Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 3 Spl Issue III 2014: 62-68
©2014 Academy for Environment and Life Sciences, India
Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
Global Impact Factor 0.533
Universal Impact Factor 0.9804

Full Length Article

Evaluation of Dez River Corrosion and Deposition amount in the range of Dez – Bamdezh

Siamak Farokhzadeh[1], Mahmoud Shafai Bajestan[2], Shahab Moradi[3], Mohamadali Hadian-Amri[4]
1, 3 Department of Civil – River Engineering, Jondi Shapur Institute of Technology, Dezful.
Email: Siamak_Farokhzad65@yahoo.com
2 –Faculty of water sciences, Shahid Chamran University
4 – University of Mazandaran, Department of Watershed Management Engineering and University of Vienna. Dep.of Geography and Reginal Research

ABSTRACT
Water corrosion and deposition is one of the factors to present the problem on quality management of water resources specially rivers. To control these problems, there is a need to have a regulated and exact planning. In this essay, Langelier and Rysnar's indexes were used during 2002 – 2012 to study the measurement of corrosion and deposition of Karoon River in range of Dez – Bamdezh. The results show the amount of Langelier indexes in different stations are almost 0.18 – 1.13. The Rysnar's indexes in Dez station is about 6.9 – 7.4 that is almost corrosive and a little sedimentary and it is about 5.8 – 6.1 for Bamdezh station which shows that Karoon river water in this range is sedimentary and a little corrosive.
Key words: deposition, corrosion, Langelier and Rysnar's indexes, Karoon River

Received 12.04.2014 Revised 11.05.2014 Accepted 19.06. 2014

INTRODUCTION

Today, the amount of water with suitable quality and quantity is decreasing according to extending the cities crowd daily and also the development of factories and industries. So, to cover the needed water in urban, industrial and agricultural department with good quality, we cannot take a look to operation of the water resources but the quality of these resources and the correct way of their usage must be paid attention [5].

Water corrosion and deposition is one of the quality management problems in water resources especially in rivers. Corrosion and deposition can make problems in cross range in rivers such as the bridges legs, hatches, pumps, water transferring canals and so on. Also in irrigation systems in addition to financial damages because of damaging the installation, the products caused by corrosion heavy metals like lead, copper, chromium and cadmium enter to water that endanger the consumers' health [1]. Mahvi and Eslami [4] have studied the quality of water resources in Zanjan (a city in Iran) for corrosion and deposition, and the results based on Langelier and Rysnar's indexes have shown that 53.51 % of the samples belong to corrosive and 7.45 % belong to sedimentation . Savari and Jafarzadeh (2008) have estimated the drinking water in Ahvaz and the results have shown that the water corrosion was restricted to average and without sedimentation [7]. Zare Abyaneh and Kazemi (2008)have studied the corrosion and deposition in underground water resources in Dasht-e-Bahar in Hamedan and the results of this research have shown that the amount of the corrosion and deposition in 64.25 % of underground water. Samples is in low level according to Langelier'sview point. From the Rysnar's view point, 85.2% of the water samples have the low ability of corrosion and deposition [9]. Moazed and Hamze (2010) have studied the amount of corrosion and deposition of Karoon River from Shushtar to Ahvaz. The results have shown that Langelier indexes amount is about 0.3 to 0.4 and for Rysnar index it is about 7 which is almost corrosion and deposition in Karoon river in this period. Moradi et.al (2012) have used Langelier and Rysnar indexes to study the deposition and corrosion amount of Tajan River from Aliabad to Rigcheshmeh during 2002 to 2011. The results have shown thet the Langelier index amount is about 0.4 to 0.7 in different stations. Rysnar index amount is about 6.8 to 7.1 in Aliabad and Rigcheshmeh stations

and 6.6 in Soleimantangeh station which shows that Tajan river water is corrosive and a little sedimentation [6].

Water deposition caused to make sediment layers inside the transferring pipes during the time which caused to reduce the water transferring systems output. So, it is necessary to have and exact planning to control these problems to make it possible to reduce their risk amount. Corrosion occurs because of electrochemical, physical, chemical and biological factors and the factors like alkalinity, hardship, solved gasses existence, temperature and PH are some of the most important and effective factors in it [2]. Kind and amount of sediment are affected by the factors such as the water quality, the source of water providing, the quality of additives to water, PH, EC, density and the kinds of salt, temperature, water currency speed and microbiological factors [2] in order to evaluate the water corrosion and deposition situation, various methods are used like the indexes of corrosion and stability and also Koopen and Marbel test. The saturation indexes which usually have the most application in water industry to define the corrosion and deposition of water, include Langelier indexes (LI), Rysnar resistance index (RI) and also calcium carbonate resistance test (Marbel) [3].

MATERIAL AND METHODS

Introducing the study region

Dez River is one of the most watery rivers in Khuzestan province that originates from Zagros Mountains. Dez water-shed basin is about 17430 square kilometers with the average slope of 0.4 percent. This basin in located in geographical features from 48° 9' to 50° 18' of eastern longitude and from 31° 35' to 34° 5' the northern latitude. The mentioned river passes through the city of Dezfoul and after running 415 kilometers it joins Karoon River. Figure (1) Geographical location of Dez and Bamdezh stations on river study is shown.

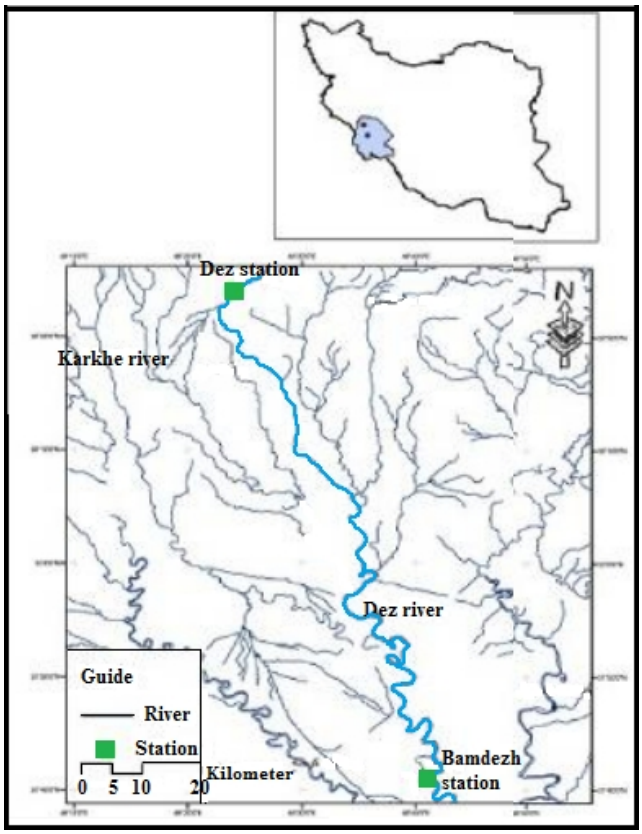


Figure (1) Geographical location of Dez and Bamdezh stations

One of the most common methods to measure the amount of water corrosion and deposition is to use the Langelier and Rysnar indexes. These indexes are expressed as follow [8].

Langelier index = pHmeasured – pHsat(1)

Rysnar index = 2*pHsat – pHmeasured (2)

In this "PH measured" is the real amount of water PH which is measured and "PHsat" is the PH amount for saturated calcium carbonate (CaCo3) which is gained from formulates(3):

$$PH_{sat} = -\log\left[\frac{K_2 \times \gamma_{Ca^{+2}}[Ca^{+2}] \times \gamma_{HCo_3^-}[HCo_3^-]}{K_{sp}}\right] (3)$$

In this, K2 and Ksp are carbonate balance coefficients and dependent on temperature which are calculated paying attention to density and solution coefficient of carbonate and the water temperature from the standard existed tables. Ca^{2+} and HCo^{3-} are activity coefficients in order which are gain from formulate (4):

$$\log \gamma_{HCo_3^-} = -\frac{0.5\,(Z_i)^2 \times \alpha^{\frac{1}{2}}}{1+\alpha^{\frac{1}{2}}} (4)$$

In which, Zi is the amount of the desired Ion capacity and α is the dependent amount to the measure of solved material in water which is calculated from the formulated (5) and (6):

$$\alpha = (2.5 \times 10^{-5}).TDS(gr/cm^3) (5)$$

$$\alpha = (1.6 \times 10^{-5}).EC(\mu^{\frac{s}{cm}}) (6)$$

In the mentioned formula, TDs is the amount of solid materials solved in water based on (gr/cm3) and EC is also water hydraulic guide based on ($\mu s/cm$). Also to define PHsat, the charts and tables of references existed in standard books, can be used and final out this amount directly [4].

In calculating the Langelier index, 3 phases can be occurred [4]:

a) If Langelier index (LI) in bigger than 0: LI>0 then water is over saturated and wills to make calcium carbonate layer (it is sedimentating).
b) If Langelier index (LI) is smaller than 0: LI<0 then water is non-saturated and wills to solve the calcium carbonate (it is corrosive).
c) If LI=0, water is stable and neutral (willing to deposition and corrosive is very low).

The important thing is that the Longelier index is only used for calcium carbonate deposition in the environment with low TDs, also this index is more used in system with low speed water current. In calculating the Rysnar index, 4 phases may occur whose results have presented in table (1):

Table (1) results of Rysnar index calculated

Rysnar index (RI)	Water status
RI < 5.5	High deposition
5.5 < RI < 6.2	Relatively corrosive and a little deposition
6.2 < RI < 6.8	Neither corrosive nor deposition
6.8 < RI < 8.5	Relatively deposition and a little corrosive
8.5 < RI	High corrosion

To indicate the amount of corrosion and deposition the Dez water from the distance from Dez to Bamdezh, the quality data of two stationsof Dez and Bamdezh built around Dez river bound, are used.

The statistics related to mention station got from Khuzestan water and electricity organization, is related to the years 2001to 2012. The related data includes temperature, water chemical parameters such as calcium and Bicarbonate, hardness, the total of solution solids (TDs), electrical guide (EC) and acidity (PH) which are done to in identify Langelier and Rysnar index in different stations using them. A sample of calculated result for Bamdezh station in 2011 is presented in table (2).

Table (2) a sample of calculated Langelier and Rysnar index for Bamdezh station in 2011

month	Dama	Ec	PH	HCO3(mol/l)	Ca(mol/l)	μ	γ(ca)	γ(HCO3)	PHsat	)LI(	)RI(
march	23	1505	7.4	0.003	0.008	0.024	0.539	0.857	6.658	0.742	5.916
April	21	1225	7.2	0.001	0.004	0.020	0.568	0.868	7.535	-0.335	7.870
may	26	1073	8.0	0.003	0.006	0.017	0.587	0.875	6.769	1.231	5.538
June	27	1082	7.5	0.003	0.007	0.017	0.585	0.875	6.745	0.755	5.991
July	30	1938	8.1	0.002	0.009	0.031	0.502	0.842	6.628	1.472	5.156
august	29	1910	7.1	0.004	0.011	0.031	0.504	0.843	6.330	0.770	5.561
September	27	2020	7.3	0.004	0.009	0.032	0.496	0.839	6.539	0.761	5.777
October	24	1554	7.6	0.003	0.008	0.025	0.534	0.855	6.622	0.978	5.644
November	17	1190	7.4	0.003	0.006	0.019	0.572	0.870	6.966	0.434	6.531
December	15	1421	7.5	0.003	0.006	0.023	0.547	0.860	6.938	0.562	6.376
January	16	1225	7.1	0.003	0.006	0.020	0.568	0.868	7.035	0.065	6.969
February	19	1642	7.9	0.003	0.007	0.026	0.526	0.852	6.789	1.111	5.677

For calculated indexes in designed stations, some charts have been drawn to show these indexes changes in different months from 2002 to 2012 (figure 2 to 23). The gained results have shown that the average amount for Langelier index include significant changes about 0.18 to 1.13 from 2002 to 2012 in mention stations. The amount of Rysnar index in Dez station is about 6.9 to 7.4 and for Bamdezh it is about 5.8 to 6.1 that indicates that Dez river water is almost corrosion and a little sedimentary in Dez station and almost sedimentary and a little corrosion in Bamdezh station.

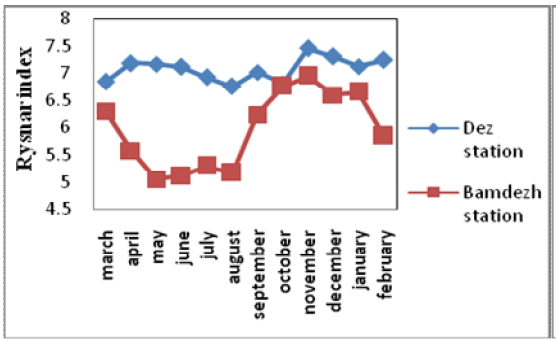


Figure (2) Rysnar index for 2 stations in 2002

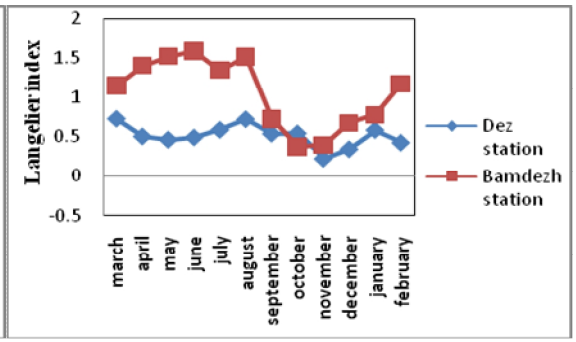


Figure (3) Langelier index for 2 stations in 2002

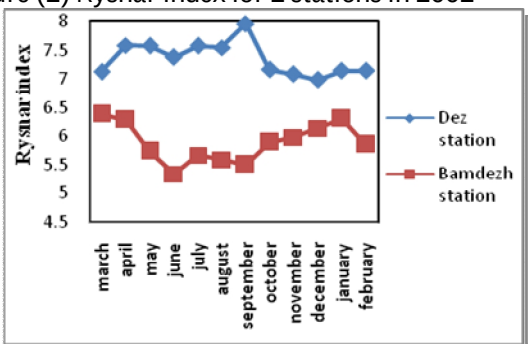


Figure (4) Rysnar index for 2 stations in 2003

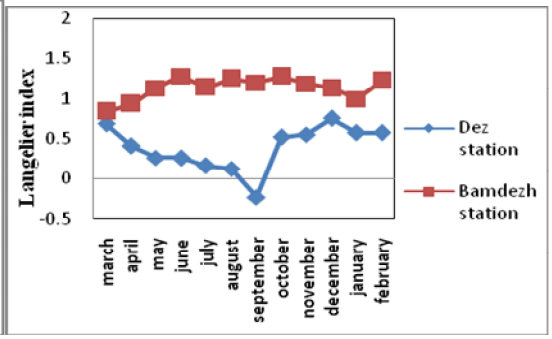


Figure (5) Langelier index for 2 stations in 2003

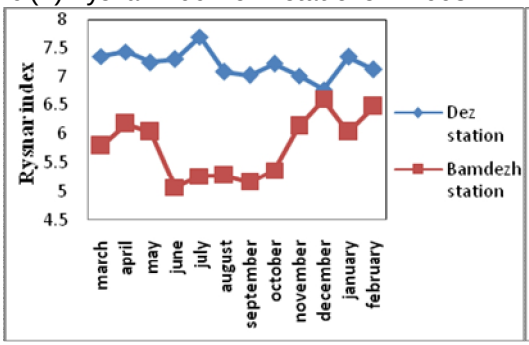


Figure (6) Rysnar index for 2 stations in 2004

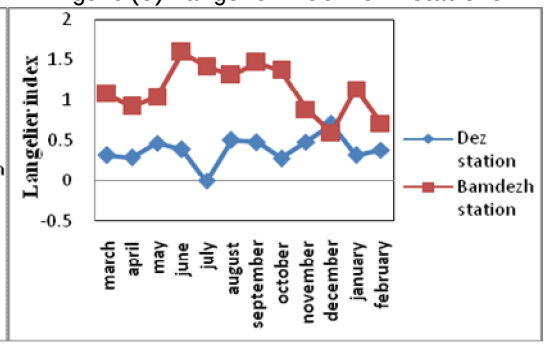


Figure (7) Langelier index for 2 stations in 2004

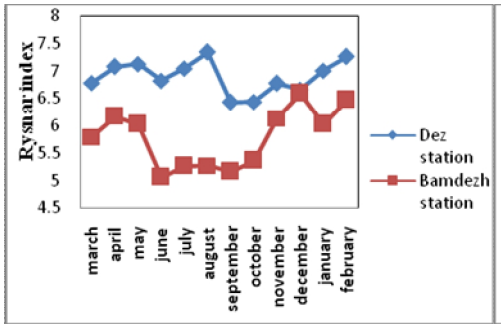


Figure (8) Rysnar index for 2 stations in 2005

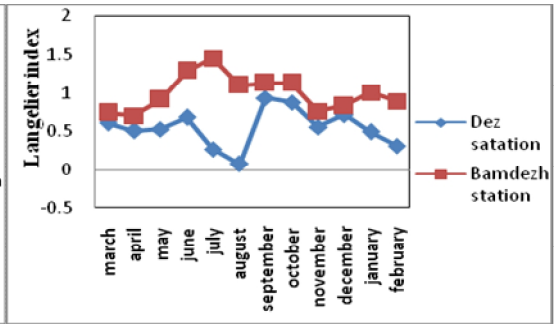


Figure (9) Langelier index for 2 stations in 2005

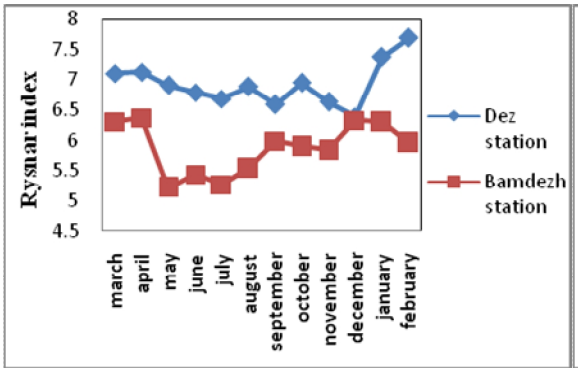


Figure (10) Rysnar index for 2 stations in 2006

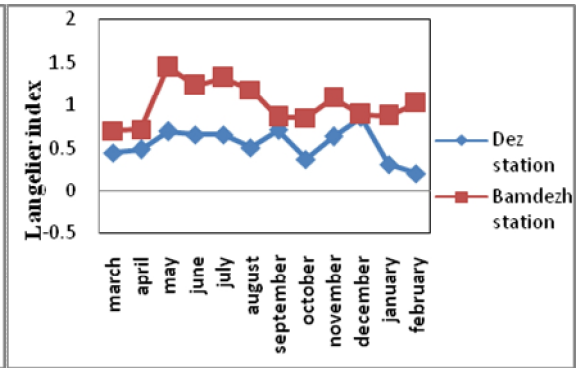


Figure (11) Langelier index for 2 stations in 2006

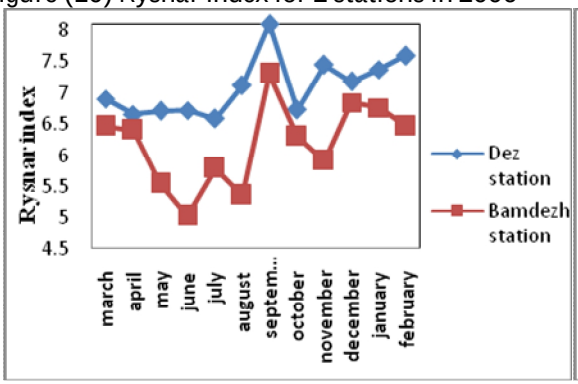


Figure (12) Rysnar index for 2 stations in 2007

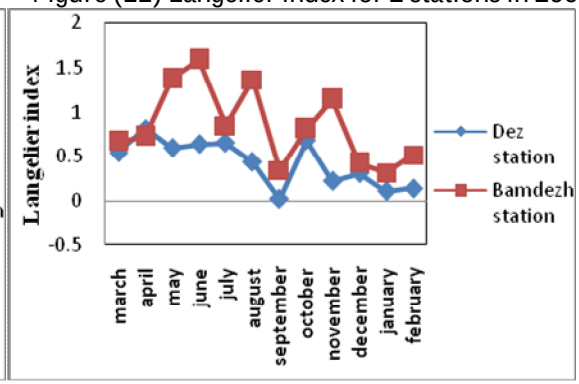


Figure (13) Langelier index for 2 stations in 2007

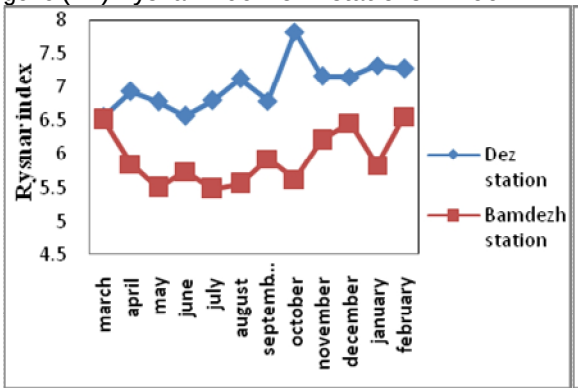


Figure (14) Rysnar index for 2 stations in 2008

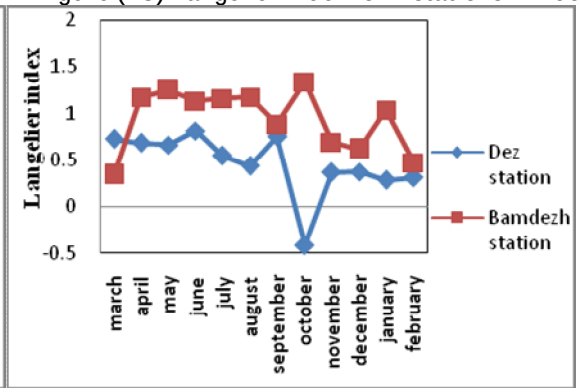


Figure (15) Langelier index for 2 stations in 2008

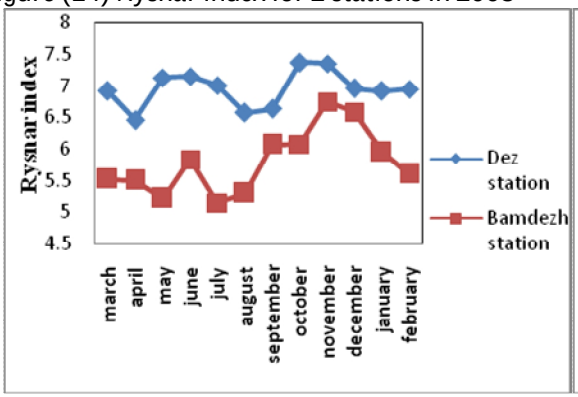


Figure (16) Rysnar index for 2 stations in 2009

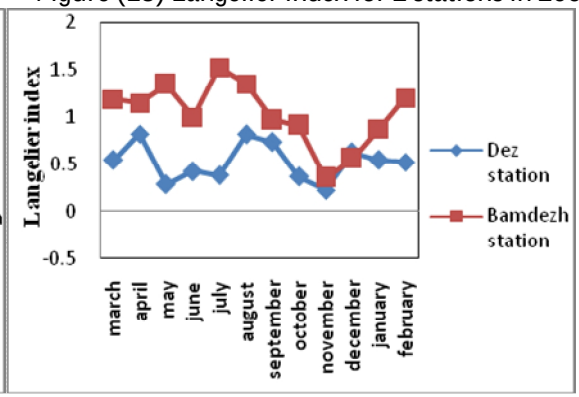


Figure (17) Langelier index for 2 stations in 2009

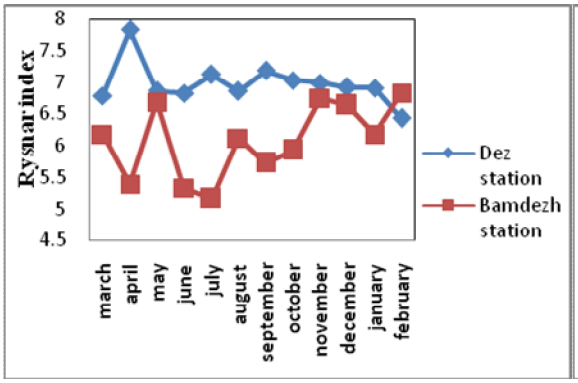


Figure (18) Rysnar index for 2 stations in 2010

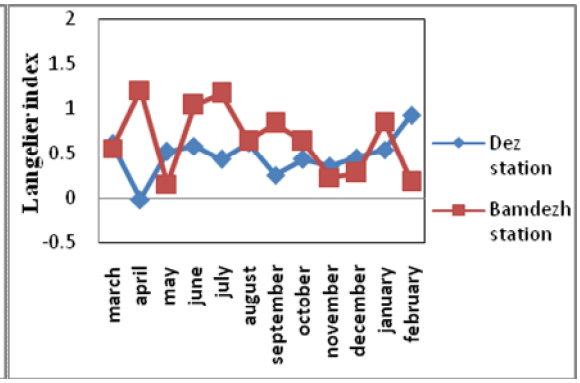


Figure (19) Langelier index for 2 stations in 2010

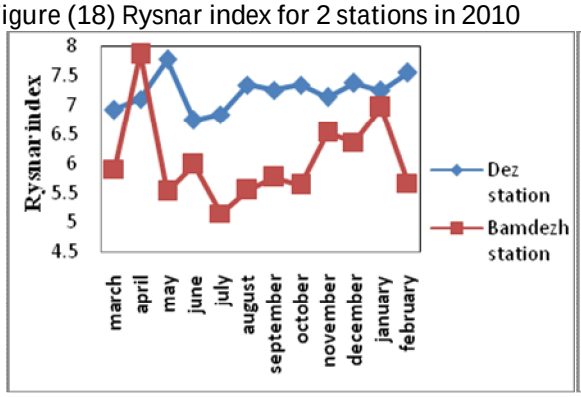


Figure (20) Rysnar index for 2 stations in 2011

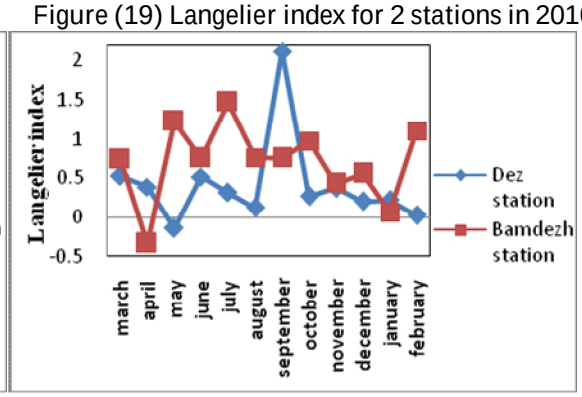


Figure (21) Langelier index for 2 stations in 2011

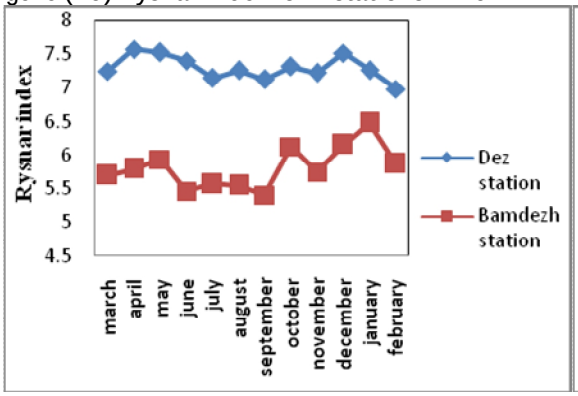


Figure (22) Rysnar index for 2 stations in 2012

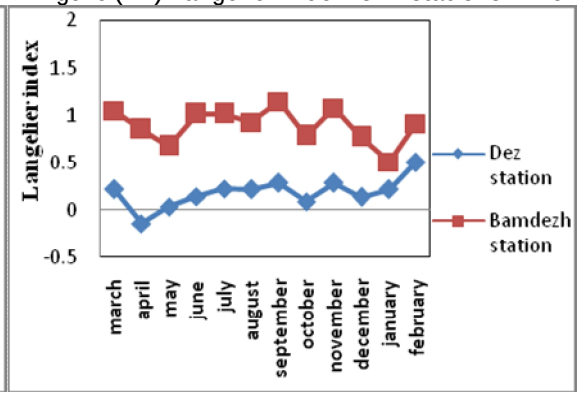


Figure (23) Langelier index for 2 stations in 2012

To better presentation and explanation of the mentioned indexes in the studying range, the charts related to average amount of these indexes have been drawn (figure 24, 25).

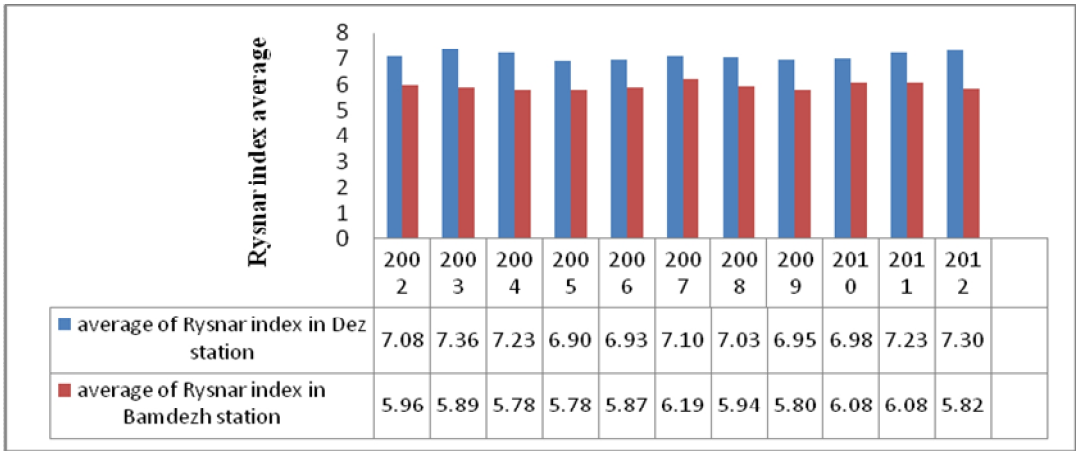
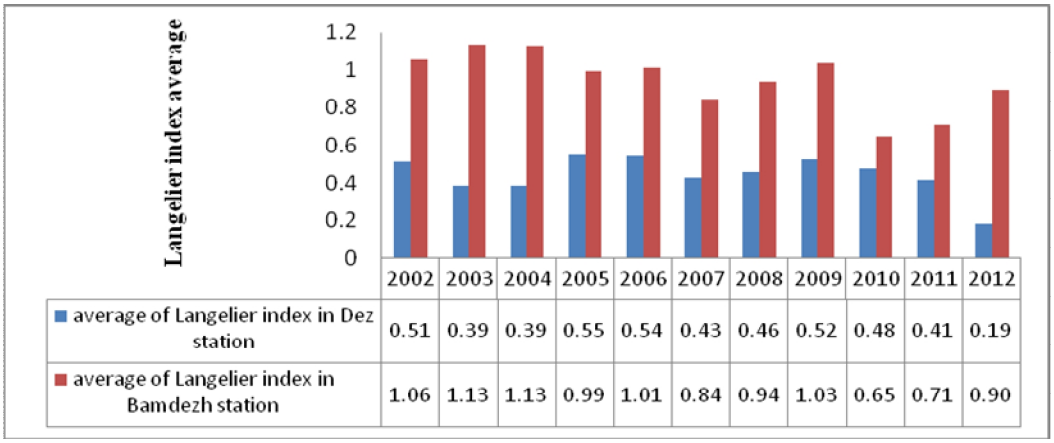


Figure (24) average values of Rysnar index for 2 stations in 2002 – 2012



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
average of Langelier index in Dez station	0.51	0.39	0.39	0.55	0.54	0.43	0.46	0.52	0.48	0.41	0.19
average of Langelier index in Bamdezh station	1.06	1.13	1.13	0.99	1.01	0.84	0.94	1.03	0.65	0.71	0.90

Figure (25) average values of Langelier index for 2 stations in 2002 – 2012

The achieved result from the related charts express the hard fluctuation in the amount of calculating indexes in desired structured. The reason for these fluctuations may be caused by this reason that in the studied structure, there are several secondary branches run into Dez River. As, it is observed, Dez river water from Dez to Bamdezh station is sedimentary based on Langelier index.
However based on Rysnar index, it is almost corrosion upstream and almost sedimentary downstream. The reason for this difference is disability of Langelier index in the existed condition because Langelier index indication method is completely valid when the water is still or has the maximum speed of 0.6 meters in a second [5] and due to this fact that Dez river speed in mentioned range is more than this amount in most time of the year, it is better to used Rysnar index result which has higher validity.

CONCLUSION

Because Dez River provides the drinking water, agriculture water for several villages and farm lands and some fish breading plans, it is necessary to control this river water quality all the time. The calculation have shown that the lowest amount of Rysnar index has come in Bamdezh station which is locally state downstream of range studying and generally monthly minimum of Rysnar index occurs in summer which can be because of corresponding effects caused by increasing temperature and decreasing discharge. In a general view, Rysnar index history has been in Dez station in which the history amount observation is in winter. The studies done, have shown that Dez river water in the study time has not been in balanced mood and this can be because of entering the secondary branches into Dez River in this period. According to important and effective problems of corrosion and deposition phenomena in water system and especially in rivers, knowing rivers water quality condition can significantly help to have better operation of river water and existed range in it. Also regarding the gained results from this research, is most be more care to use this rivers water in different parts and providing the materials, pipes and various parts of water system that of fed by this river.

REFERENCES

1. AWWA. Water quality and treatment: A Handbook of community water supplies. Technical edited by Pontius F.W.4nded. Washington D.C. McGraw-Hill, 1990; 613_781.
2. HDR Engineering Inc ;(2001)."Handbook of bublic water systems".2nd ed. John Wiley and Sons, 1152 p.
3. Mahvi A, Dindarlou K, Jamali H and Alipour V, (2008). “Corrosion and deposition of water in Bandar Abbas water network”, Medical Journal of Hormozgan, No. 4, Pages 335-340.
4. Mahvi A and Eslami A, (2006). “Qualitative evaluation of water supply of distribution system in Zanjan in terms of corrosion and deposit formation”, Journal of Environmental Science & Technology, No. 28, pages 90-95.
5. Moazed H and Hamzeh S, (2009). “ to study of corrosion and deposition of Karoon river in range of Shushtar to Ahvaz”, Journal of Water Engineering, No. 1, spring 2010, pages 7-17.
6. Moradi SH, Akhondali A.M, Farokhzadeh S, Ghotbi S.M.H, (2012). “Investigating the corrosion and precipitation of the water of the Tajan river in the range of Aliabad-Rigcheshmeh”, 9th International River Engineering Conference, ShahidChamran University, 22-24 jan 2013, Ahwaz.
7. Savari J, Jafarzadeh N, Hasani A and Shams KhoramabadiGh, (2008). “Comparison of corrosion indices changes the drinking water distribution network in Ahwaz”, 2th International Conference on Environmental Engineering, Department of Environment, Tehran University.
8. Thecobanoglous, G., Edward, S. (1987). "Water quality" , Addison-Wesley Publishing Company, 769p.
9. ZareAbyaneh H and Kazemi A, (2010), “to study the corrosion and deposition of groundwater in Hamedan plain-bahar”, Journal of Environmental Science and Technology, period 12, No. 2, Pages 89-101.