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Original Article

A Continuous Monitoring of Quality and its Relation with the Optimum Management of Drainage Basins (A Case Study of The Catchment of Dez River in the Taleh Zang Upstream)

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ABSTRACT

The purpose of this study was to compare the quality of water in Dez River in Taleh Zang's hydrometric station with the various national and international standards for the water used for drinking and agriculture sector. The method employed for conducting the research was descriptive-cross sectional. To study the quality and quality monitoring the water in Dez River, 392 samples were collected and analyzed, and then the results obtained from chemical analyzing of the water resources in the region were studied and interpreted. The obtained results were studied and compared according to the WHO standard, Schoeller diagram and a number of tables and signs for determining the livestock drinking water quality. Most quality parameters have been of values within WHO allowable standard limits. Among all the quality variables studied, EC, TDS, pH, Ca, Mg, Na, So4 and Cl were within the standard limit and TH exceeded the limit. Regarding Schoeller diagram, all studied parameters were evaluated as being well oriented. Using the agricultural classification of water, the Dez River was evaluated as being in the C2-S1 class. Furthermore, the quality of the river's water is suitable for livestock and poultry's drinking and is not problematic.

Keywords: Dez River, Taleh Zang, SAR, Wilcox, Schoeller.

Introduction

Human beings need water with a favorable quality and quantity for their living and diversified activities. Throughout history, rivers have been one of the main resources for the consumable water for human beings and constitute a small portion of the waters available on the earth planet which is about 2%. Water is not found in the nature in pure forms. But it contains always a portion of salts in water essential for humans, while the exceeding of the allowable limits will endanger human beings health [3, 13]. Maintaining and optimum consuming of water is among the principle for the Sustainable development of each country. The water in the flowing surface or the rivers are among the most important water resources which play a very important role in providing the needed water for various activities such as agriculture, industry, drinking and power generating. Many planning programs for water resources in different countries is based on the potential resources for the surface water and the first step for knowing the water is to study the parameters for drinking water. To be informed about these parameters and the quality of water resources and to produce the needed information, monitoring must be carried out. The quality monitoring of water, not only results in improving the water's quality, but also it is of economic value in the process of producing clean water, and is an important factor in reducing the producing expenses and water treatment. Enough and high quality water is essential for humans' life continuity. Health promotion and protection of the environment is dependent on providing clean water. In developing countries, lack of proper implementation and true monitoring of regulations and decentralized growth of industry has resulted in the ever increasing pollution of the rivers. In fact the pollution in the rivers' water could be seen as an indicator of environmental pollution. Because rivers are the only water sources that take a long path through cities, villages, industrial and agricultural regions, and may have been polluted by various type of polluters. Many different purposes could be followed in terms of consuming water; water may not be suitable for drinking but may be recognized as beneficial for agriculture. Thus, there are different types of classification in this regard. There are various compounds in waters which are effective in the chemical a physical quality of the water. Chemical analyses of numerous water samples provide us with ample data which must be analyzed aimed at a target. Because studying the water quality could be very beneficial. Additionally, administrative instructions are essential for utilizing the experts for reviewing the quality of the river's water. Nowadays, the quality specifications of water is one of the factors which has been considered as essential in managing the resources and the related planning programs (Khadam and Kaluarachchi 2006). The health assessment of watersheds and making managerial changes in that regard has been deemed as necessary however has been less noticed. By reviewing the ground water's quality index in the county Karnataka expressed in these waters, mg, Cl, TDS was high of water "hard".

Came to a conclusion in their study of physic-chemical properties of surface water in the River Jia-Bharali that the cat ion concentration in the studied river is in this form: Ca>Mg>Na>k and the concentration of the anions follows the form of Hco3 > Cl>So_4> PO_4> No_3 in both the hot and cold seasons [5]. Identified in their research on the chemical quality of water in several rivers in India that the pH variations have been 7 to 10, calcium from 80 to 200 milligrams per liter, magnesium from 20 to 320 milligrams per liter, and the total hardness of water varies from 100 to 520 milligrams/ liter [8]. Thus the water quality in this river is not suitable. Saksena [10] by studying the physical and chemical parameters of the Chambel River's water in India concluded that the EC variations are from 145.6 to 880 milligrams/ lit, TDS from 260 to 500 milligrams/ liter, Na from 14.3 to 54.4 milligram/ lit, SO4 from 3.50 to 45 milligrams/ lit. Therefore, since the water is polluted, it is only suitable for animals' drinking.

Jothivenkatachalam [2] stated that there is a good linear correlation between EC, TDs, TH, Ca, Mg and Cl. The correlation coefficients for the obtained relations are more than 0.68. The purpose of this article is to study three quality parameters of TDS, EC, TH and SAR in the Dez River with the WHO standard.

Material and Methods

Dez river is located in the south of Iran and reginated which originates from the Central Zagros Mountains (located in the south of Lorestan Province, Alogoodarz) and has played a significant role in the Northen Khouzestan economy for several millenniums. Dez River is a combination of several rivers. Passing through the Southern Lorestan and Northern Khouzestan and cities like Aligoodarz, Andimeshk, Shoushtar and Shoush joins the Karoon River in region called Bandeghir in the south of Shoushtar. In figure 1 the satellite image of the Dez Dam reservoir has been presented near. The Dez dam is located so km far from Dezful city**.**

Figure 1. The Region of study

In Figure 2 a view of waterways in the catchment is demonstrated.

Figure 2. A view of waterways in Dez Catchment

Results

The parameters taken include pH, TDS, some cations and anions .According to the relations and formulas available in the standard method of water and waste water [2002] and the affairs related to laboratories for water, soil, and sediment.

Discussions

Data Normality Test

The deputy basic studies and the inclusive programs for water resources in Khuzestan was used as the trustee in collecting the data have been determined. In table 1, the statistical analysis for parameters TDS, EC, TH, SAR has been presented.

Table 1. The results obtained from the chemical analyses for the surface water samples

parameter		No. Samples	Maximum	Minimum	average	SD	Coefficient of variation
EC(μmhos/c)		336	8.50	300.00	544.72	137.12	0.25
pH		336	895.00	7.10	7.99	0.23	0.03
TDS mg/l		335	6753.00	170.00	344.37	90.51	0.26
HCO_3^-	meq/l	336	4.33	1.30	2.64	0.52	0.52
CO_3^{2-}	meq/l	329	0.80	0.00	0.01	0.06	0.06
Cl^-	meq/l	336	3.95	0.05	1.73	0.86	0.49
SO_4^{2-}	meq/l	336	4.00	0.10	1.14	0.54	0.47
Na^+	meq/l	336	3.95	0.28	1.71	0.82	0.48
K^+	meq/l	336	0.11	0.00	0.03	0.02	0.76
Ca^{2+}	meq/l	336	3.10	1.00	2.56	0.53	0.33
Mg^{2+}	meq/l	336	4.90	0.15	1.20	0.40	0.21
%Na		336	49.38	9.04	29.71	8.53	0.29
TH(mg/l)		336	335.00	110.00	188.16	36.04	0.19
S.A.R		336	2.71	0.21	1.23	0.54	0.44

In this regard, the diagram p-p was utilized. Due to much of the data, the results obtained from TDS, EC, SAR are only pointed out here.

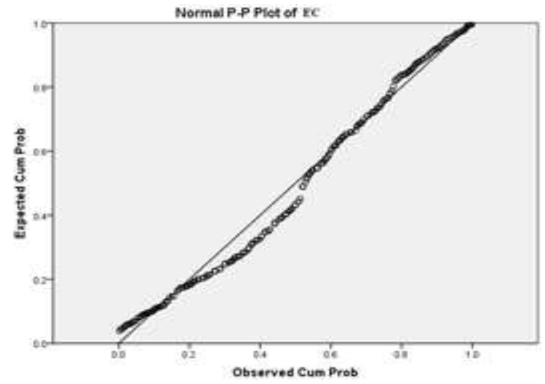

Figure 3. The EC data normality test

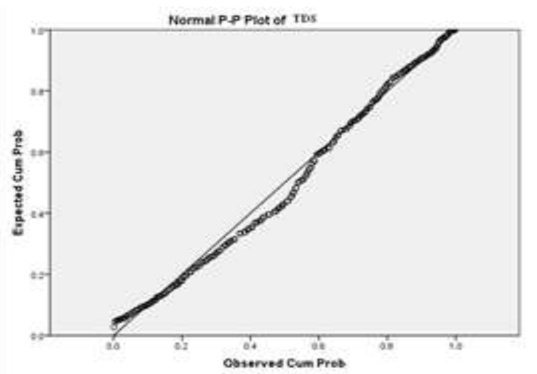

Figure 4. The TDS data normality test

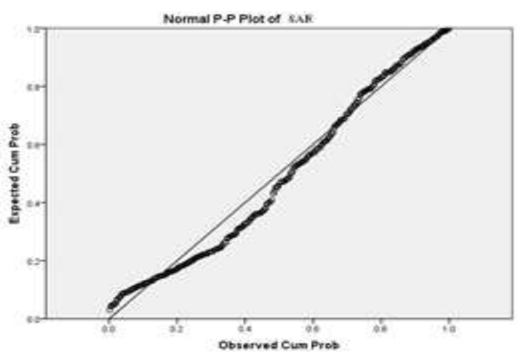

Figure 4. The TDS data normality test

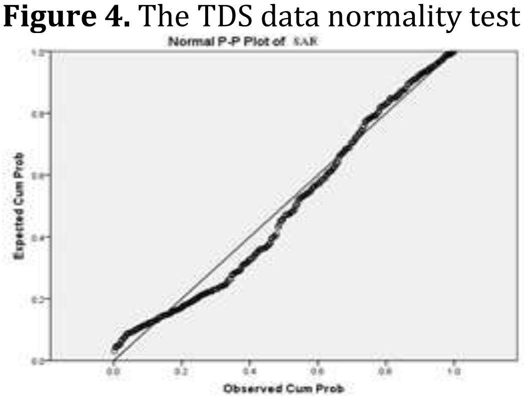

Figure 5. SAR data normality test

As it is shown, because a major part of points are located over the first quarter's bisector, the data follows almost the normal distribution.

2-3- Ionic charge balance error

Prior to analyzing the data related to water quality, the accuracy and correctness of the chemical data is determined by calculating Ionic charge balance error or reaction error, according to the following relation:

$$RE = \frac{\sum Cations - \sum Anions}{\sum(Cations + Anions)} \times 100$$

(1)

If the value is more than 5, then the accuracy and correctness of the data is questionable. By calculating the total cat ions and anions and placing them in the above relation, the ionic charge balance error value was obtained 0.078. Thus, the correctness and validity of the data is verified and the quality and the correctness of the data are verified. The mean total amount of total dissolved solids has been equal to 344.37 mg/lit. The minimum value of TDS was 175 mg/liter which has been 65% lower than the favorable maximum by WHO standard. By using SPSS 18 software the statistical analysis was conducted between TDS and total cat ions which the results have been presented in table 2 and table 3.

Table 2. A summary of statistical analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.915[a]	.837	.837	36.63273

Table 3. Anova test for the correlation between TDS and total cations

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2309385.306	1	2309385.306	1720.908	.000[a]
	Residual	449555.685	335	1341.957		
	Total	2758940.991	336			

According to the results obtained from the above mentioned software, the following relation is achieved:

$$TDS = 60.27 Sum\ Cations + 12.699 \quad R^2 = 0.915 \tag{2}$$

Additionally, based on the statistical analysis between TDS and total anions, the following relation is achieved:

$$\mathbf{TDS = 60.814 Sum\ Anions + 8.375 \quad R^2 = 0.912} \tag{3}$$

By using SPSS software the relation between TDS parameter and water discharge was made in a significant level which leads to the results obtained in table 4.

Table 4. Correlation test between water discharge and TDS

t-Test: Two-Sample Assuming Equal Variances

DIS	*TDS*	
263.3905	314.7303	Mean
81742.41	4601.606	Variance
380	393	Observations
	42521.66	Pooled Variance
	0	Hypothesized Mean Difference
	771	df
	3.46057	t Stat
	0.000284	P(T<=t) one-tail
	1.646832	t Critical one-tail
	0.000569	P(T<=t) two-tail
	1.963046	t Critical two-tail

As it is seen, there is significant relation between the water discharge and TDS. i.e. by changing water's discharge, TDS changes as well. By using SPSS software, Mann-Kendall test, Spearman test and Pearson test was analyzed between two variables for total dissolved solids and conductivity was analyzed which the results are presented in table 5 and 6.

Table 5. The Mann-Kendall and Spearman test between TDS and EC

			EC	TDS
Kendall's tau_b	EC	Correlation Coefficient	1.000	.799**
		Sig. (2-tailed)		.000
		N	338	337
	TDS	Correlation Coefficient	.799**	1.000
		Sig. (2-tailed)	.000	
		N	337	337
Spearman's rho	EC	Correlation Coefficient	1.000	.937**
		Sig. (2-tailed)		.000
		N	338	337
	TDS	Correlation Coefficient	.937**	1.000
		Sig. (2-tailed)	.000	
		N	337	337

**. Correlation is significant at the 0.01 level (2-tailed).

Table 6. Pearson test between TDS and EC

		EC	TDS
EC	Pearson Correlation	1	.933**
	Sig. (2-tailed)		.000
	N	338	337
TDS	Pearson Correlation	.933**	1
	Sig. (2-tailed)	.000	
	N	337	337

Based on these tables, the correlation coefficient between the two parameters by means of Pearson's method is more robust than the other tests.

The average EC parameter is about 544.72 µmhos/ cm. The box diagram related to parameter EC of the water in Dez River has been presented in one of the hydrometric station in Taleh Zang in the figure 6.

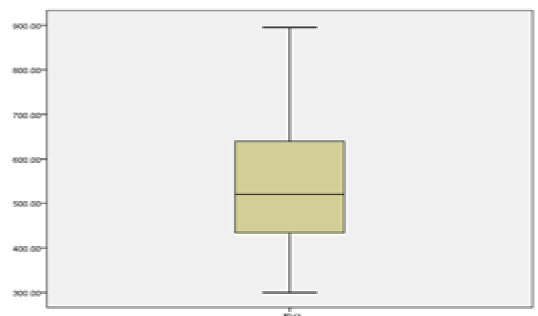

Figure 6. The box diagram of parameter EC

As it could be seen, none of the data from the total 392 data related to EC is out of standard which shows the appropriateness of the water quality in term of EC.

The Dez River's water within the Taleh Zang hydro station is in C_2 limits. The average total hardness $CaCO_3$ parameter is 188.16 mg/liter. By comparing to the WHO standard, it could be figured out that the quality of Dez River within the Taleh Zang framework is beyond the allowed level of the standard. Dez River's water in the hydrometric station in Taleh Zang virtually it is considered as hard waters. Based on the standard by WHO the quality of Dez River is not appropriate within Taleh Zang.

In figure 7, the box diagram for the total hardness parameter of the river's water has been shown in the hydrometric station in Taleh Zang.

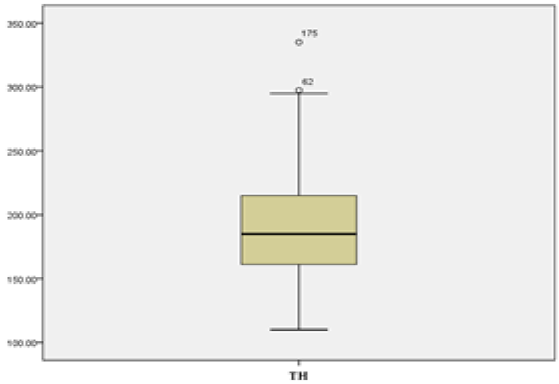

Figure 7. The total hardness box diagrams (TH) of Dez in Taleh Zang station

By using SPSS, the correlation between parameter TH and Calcium was held, which the best fitness function according to the correlation coefficient and cubic has been achieved.

$$TH = -3.058 + 0.072Ca - (2.455 \times 10^{-7})Ca^3 \quad R^2 = 0.741$$
(4)

The average absorption proportion of Na is 1.3. By means of SPSS the nonlinear regression among SAR and four parameters of Sodium, chloride, total dissolved solids and conductivity was established.

$$R^2 = 0.48 + 0.072\,Ca - (3.802 \times 10^{-6})EC - 0.001TDS \quad R^2 = 0.595$$
(5)

In terms of sodium absorption proportion, the quality of water within Taleh Zang is at the "excellent level" and according to the table 1 is within the framework of "low levels of alkaline risk" or S_1. Reihan and Allam [7] obtained the average sodium absorption proportion of sodium at 15.29 mg/ liter, which is more than that of Dez River. The reason for this could be found in low sodium value in Dez River Water.

According to the Parameter, it could be said that the water of Dez River within the Taleh Zang hydrometric station lacks any problems. Because the average TDS is lower than that of worldwide standard. Sharifinia [11] obtained the average value of parameter TDS in the lake reservoir of Zarivar in Iran at 201.6 mg/ liter which has a more favorable condition compared to the water of Dez river in Taleh Zang hydrometric station. The quality of water in was set at a better position by using parameters EC within the limits of Taleh Zang, and is suitable for human's drinking. Because 67% is lower than the allowable amount of WHO's allowable rates. The minimum and maximum parameter EC of the water in the Tatva city was 188 and 684 µm/cm respectively by Doormishi et al [2013], which has been by far more than the minimum and maximum values of water in Dezz River, thus the quality of water in Dez River is in a worse situation. Jotion Katakalam et al (2010) achieved the average total hardness at 1351 mg/liter which is by far much higher compared to total water hardness of Dez River. In terms of sodium absorption, the quality of the water of Dez river within Taleh Zang is at the excellent level and according to table 3 is located within the "danger of Alkaline becoming" or S1 are placed in the rating C2S1 and categorized in terms of agriculture. The Reihan, Alam [7] obtained the average sodium proportion at 15.29 mg/ liter which was higher than that of Dez River. The related reason could be known as because of lower sodium values in Dez River.

Conclusion

It could be concluded that the quality of water in Dez River in the Taleh Zang hydrometer's station for human and livestock drinking and generally it bears no problems and it could be useful. Even we can make comprehensive planning for Livestock and Poultry according to the appropriateness of the quality of Dez River water. In addition, the quality of water in agriculture sector is rather appropriate as well.

References

Bujar, B. H., Durmishi, A. A., Ismaili R. M., Shabani, A. (2013). Physico-Chemical Quality of Drinking Water in The Autumn Season of Tetova City, Macedonia, Universal Journal of Environmental Research and TechnologyAll Rights Reserved Euresian Publication © 2013 eISSN 2249 0256.

Jothivenkatachalam, K., Nithya, A,. Chandra, S.M. (2010). Correlation analysis of drinking water quality in and around perur block of coimbatore district, tamil nadu, INDIA, http://www.rasayanjournal.com, Vol.3, No.4, 649-654,ISSN: 0974-1496.

Kawamura, S.1991. Integrated design of water treatment facilities. 1st ed. New York: John Wiley and Sons.

Khadam, I.M., Kaluarachchi, J.J. (2006). Water quality modeling under hydrologic variability and parameter uncertainty using erosion-scaled export coefficients. Journal of Hydrology, 330: 354-367.

Khound, N.J. Phukon, P. Bhattacharyya. K.G. (2012). Physico-chemical studies on surface water quality in the Jia-Bharali River, Scholars Research Library Archives of Applied Science Research, 2012, 4 (2):1169-1174.

Nayan, J., Khound, P., Krishna, P., Bhattacharyya, G. (2012). Physico-chemical studies on surface water quality in the Jia-Bharali River Basin, North Brahmaputra Plain, India, Archives of Applied Science Research, 2012, 4 (2):1169-1174, ISSN 0975-508X.

Raihan, F., Alam, J. B. (2008). ASSESSMENT OF GROUNDWATER QUALITY IN SUNAMGANJ OF BANGLADESH, Iran. J. Environ. Health. Sci. Eng., 2008, Vol. 5, No. 3, pp. 155-166.

Rajeev, P., Surendranathan, A. O., Murthy, Ch.S.N. (2012). Corrosion mitigation of the oil well steels using organic inhibitors -A review. J. Mater. Environ. Sci. 3 (5) (2012) 856-869.

Ramakrishnaiah, C.R., Sadashivalah, C., Ranganna, G. (2009). Assessment of water quality index for the groundwater in TumkurTaluk, Karnataka State. Indian J.Chem., 6: 523-530.

Saksena, D.N R.K., Rao, R.J. (2008). Water quality and pollution status of Chambal river in National Chambal sanctuary, Madhya Pradesh, Journal of Environmental Biology. www. jeb.co.in.

Sharifinia, M., Ramezanpour, Z., Imanpour, J., Mahmoudifardi, A., Rahmani, T. (2013). Water quality assessment of the Zarivar Lake using physico-chemical parameters and NSF- WQI indicator, Kurdistan Province-Iran, International journal of Advanced Biological and Biomedical Research ISSN: 2322 - 4827, Volume 1, Issue 3, 2013: 302-312 Available online at http://www.ijabbr.com

Standard methods for the examination of water and wastewater, 20th –Edition, 2001.

Wachinski, AM., Water quality. 3rd ed. AWWA; 2003.

WHO. World Health Organization. (2004). Guidelines for Drinking Water Quality, 3rd Edition, Geneva.

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