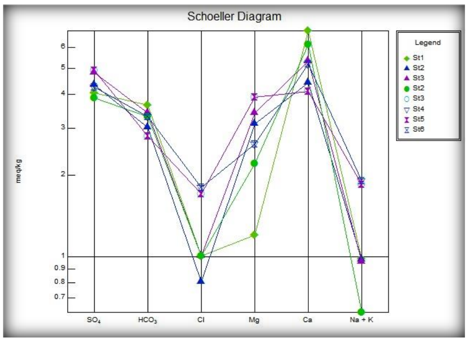

Fig 6: Chemical Analysis of surface water on Schoeller diagram (October 2008)

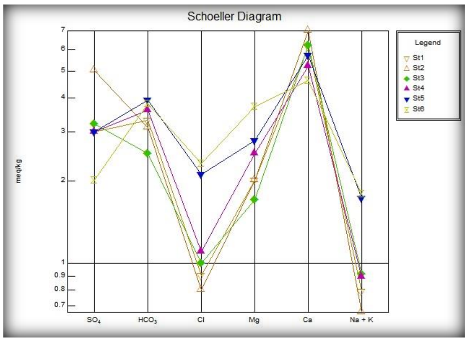

Fig. 7: Chemical Analysis of surface water on the Schoeller diagram (January 2009)

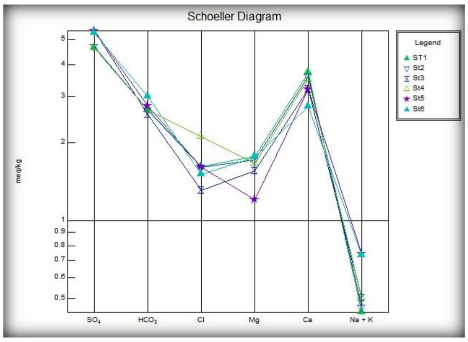

Fig. 8: Chemical Analysis of surface water on the Schoeller diagram (April 2009)

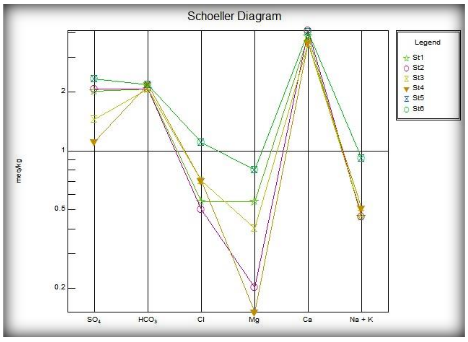

Fig. 9: Chemical Analysis of surface water on the Schoeller diagram (July 2009)

4. Conclusions

Regarding the piper diagram, the type of surface water in October, January, April and July samples is calcium-bicarbonate which is the typical water type in the study area. It should, therefore, be stated that the concentrations of the major anions and cations, are not still so high in the vicinity of ore bodies.

According to the results gained from the shoeller diagrams, the quality of water for drinking uses is also acceptable in all seasons.

On the other hand, the surface water of the area is used for purposes like drinking and irrigation potable without any treatment. Therefore precise monitoring of water resources of the region is very important considering the health of people and other organisms in downstream.

5. Acknowledgments

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6. References

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