

Quality Assessment the Plains in Mehr Gerd City of Semirom and the Impact of Geological Units

Saeed Taki¹, Shahram Nakhaei^{2,*}

¹ Assistant Professor at Islamic Azad University Lahijan Branch, Iran

² Master Degree in Environmental Geology, Islamic Azad University, Lahajan Branch, Iran

ABSTRACT

The study area is located about 150 km south of Isfahan and in the geographical range of '36, 31 'to 52' and 31 'north and the geographic length '15, 51' to 47 'and 51' east. This area covers the entire extent of 1274.7km² parts of the Great Caroon Basin. The aim of this study is to update and update the quantitative and qualitative evaluation of the springs of the region with the aim of determining the quality status of water in terms of physicochemical properties for drinking. In this paper, the parameters of pH, TDS, EH, BOD, EC, cations and major anions in water of 5 fountains and river from fountains are studied and qualitatively with the sample of water purified water network of the region which is the fountains are fed by comparison. Data were evaluated using AqQA software and Piper, Stiff, Ion Balance, Durov and Schoeller charts were drawn for springs analysis and the results of physicochemical parameters of the fountains were compared to the standards WHO, 2011, Standard 1053 of Iran, Schuler and the United States Environmental Protection Agency (USEE). Also, other similar studies in the mentioned area including Dorahean, Choghour Cheshmeh, were calculated and compared using Langeleigh Index and Metal Index. In order to better evaluate the data, a mapping of the data was made.

KEYWORDS

Qualitative, Physicochemical, Langeal Indicators, geological

INTRODUCTION

The most important natural resource in the world, where life and survival are not possible without it, is water. Water contamination is one of the major environmental problems today.

Therefore, preservation of water resources from the risk of pollution is an important issue that has attracted many studies and research. By measuring physicochemical variables and concentration of cations, heavy elements and

major water anions, can determine the type of water, the desired pollutant in water and water quality for drinking and irrigation. In this study, to determine the proportion of water sources in the studied area for drinking, the parameters measured in water samples with the standard (2011) (WHO and the standard of drinking water quality in Iran and Schoeller classification (1995)) and the results were presented in the relevant tables. Firstly, in order to identify the region in general, a geological map of 1:100000 Semirom, 1:100000 Shahreza and 1:250000 Boroujen from the Geological Survey of Iran was prepared. In order to evaluate physicochemical properties, sampling of the sources in the study area was performed and samples were analyzed in the laboratory of Actlabs Canada and Laboratory of the Regional Water Company of Isfahan.

SUMMARY OF CURRENT AQUIFER STATUS

The area of one of the basins of the Karoon River catchment area is 1274.7 sq. Km, which is 620 square kilometers of that elevation and 654.75 km of which is plain. The aquifer is a free and alluvial zone, which according to the map has the highest thickness of alluvium in the center of the plain and about 100 to 140 meters and has the lowest thickness in the northern margin of the aquifer. The lowest groundwater level depth of 0.59 m was found in the aquifer output range. The highest depth of groundwater in the southern part reaches more than 38 m (maximum 39.7 m).

MEASUREMENT OF ALKALINITY

The proper amount of water sample was poured into a 250 ml dispenser and then added a few drops of phenol-phthalin to erlon. The color of the solution ($3/8 < \text{pH}$) was adjusted to 0.02 with normal color to make the solution colorless. We record the amount of acid consumed then, a few drops of the methyl orranger are added to the solution and until the solution is orange-like, we continue to titration.

*Corresponding Author: Shahram Nakhaei
E-mail: shahram_nakhaei@yahoo.com
Telephone Number: +989133021810

Fax. Number:

If no color change occurs after adding phenol-phthalin, a few drops of methyl orangin are added to the solution and until the solution changes to orange-like color (reaching the end point of the experiment) we continue titration.

$$\text{Alkalinity} = A \cdot N \cdot 5000 / V$$

$$\text{Alkalinity} = A1 \cdot N \cdot 5000 / V$$

A: Volume of acid consumed for phenol-phthalin alkali

N: Normality of sulfuric acid used

A1: The amount of acid used for phenol-phthalin and methyl orange

V: Sample size in milliliters

The alkalinity is based on calcium carbonate, so the calcium carbonate number can be used in the formulas used to calculate it.

$$\text{ppmCaCO}_3 \times 1/22 = \text{ppmHCO}_3$$

CHLORIDE MEASUREMENT

Using a neutral or slightly alkaline solution and with a potassium chromate detector, a sample containing silver nitrate chloride was performed. At the end of titration, the silver chloride deposition changes to the silver chromate that is bricks. We used this method to measure chloride in water, which is relatively transparent and free of turbidity. To do this, you must first prepare the materials and solutions needed for the test. To prepare 0.1 molar silver nitrate solution, we first weighed 498.8g of silver nitrate and then we collected in a 500 ml balloon. We then weighed 0.25 to 0.3 mg sodium chloride (NaCl) in order to standardize the silver nitrate solution, with 50 ml of distilled water, in a 250 ml echinoderm. Then add 2 ml of chromatography to the solution and titrate with nitrogen silver 0.1 it is noteworthy that the solution is yellow before the start, because of the presence of chromate, but after the titration, a red brick deposit was formed. Using the following equation, the norm of silver nitrate was obtained:

$$N, \text{AgNO}_3 = \text{grNaCl} \times \left(\frac{1 \text{ mol NaCl}}{58.5 \text{ grNaCl}} \right) \times \left(\frac{1 \text{ mol AgNO}_3}{1 \text{ mol NaCl}} \right) \times (1 / \text{ml AgNO}_3) \times (1000 / \text{L})$$

In the next step, to prepare the potassium chromate reagent, dissolve 50 g of potassium chromate in distilled water, then add the silver nitrate solution, which remained in this red brick deposit. After 12 hours, we filtered sodium and spread it to a volume of one liter. Afterwards, 25 ml of the sample was placed in the Arlene Meyer and added to the pH of 10-7 by adding the pH. Then add a few drops of the chromatum to the solution and appear with a nitrogen - 0.0141 tortilla to brown orange.

SULFATE MEASUREMENT

The equipment required for this test includes a spectrophotometer, a sensitive electrical balance and laboratory glassware.

REAGENTS AND MATERIALS

1. Reagents:

30 ml of concentrated chloride acid was added to 300 ml distilled water and then washed with 100 ml of ethanol or

isopropyl alcohol and 75 g of sodium chloride in a human, then added 10 ml of glycerin and mixed.

2. Crystal Barium Chloride:

The standard solution of sulfate is prepared in two ways (1ml = 100µg So4). In this study, the second method was used:

10.4 ml of sulfuric acid give a standard dose of 100 ml to a volume of 100 ml. Dissolve 142.7 mg of sodium-free sodium sulfate in a portion of distilled water to give a volume of 1 liter. Standard solutions yielded from 5 to 40 mg per liter of sulfate from standard solutions. After adding barium chloride and reagent, the absorbance was measured at 420 nm with spectrophotometer and the calibration curve was measured according to the standard concentrations are plotted. Add 50 ml of water sample in a 250 ml dispenser and add 50 ml distilled water. We also added 5 ml of sulfate reagent and 0.2 g of barium chloride. Then, with the aid of an electric stirrer, we stirred the Erlene contents for one minute and measured the absorbance of the samples over a 5 minute ± 5 minute period by spectrophotometer at 420 wavelengths.

$$\text{Volume / mg sulfate} = \text{mg of sulfate per liter}$$

NITRATE MEASUREMENTS

Examples for nitrate assessment should be tested immediately after sampling, otherwise they should be kept at 4 ° C for 2 days. Disinfected specimens are fixed for at least 14 days without acid if the nitrate is present in the sample, the acidification of the sample results in the heterogeneity of the nitrite to the nitrate and nitrous oxide, and converted to the nitrate by oxidation and hydrolysis. This causes the nitrate content of the total nitrate and nitrite to be sampled, so the samples should not be acidic. The most common methods of nitrate measurement are ultraviolet (UV). This method is used to determine the amount of nitrate in non-polluted water and low-organic water. Pending particles are removed and removed by filtration. Organic matter, a six-layer cream, inorganic ions such as chlorite and chlorates not found in natural waters, may interfere. In this method, the nitrate absorption rate is measured at 220 nm. Another method is based on the use of bruxin sulfanilic acid, which is principally used for waste products containing organic matter. In this study, the first method (Ultra Violet) was used. The equipment required in the ultra-violet method includes a sensitivity scale, required glassware, UV spectrophotometer and chloride-free acid. In this method, 10 ml of the acidic sample was removed and transferred to the test tube, then added 2 ml of saturated brine solution, then 0.5 ml of brucine and 10 ml of sulfuric acid was added to the mixture for 15 to 30 minutes. It was placed in boiling water and after cooling, its absorption was read at 410 nm.

MEASUREMENT OF CATIONS

Specimens submitted to the Laboratory of Actlabs Canada were tested using ICP-MS Spectrometry (ICP-MS). The amount of cations and its main and rare elements was measured. This method is a relatively new method, which is

welcomed due to the low detection rate, accuracy and precision, and the necessity of a small sample size. The ions in the plasma are drawn through a needle hole into the vacuum system and concentrated by means of an ion lens within the mass spectrometer.

WATER CHEMISTRY DIAGRAMS

After performing chemical tests and determining the main parameters for each source of drinking water, raw data from the experiments should be analyzed. Thus, using the AqQA software, qualitative diagrams such as Ion balance, Durov, Stiff, Schoeller and Piper are drawn. In this study, version 1.1.5 of the AqQA software was used. This application is written by water chemists for use by water chemists AqQA analyzes the results of the chemical analysis and presents the results in graphical form.

Tab.1.Results of Isfahan Laboratory Data Processing in AqQA Software

Parameters	Sam ple 1	Sam ple 2	Sam ple 3	Sam ple 4	Sam ple 5	Sam ple 6	Sam ple 7
Water Type	Ca-HCo 3	Ca-HCo 3	Ca-HCo 3	Ca-HCo 3	Ca-HCo 3	Ca-HCo 3	Ca-HCo 3
Density(g r/cm3)	0.997 31	0.997 29	0.997 28	0.997 29	0.997 28	0.997 31	0.997 27
Conductivity (µmho/cm)	559	534	498	530	507	574	481
Hardness(as CaCo3)m g/l	245	210	250	255	215	260	200
Dissolved Solids (mg/l)	363	347	324	345	330	373	313
TDS mg/l	363	347	324	345	330	373	313
SAR	0.766 7	0.966 1	0.189 7	0.313 1	0.613 8	0.496 1	0.565 7
Temp Hardness mg/l	265	235	245	220	190	245	175
Irrig.Clas s	C2-S1	C2-S1	C2-S1	C2-S1	C2-S1	C2-S1	C2-S1

PIPER DIAGRAM

This diagram shows the original ionic compounds of any number of samples. A graphical representation of chemistry is a plurality of samples and is made up of three distinct fields the percentage of anions and cations in triangular fields and their combined position is carried out in a rhombic square. In fact, the piper diagram shows the chemical profile of water based on the relative concentration of its components, not the absolute concentration of them, and the type of water can be quickly detected. When we divide the rhizome-shaped field according to Figure 4-1, in the region of one earth alkali is more than alkali, and in region 2, the alkali is more than earth alkali. In area 3, weak

acids are stronger than strong acids, and in area 4, strong acids are more than weak acids. In zone 5, the carbonate hardness exceeds 50%. In area 6, non-carbonate hardness is more than 50% and is overcome with strong alkalis and acids. The waters of the ocean and the waters are very salty in this area and close to the top of the right in area 8, carbonate alkali exceeds 50%. Here are samples of water whose hardness is very low compared to the soluble materials contained therein. In area 9, no couples of cationic anion exceed 50%.

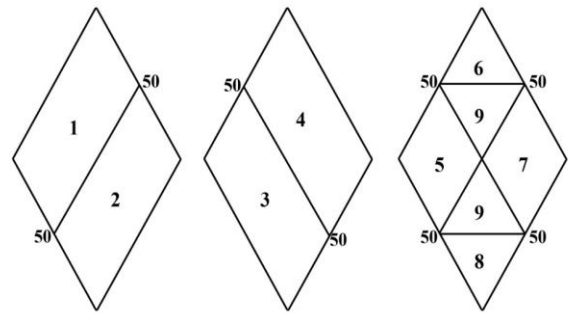


Fig.1. Below subdivisions of the diamond-shaped Piper diagram

The Piper diagram is a useful tool for illustrating the differences and similarities between the water bodies this diagram also shows the effect of mixing between different waters because the mixing of two water, in every proportion, is located in all three fields along a straight line provided that all ions remain in solution and do not react. The position of the hydrogeochemical data of the springs studied on the Piper diagram is as follows:

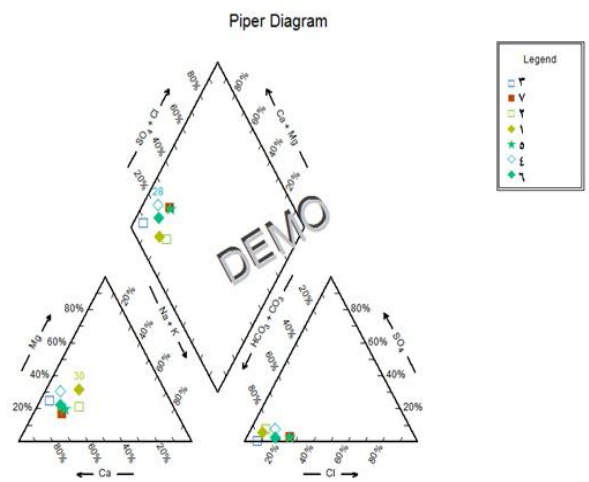


Fig.2. Piper chart of sampled water samples

Examples are in Diagrams 1, 3 and 5. In studied waters, alkaline earth elements are more than strong acids in excess of alkali and weak acids. The non-carbonate hardness is over 50% and the earth's alkali and weak acids predominate.

DIAGRAM DUROV

The Durov diagram is a very suitable alternative to the Piper chart. The Durov diagram is widely used to display natural water soluble components and to demonstrate acceptable hydrochemical processes in a hydrological system. It is usually used to study the source of the chemical composition of water and determine the concentration of the chemical composition of water.

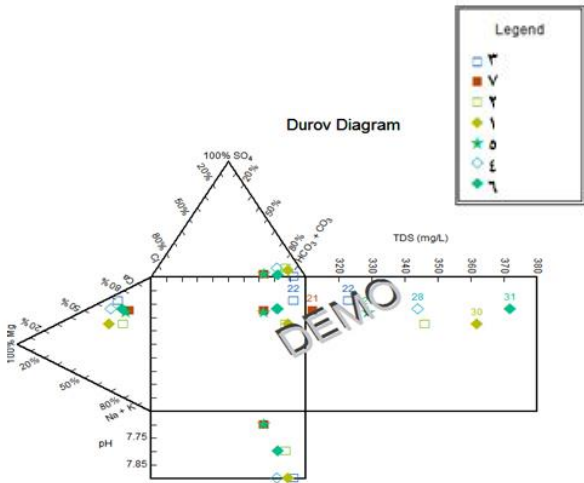


Fig.3. Durov chart of sampled water samples

STIFF DIAGRAM

Indicates the composition of cations and anions is only one sample. The Stiff diagram is actually a graphical representation of the chemical analysis, first developed by H.A. It was developed in 1951. This diagram is used in geochemistry and hydrogeology to demonstrate the basic composition of ion in a water sample. The cations with the mEq unit on the left of the zero axis and the anions are also drawn to the right the Stiff pattern is actually a quick visual comparison of various sources. The diagram stiff is used to assess water quality changes in one place and in a period this diagram depicts a better representation of the total salt concentration than other commonly used graphs the concentration or dilution effect in these graphs has been minimized. Therefore, the distinction between the various types of water becomes more intense. It has a wide range of uses, for example, in the detection of mixing of wetlands belonging to oilfields with groundwater, impregnation of water with mudflows, pollution of groundwater with contaminating water sources, mixing of groundwater with sea water, etc. (Stiff, 1951). The Stiff diagram illustrates the composition of cations and anions in just one sample. This diagram is used in geochemical and hydrogeological sciences to represent the main ionic composition in a water sample and consists of 4 parallel horizontal axes that cut a zero-axis vertical axis, the values of each of the major anions and cations are expressed in mEq on one of the horizontal axes and the level of these graphs also represents the total amount of TDS soluble solids (Hounslow, 1995). The diagrams indicate that the patterns of each of the seven springs are similar to each other, with each other having a

relatively small difference, so the overall composition and origin of all are the same and have not undergone significant mixing processes.

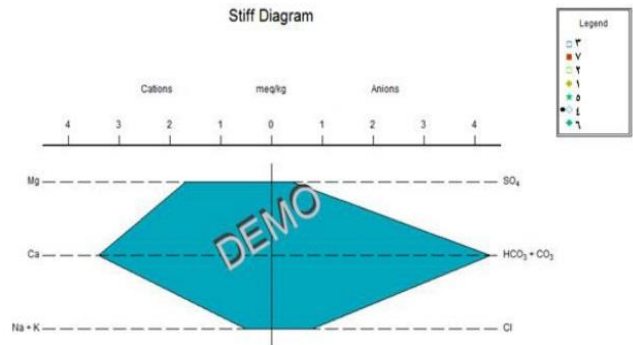
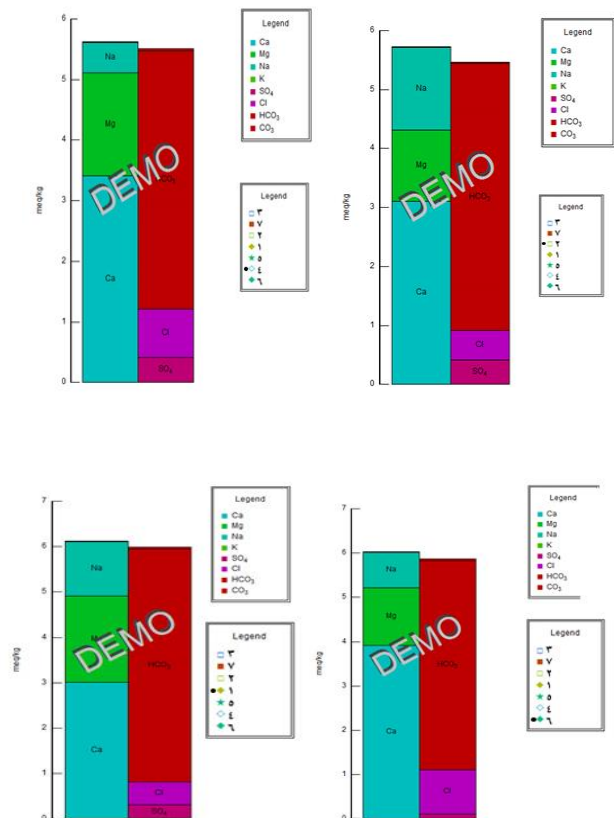


Fig.4. The stiff diagram of the study area

ION BALANCE DIAGRAM

This chart shows the balance or imbalance of anions and cations of each source individually. In chemical analysis of water, the amount of total anions and cations is equal. If the percent difference between the total cations and anions exceeds their total value of 6%, it indicates an analysis error or an unusual situation. Anthony-cationic equilibrium diagrams for source show that there is a good balance between anions and cations. Therefore, the sampler analysis of the samples is correct and we do not face any unusual situations.



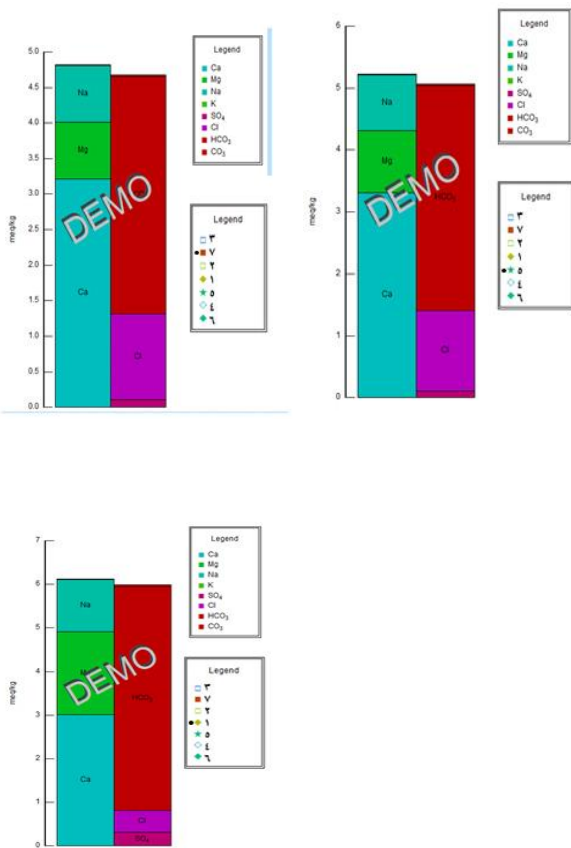


Fig.5. Ion Balance Graphs of Water Resources Studied

SCHULER CLASSIFICATION

The Schuler diagram is one of the most important categories for assessing drinking water quality. The Schuler diagram is a semi-logarithmic diagram that shows the concentration of the main ions in mEq. In this chart, based on the six chemical parameters, sodium, calcium, magnesium, chlorine, bicarbonate and water sulfate are classified into six groups of good, acceptable, inappropriate, bad, acceptable in emergencies and non-drinkable Also, the physicochemical parameters of the samples were compared with Shooler, Iran 1053, WHO and EPA standards, and the results were plotted in separate tables.

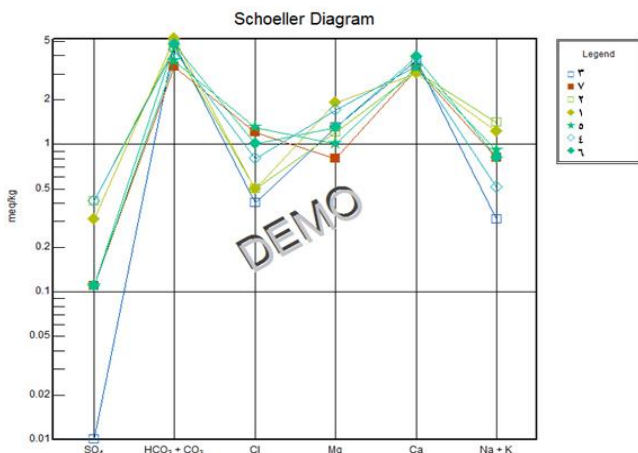


Fig.6. Water sample diagram of studied springs

CONCLUSION

Based on data processing by AqQA software, the type of sprinkled water is Ca-HCO₃.

According to the ICP-MS test data, the amount of zinc, copper, lead, nickel and cadmium as heavy metals in all samples is normal, but there is considerable amount of purified water distribution network (No. 7). This frequency is 792 times, lead is 16.5 times, copper 57 times, nickel is 2 times, and in cadmium it is 7 times the average of springs. The amount of arsenic in all samples is within the permitted range, and in the water sample, the distribution network has the lowest amount. Chromium, molybdenum, vanadium and barium are among the heavy metals and sodium groups of cations in samples 1 and 2, but at the same time, in all samples, it is at a desirable and desirable level. Selenium and manganese are also about three times the average in other samples, despite being within the permitted range, in sample No. 2. Antimony has a normal distribution in the studied samples, but in sample number 4, it has the highest frequency. Calcium and magnesium are cations of the standard according to standard 1053, but based on the Schuler charts, they have no desirable descriptions and are classified as inappropriate to poor. The nitrate in Iran is 1053 in the normal range, but in comparison with the WHO standard, in all cases it exceeds the limit and does not conform. Ion sulfate is also in the desired range, but in sample number 3, it is the least frequent and in samples number 2 and 4 is the most abundant. Chloride ion in sample number 5 has the lowest amount. The alkali of all samples is normal and in the distribution network is the lowest.

Examining physical parameters PH in all specimens is within the normal range from 7.7 to 7.9 and it is compatible with different standards. TDS is also allowed in all samples However, TDS is not comparable in comparison to the measured and calculated values of the AqQA software. The EC electrical conductivity is higher than the normal sample in samples other than sample number 7. All samples are sediment-free and have no corrosion properties for industrial applications. Metal Index (MI) and Heavy Metals Pollutant Index (HPI) are normal, but in samples 2 and 7, it is about one and a half times the average of other samples.

Based on the Piper diagram, the samples are located in diagrams 1, 3 and 5, in studied waters, alkaline earth elements are more than strong acids in excess of alkali and weak acids. The non-carbonate hardness is over 50% and the earth's alkali and weak acids predominate.

According to Durov diagram, the amount of TDS in samples 1 and 6 is the highest and in sample number 3 is the lowest. The bicarbonate content in sample number 1 is the highest and in sample number 5, the lowest.

In the Ion Balance diagrams, it can be concluded that ionic balance exists and the amount of anions and cations in equilibrium is present in all specimens.

According to Schoeller classification, in all samples, nitrate is good in terms of Iran's 1053 standard but in some samples, like sample number 3, Compliance with International Standards not acceptable. The total hardness (TH) is only acceptable in examples 4 and 6 and is well-

evaluated in other cases. The amount of potassium and sodium in all samples is good, but calcium and magnesium in most samples are desirable and beyond limits. Magnesium in samples 1 and 2 is the highest and in sample number 5 is the lowest. Sodium has the lowest concentration in sample 2 and in sample number 3 it has the lowest presence.

According to standard WHO, 2011 all parameters are in the fountain except for nitrate which in all samples is acceptable or non-compliant. This also applies to the United States Environmental Protection Agency standard. In examining the physical parameters, it was also observed that all the parameters, except the electrical conductivity in all specimens, were in acceptable and acceptable limits.

As you move from the heights and move to the alluvial plain arsenic levels should be increased with gentle gradients. Which is probably lacking in geological reasons due to the use of agricultural pollutants.

REFERENCES

- [1] **Arvidson, J. D., (2006)**, *Relationship of forest thinning and selected water quality parameters in the Santa Fe Municipal Watershed, New Mexico, Hydro-science Concentration Water Resources Program, University of New Mexico.*
- [2] **Dahlen, F A. (1990)**. "Critical Taper Model of Fold-And-Thrust Belts and Accretionary Wedges". *Annual Review of Earth and Planetary Sciences*. 18: 55–99. *Bibcode: 1990AREPS.18...55D*.*doi:10.1146/annurev.earth.18.050190.000415.*
- [3] **Dahlen, F.A., Suppe, J., Davis, D. (1984)**. "Mechanics of Fold-and-Thrust Belts and Accretionary Wedges: Cohesive Coulomb Theory". *J. Geophys. Res.* 89 (B12): 10087–10101.
- [4] **Gutscher, M., Kukowski, N., Malavieille, J., Lallemand, S. (1998)**. "Material transfer in accretionary wedges from analysis of a systematic series of analog experiments". *Journal of Structural Geology*. 20 (4): 407–416. *Bibcode:1998JSG....20..407G*.*doi:10.1016/S0191-8141(97)00096-5.*
- [5] **Hounslow, A., (1995)**, *Water quality data: analysis and interpretation, CRC-Press, 397, p:86.*
- [6] **Koons, P O. (1995)**. "Modeling the Topographic Evolution of Collisional Belts". *Annual Review of Earth and Planetary Sciences*. 23: 375–408. *Bibcode:1995AREPS..23..375K*.*doi:10.1146/annurev.earth.23.050195.002111.*
- [7] **McBirney, Alexander R. (2007)**. *Igneous petrology*. Boston: Jones and Bartlett Publishers. ISBN 978-0-7637-3448-0.
- [8] **Quevauviller, PH., MarieFouillac, AN., Grath, J., Ward, R., (2009)**, "Groundwater Monitoring", Wiley. Publishing Company, Part 3.
- [9] **Stiff, H. A. JR., (1951)**, *The interpretation of chemical water analysis by means of patterns, Journal of PetroleumTechnology*, 3(10), 15-17.
- [10] **Sack, R. O., Walker, D., Carmichael, Ian S.E., (1987)**. "Experimental petrology of alkalic lavas: constraints on cotectics of multiple saturation in natural basic liquids". *Contributions to Mineralogy and Petrology*. 96 (1): 1–23. *Bibcode:1987CoMP...96....1S*. *doi:10.1007/BF00375521.*
- [11] **Spear, F. S. (1995)**. *Metamorphic phase equilibria and pressure-temperature-time paths*. Washington, DC: Mineralogical Soc. of America. ISBN 978-0-939950-34-8.