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REVIEW ON HYDROCHEMICAL AND HEALTH EFFECTS OF IT IN SISTAN AND BALUCHISTAN GROUNDWATER'S, IRAN

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Abstract

Science the ground water quality is important for drinking and other applications and given that this area has a dry climate and drinking water supply by transferring from other cities, due to far distance, is difficulties. Considering to underground water resources in this area will be reasonable and inevitable. In this study groundwater resources quality of Sistan and Baluchistan with determine and evaluation important chemical parameters of Sulfate, Phosphate, Calcium, Sodium, Magnesium, Potassium, Chloride ions and Nitrate ions was reviewed. For this 357 water samples at the 2015 collected from designated wells in the area and transported to laboratory according to standard methods and analyzed.The Result showed that maximum concentration of Calcium in Konarak with 136 mg/l, Potassium in Konarak with 8.38 mg/l, Potassium in Konarak with 8.38 mg/l, Sodium in Zahedan with 416 mg/l, Chloride in Zahedan with 410 mg/l, Nitrate & Nitrate in Iranshahr with 15 mg/l, Phosphorus in Zahedan with 0.012 mg/l, Sulfatein Zahedan with 509 mg/l and

Magnesiumin Zahedan with 47 mg/l. most citiesparameters concentration to be within the standards/guidelines recommended by international organizations.

Finally, result showed that Groundwater quality (Phosphorus, Magnesium, Nitrate & Nitrate, Calcium, Chloride) of Sistan Baluchistan is good for water suppling except sodium, Chloride and Sulfate parameter that need attention and treatment in some city such as Zahedan and Chabahar.

Keywords: Groundwater quality, Human health, Drinking water, Sistan and Baluchistan

Introduction

Supply the safe drinking water is one of essential elements to protectedand enhanced public health(1, 2).Environmental pollutants cause significant threats to freshwater sources of human and other organisms (3, 4).In recent years'ions concentrationreceiving from water bodies to human body has been tremendous attentions all over the globe (5). The hydro chemical processes and hydro geochemistry of the groundwater vary spatially and temporally, depending on the geology and chemical characteristics of the aquifer (6). Moreover natural means (weathering and erosion of bed rocks and ore deposits), anthropogenic factors (mining, industries, wastewater irrigation and agricultural activities),infiltration water,topography and geology of the reservoir rock are main sources which have been influenced on Chemical and physical parameters in water bodies (7-9).

It is reported that systematic health problems can appear in human body as a result of excessive dietary of some chemical ions such as Chloride, Phenol and Sodium(10, 11).Furthermore, exposure to high amount of water soluble ions can arise serious problems to human such as neurotoxic, nephrotoxic, carcinogenic effects, impairment of cardiovascular system function, etc. (11, 12). The intense effects of ions on human body are not only due to the consumption of it via water but also irrigation of lands with ions rich water releases it to the soil of near or far lands.

The presence of elevated metal concentration can disrupt the soil microbial processes, occasionally leads to serious ecosystem disturbance (13). On the other hand, accumulation of some ions in soil is a potential risk to plants, carnivores and human, or food chain. Therefore, accurate determination of bad effects ions has tremendously become necessary to solve the problems associated with the pollution of water bodies (4, 14). Knowing these groundwater hydrochemical quality is effected on human health. Numerous studies on groundwater quality have been made in different region aiming to determine qualityof water body resources and they have balanced with different methods(15-20). The present study is an attempt to determine the hydrochemical and statistical characterization of groundwater in the Sistan and Baluchistan, Iran.

Materials and Methods

Sistan and Baluchistan is the largest province of Iran that located in south east of Iran between 25˚ 03′ and 31˚ 28′ northern latitudes and 58˚ 47′ and 63˚ 19′ eastern longitudes. It is one of the driest region of Iran. This district is divided to 9 counties and the capital of it, is Zahedan (Fig.1). In this study,In accordance with our previous study(3, 4), the concentrations of Magnesium, Sulfate, Phosphorus, Nitrate & Nitrate, Chloride, Sodium, Potassium and Calciumin water resources of Sistan and Baluchistan was conducted in 2105. For this purpose, 357 samples of fresh water from all over 5,000 wells according to the following formula (Eq (1)) with significance level 5 percent from various and possible location of ground waters of Sistan and Baluchistan resources, as much as possible due to security issues, according to standard methods were collected and tested. Because the region's surface water resources are seasonal, generally the groundwater resources being use for all purposes, including drinking and agricultural. In this study water all of them used for drinking. All samples were stored in a cool box and then pass on to the laboratory in standard conditions. Preparation of samples procedure was considered in all of steps, including collection, storage, transportation and final analysis to protect samples from secondary pollution. At the end the contents of contaminants were analyzed using Titration and flame photometer model PFP7/C made by JENWAY (England) and reported. A hand held global positioning system (GPS, Garmin Montana 650 model) with position accuracy of less than 10meter was applied to specify the location of sampling points. The sampling locations are shown in Fig 1.

$$n = \frac{\frac{z^2 pq}{d^2}}{1 + \frac{1}{N}\left(\frac{z^2 pq}{d^2} - 1\right)} \quad \text{Eq (1)}$$

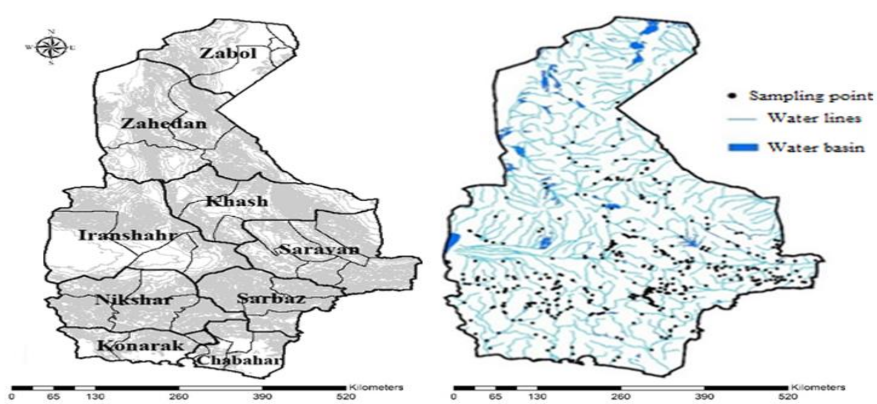

Fig 1. Sampling points in Sistan and Baluchistan(3).

Results and discussion

Calcium

Result from table 1 are shown that only Iranshar have high calcium concentration (800 mg/l) while maximum amount of Calcium obvious in Konarak with 136 mg/l concentration. Calcium is naturally present in water. It may dissolve from rocks such as limestone, marble, calcite, dolomite, gypsum, fluorite and apatite. Calcium is a determinant of water hardness, because it can be found in water as Ca^{2+} ions (21). The average abundance of Ca^{+2} in the soils is 0.07 to 1.7%, in streams it is about 15 mg/L and in ground waters it is from 1 up to 500 mg/L. The most common forms of calcium are calcium carbonate (calcite) and calcium-magnesium carbonate (dolomite). Calcium carbonate solubility is controlled by pH and dissolved CO_2. The CO_2, HCO_3^- and CO_3^{2-} equilibrium is the major buffering mechanism in fresh waters. Hardness is based on the concentration of calcium and magnesium salts, and often is used as a measure of potable water quality.Calcium is necessary in plant and animal nutrition and is an essential component of bones, shells, and plant structures. The presence of calcium in water supplies results from passage over deposits of limestone, dolomite, gypsum, and gypsiferous shale. Small concentrations of calcium carbonate combat corrosion of metal pipes by laying down a protective coating. Because precipitation of calcite in pipes and in heat-exchangers can cause damage, the amount of calcium in domestic and industrial waters is often controlled by water softening (e.g., ion exchange, reverse osmosis). Calcium contributes to the total hardness of water. Chemical softening treatment, reverse osmosis, electro dialysis, or ion exchange is used to reduce calcium and the associated hardness(22, 23). Calcium is a dietary mineral that is present in the human body in amounts of about 1.2 kg. No other element is more abundant in the body. Calcium phosphate is a supporting substance, and it causes bone and tooth growth, together with vitamin D(24). Calcium is also present in muscle tissue and in the blood. It is required for cell membrane development and cell division, and it is partially responsible for muscle contractions and blood clotting. Calcium regulates membrane activity, it assists nerve impulse transfer and hormone release, stabilizes the pH of the body, and is an essential part of conception. In order to stimulate these body functions a daily intake of about 1000 mg of calcium is recommended for adults. This may be achieved by consuming dairy, grains and green vegetables.Calcium carbonate works as a stomach acid remedy and may be applied to resolve digestive failure. Calcium lactate may aid the body during periods of calcium deficiency, and calcium chloride is a diuretic.Hard water may assist in strengthening bones and teeth because of its high calcium concentration. It may also decrease the risk of heart conditions. Drinking water hardness must be above 8.4 ^{o}dH. Calcium carbonate has a positive effect on lead water pipes, because it forms a protective lead (II) carbonate coating. This prevents lead from dissolving in drinking water, and thereby prevents it from entering the human body.When one takes up large amounts of calcium this may negatively influence human health. The lethal dose of oral uptake is about 5-50 mg/kg body weight. Metallic calcium corrodes the skin when it comes in contact with skin, eyes and mucous membranes (25-27).

Potassium

Result from table 2 are shown that only Khash have high calcium concentration (31 mg/l) while maximumaverage amount of Calcium obvious in Konarak with 8.38 mg/l concentration. The average abundance of Potassium (K) in the soils it has a range of 0.1 to 2.6%; in streams it is 2.3 mg/L, and in ground waters it has a range of 0.5 to 10 mg/L. Potassium is commonly associated with aluminosilicate minerals such as feldspars. Potassiumis a naturally occurring radioactive isotope with a half-life of 1.3 × 109 years. Potassium compounds are used in glass, fertilizers, baking powder, soft drinks, explosives, electroplating, and pigments. Potassium is an essential element in both plant and human nutrition, and occurs in ground waters as a result of mineral dissolution, from decomposing plant material, and from agricultural runoff. The common aqueous species is K^+. Unlike sodium, it does not remain in solution, but is assimilated by plants and is incorporated into a number of clay-mineral structures (28, 29). potassium ion cannot be bad; the potassium ion is present in relatively large amounts in all living organisms and is essential for life. However, if combined with some elements, such as Potassium Bromide is risky, All of EPA generic toxicology data requirements for potassium bromide have been satisfied (30-33). Potassium bromide is not acutely toxic and it poses a low toxicity hazard. Its oral toxicity is well known and is very low. A high dose will cause only nausea and vomiting. Similarly, its dermal toxicity is low, and it is not a skin irritant (34, 35). Chronic Effects: EPA has reviewed information in the public literature on potassium bromide, and finds that it raises no concerns regarding the chronic or long term toxicology of the approved pesticide uses (36).

Sodium

Result from table 2 are shown that only Zahedan have high calcium concentration (1228 mg/l) and maximum average amount of Calcium also obvious in Zahedan with 416 mg/l concentration. The average abundance of Sodium (Na) in the soils, streams and ground waters is 0.02 to 0.62%, 6.3 g/L andmore than 5 mg/L, respectively. Sodium is very soluble, and its monovalent ion Na^+ can reach concentrations as high as 15000 mg/L in equilibrium with sodium bicarbonate. The ratio of sodium to total captions is important in agriculture and human physiology. Soil permeability can be harmed by a high sodium ratio(37). In large concentrations it may affect persons with cardiac difficulties. Alimiting concentration of 2 to 3 mg/L is recommended in feed waters destined for high-pressure boilers.The U.S. EPA advisory limit for sodium in drinking water is 20 mg/L (38). Sodium is included on the Drinking Water Contaminant Candidate List (CCL). The CCL is a list of contaminants which, at the time of publication, are not subject to any proposed or promulgated national primary drinking regulation (NPDWR)(28, 39).The issue of sodium posed a unique challenge for the Agency priority setting and contaminant candidate listing process. In the other words, high levels of salt intake may be associated with hypertension in some individuals. The sodium levels in drinking water are usually low and unlikely to be a significant contribution to adverse health effects(40, 41).This low level of concern is compounded by the legitimate criticisms of EPA 20 mg/l Drinking Water Equivalency Level (DWEL or guidance level) for sodium. EPA believes this guidance level for sodium needs updating, and is probably low. If a health benchmark for drinking water were established using current information and current drinking water health assessment procedures, it would likely be higher. This revision could establish a new level at which sodium occurrence would not meet the criteria for inclusion on the CCL as a drinking water contaminant of concern. There was insufficient time to complete a reassessment of the sodium guidance in advance of the CCL issuance.Given the state of the data, EPA faced a dilemma on whether or not to list sodium. A decision not to list would be justified by the fact that much is known about sodium, and it does not appear to be a drinking water risk comparable to other priority contaminants. In fact, this was the logic supporting the decision not to include sodium on the previous drinking water priority list in 1991. However, a decision to list sodium would afford EPA the opportunity to address the confusion surrounding the current guidance for sodium in drinking water. Don’t concerned about sodium in drinking water, Sodium levels in drinking water from most public water systems are unlikely to be a significant contribution to adverse health effects (42-44). Sodium is a dietary mineral, partially responsible for nerve functions. Blood serum contains 3.3 g/L sodium. It regulates extra cellular fluids, acid-base balance and membrane potential, partially together with potassium. One may overdose on sodium from kitchen salt. This causes increased blood pressure, arteriosclerosis, edema, hyperosmolarity, confusion and increased riskof infection from excessive Na^+ intake. Sodium shortages may lead to dehydration, convulsion, muscle paralysis, decreased growth and general numbness. Generally, humans require about

300 mg sodium chloride per day to warrant a balanced sodium level. People that have diarrhea or other health effects that increase salt requirements need a higher dietary amount of sodium than usual. Adult intake of kitchen salt is on average 9 g per day, which translates to approximately 4 g of sodium. People with heart and kidney disease are recommended a sodium poor diet(45, 46). Kitchen salt solution was applied as vomiting provoker in the old days. Caustic soda can deeply affect tissues. Sodium is attributed water hazard class 2, in other words it is a risk when present in water. Sodium chloride however is not a risk and is attributed water hazard class 1. Sodium is a dietary mineral for animals. Plants however hardly contain any sodium. The LC50 value for gold fish is 157 mg/L. Sodium hypo chlorite from sanitary cleansers may contribute to chlorinated hydrocarbon formation, and may therefore heavily charge wastewater. Only one sodium isotope occurs naturally, namely the stable 23Na. There are 13 instable sodium isotopes, which are mildly radioactive (28).

Chloride

Result from table 2 are shown that only Chabahar have high calcium concentration (1220 mg/l) while maximum average amount of Calcium obvious in Zahedan with 410 mg/l concentration. Chloride, in the form of chloride (Cl^{-}) ion, is one of the major inorganic anions in water and wastewater. The salty taste produced by chloride concentrations is variable and dependent on the chemical composition of water. Some waters containing 250 mg Cl^{-}/L may have a detectable salty taste if the Cation is sodium. On the other hand, the typical salty taste may be absent in waters containing as much as 1000 mg/L when the predominant Cations are calcium and magnesium (28, 47). Chlorides are leached from various rocks into soil and water by weathering. The chloride ionis highly mobile and is transported to closed basins or oceans (1). The chloride concentration is higher in wastewater than in raw water because sodium chloride (NaCl) is a common article of diet and passes unchanged through the digestive system (48).Along the sea coast; chloride may be present in high concentrations because of leakage of salt water into the sewerage system. It also may be increased by industrial processes.High chloride content may harm metallic pipes and structures, as well as growing plants (49). If a daily water consumption of 2 litters and an average chloride level in drinking-water of 10 mg/L are assumed, the average daily intake of chloride from drinking-water would be approximately 20 mg per person (4), but a figure of approximately 100 mg/day has also been suggested (28). A normal adult human body contains approximately 81.7 g chloride. On the basis of a total obligatory loss of chloride of approximately 530 mg/day, a dietary intake for adults of 9 mg of chloride per kg of body weight has been recommended (equivalent to slightly more than 1 g of table salt per person per day). For children up to

18 years of age, a daily dietary intake of 45 mg of chloride should be sufficient (50). A dose of 1 g of sodium chloride per kg of body weight was reported to have been lethal in a 9-week-old child. Chloride toxicity has not been observed in humans except in the special case of impaired sodium chloride metabolism, e.g. in congestive heart failure (51).Healthy individuals can tolerate the intake of large quantities of chloride provided that there is a concomitant intake of fresh water. Little is known about the effect of prolonged intake of large amounts of chloride in the diet. As in experimental animals, hypertension associated with sodium chloride intake appears to be related to the sodium rather than the chloride ion (52).Chlorine dissolves when mixed with water. It can also escape from water and enter air under certain conditions. Most direct releases of chlorine to the environment are to air and to surface water. Once in air or in water, chlorine reacts with other chemicals. It combines with inorganic material in water to form chloride salts, and with organic material in water to form chlorinated organic chemicals. Because of its reactivity chlorine is not likely to move through the ground and enter groundwater. Plants and animals are not likely to store chlorine. However, laboratory studies show that repeat exposure to chlorine in air can affect the immune system, the blood, the heart, and the respiratory system of animals(53). Some researcher believes that chlorine causes environmental harm at low levels. Chlorine is especially harmful to organisms living in water and in soil(54, 55). The EPA Secondary Drinking Water Regulations recommend a maximum concentration of 250 mg/1 for chloride ions(38).

Nitrate & Nitrate

Result from table 2 are shown that only Zahedan have high calcium concentration (67 mg/l) while maximum average amount of Calcium obvious in Iranshahr with 15 mg/l concentration. Most nitrogenous materials in natural waters tend to be converted to nitrate, so all sources of combined nitrogen, particularly organic nitrogen and ammonia, should be considered as potential nitrate sources. Primary sources of organic nitrates include human sewage and livestock manure, especially from feedlots. The primary inorganic nitrates which may contaminate drinking water are potassium nitrate and ammonium nitrate both of which are widely used as fertilizers(56-58).Nitrate in drinking water can be responsible for a temporary blood disorder in infants called methemoglobinemia (blue baby syndrome). In infants less than six months old, a condition exists in their digestive systems which allows for the chemical reduction of nitrate to nitrite(59). The nitrite absorbs through the stomach and reacts with hemoglobin to form methemoglobin, which does not have the oxygen carrying capacity of hemoglobin. Thus, the oxygen deficiency in the infant's blood results in the "blue baby" syndrome.

When the nitrate-contaminating source is removed, the effects are reversible(60, 61). Since ingestion of water containing high nitrate concentrations can be fatal to infants and livestock, the U.S. EPA has established a level of 10 milligrams per liter (mg/L) total nitrate (measured as nitrogen) as the Maximum Contaminant Level Goal (MCLG) and Maximum Contaminant Level (MCL) in drinking water is equivalent to 44.2 mg/L(60, 62). When measured as nitrate ion the agency has also established an MCLG and MCL of 1 mg/L for nitrite (measured as nitrogen) as well as the 10 mg/L MCL for total nitrate plus nitrite (measured as nitrogen). Although extreme levels of nitrate can be associated with central nervous disorders in adults, it should be noted that nitrates and nitrites are rarely a problem in drinking water for humans older than six months of age (63, 64). Excessive levels of nitrate in drinking water have caused serious illness and sometimes death. The serious illness in infants is due to the conversion of nitrate to nitrite by the body, which can interfere with the oxygen-carrying capacity of the Childs blood. This can be an acute condition in which health deteriorates rapidly over a period of days. Symptoms include shortness of breath and blueness of the skin(65, 66).Nitrates and nitrites have the potential to cause the following effects from a lifetime exposure at levels above the MCL: dieresis, increased starchy deposits and hemorrhaging of the spleen(67).A potential cancer risk from nitrate (and nitrite) in water and food has been reported(68-71). Due to its high solubility and weak retention by soil, nitrates are very mobile in soil, moving at approximately the same rate as water, and have a high potential to migrate to ground water. Because it does not volatilize, nitrate/nitrite is likely to remain in water until consumed by plants or other organisms(72).

Phosphorus

Result from table 3 is shown that only Saravan have high calcium concentration (0.019 mg/l) while maximum average amount of Calcium obvious in Zahedan with .012 mg/l concentration. Phosphorus occurs in natural waters and in wastewaters almost solely as phosphates. These are classified as orthophosphates, condensed phosphates (pyro-, meta-, and other polyphosphates), and organically bound phosphates. They occur in solution, in particles or detritus, or in the bodies of aquatic organisms. These forms of phosphate arise from a variety of sources. Small amounts of orthophosphate or certain condensed phosphates are added to some water supplies during treatment. (64, 73, 74).Larger quantities of the same compounds may be added when the water is used for laundering or other cleaning, because these materials are major constituents of many commercial cleaning preparations(75). Orthophosphates applied to agricultural or residential cultivated land as fertilizers are carried into surface waters with storm runoff and to a lesser extent with melting snow.

Organic phosphates are formed primarily by biological processes. They are contributed to sewage by body wastes and food residues, and also may be formed from orthophosphates in biological treatment processes or by receiving water biota(76, 77).Phosphorus is essential to the growth of organisms and can be the nutrient that limits the primary productivity of a body of water. In instances where phosphate is a growth-limiting nutrient, the discharge of raw or treated wastewater, agricultural drainage, or certain industrial wastes to that water may stimulate the growth of photosynthetic aquatic micro- and microorganisms in nuisance quantities. Phosphates also occur in bottom sediments and in biological sludge's, both as precipitated inorganic forms and incorporated into organic compounds(78, 79). Phosphorous allows plants and animals to grow and function. In animal nutritionincluding human nutritionthe element is necessary for strong bones and teeth. In plants and animals alike, phosphorous is a component of Adenosine Tri-phosphate, or ATP, which is the very basic source of energy for all cellular work. As such, phosphorous is a key component of plant fertilizers and therein begins a problem. Phosphorous that's applied to the land in large doses, as it is in farming, doesn't always stay on the land. It leaches from the soil and makes its way to rivers, streams, and eventually the ocean. As essential as it is for life, too much phosphorous in lakes and oceans can cause the food web foundation including algae and plankton to go into overdrive, starting an imbalance that ripples all the way through aquatic systems(80).Eutrophication is a term for what happens when algae becomes unusually productive in a water system (81).

Sulfate

Result from table 1 are shown that only Zahedan have high calcium concentration (1600 mg/l) and maximum average amount of Calcium also obvious in Zahedan with 509 mg/l concentration. Sulfate (SO_4^{2-}) is widely distributed in nature and may be present in natural waters in concentrations ranging from a few to several thousand milligrams per liter. Mine drainage wastes may contribute large amounts of SO_4^{2-} through pyrite oxidation. Sodium and magnesium sulfate exert a cathartic action(28). Almost all natural waters contain chloride and sulfate ions. Their concentrations vary considerably according to the mineral content of the earth in any given area. In small amounts they are not significant. In large concentrations they present problems. Usually chloride concentrations are low. Sulfates can be more troublesome because they generally occur in greater concentrations. Low to moderate concentrations of both chloride and sulfate ions add palatability to water. In fact, they are desirable for this reason. Excessive concentrations of either, of course, can make water unpleasant to drink(82).Water containing calcium sulfate ions is likely to have a characteristic taste somewhat bitter and astringent(83). In fact, it has been compared to the way dissolved gypsum might taste in water. When 30 to 40 grains per gallon of calcium sulfate are dissolved in water, most people can detect the taste. If equal amounts of magnesium sulfate or sodium sulfate are dissolved in water, the taste would not be noticeable. In this way, they can be troublesome especially to people not accustomed to such water. In addition to their laxative properties and possible medicinal taste, sulfate water can mean extreme hardness, large amounts of sodium salts or acidity. Alone or together, these can pose special problems in the conditioning of water(28, 84). Health concerns regarding sulfate in drinking water have been raised because of reports that diarrhea may be associated with the ingestion of water containing high levels of sulfate. The particular concern are groups within the general population that may be at greater risk from the laxative effects of sulfate when they experience an abrupt change from drinking water with low sulfate concentrations to drinking water with high sulfate concentrations(85, 86). The EPA Secondary Drinking Water Regulations recommend a maximum concentration of 250 mg/1 for sulfate ions (38).

Magnesium

Result from table 2 are shown that only Chabahar have high calcium concentration (270 mg/l) while maximum average amount of Calcium also obvious in Zahedan with 47 mg/l concentration. The origin of the name manganese is complex. Magnesium (Mg) is the second element in Group IIA of the periodic table; it has an atomic number of 12. average abundance of Mg in the earth's crust is 2.1%; in soils it is 0.03 to 0.84%; in streams it is 4 mg/L, and in round waters it is >5 mg/L. Magnesium occurs commonly in the minerals magnesite and dolomite(28). The common aqueous species is Mg^{2+}.

The carbonate equilibrium reactions for magnesium are more complicated than for calcium, and conditions for direct precipitation of dolomite in natural waters are not common. Important contributors to the hardness of a water, magnesium salts break down when heated, forming scale in boilers. Chemical softening, reverse osmosis, or ion exchange reduces magnesium and associated hardness to acceptable levels(87).Magnesium is an essential element in chlorophyll and in red blood cells. Some salts of magnesium are toxic by ingestion or inhalation. Concentrations greater than 125 mg/L also can have a cathartic and diuretic effect (28). Manganese (II) ions function as cofactors for a number of enzymes in higher organisms, where they are essential in detoxification of superoxide free radicals. The element is a required trace mineral for all known living organisms.

In larger amounts, and apparently with far greater activity by inhalation, manganese can cause a poisoning syndrome in mammals, with neurological damage which is sometimes irreversible (88). The human body contains about 10 mg of manganese, which is stored mainly in the liver and kidneys. In the human brain the manganese is bound to manganese metalloproteins most notably glutamine synthetase in astrocytes (89, 90). All of these soluble compounds in water can be dangerous to human's health (91).

Table-1. Max, Min, Average and Standard deviation of the chemical parameters.

Total	**357**	**Calcium (mg/l)**				**Chloride (mg/l)**				**Sulfate (mg/l)**				**Temperature (Celsius)**			
cities	No	min	average	max	STDEV	min	average	max	STDEV	min	average	max	STDEV	min	average	max	STDEV
Iranshahr	74	16	65.19	169.4	32.79	37	278.21	1150	218.36	39	317.65	1150	226.76	18	21.94	24	1.09
Chabahar	45	31.2	87.83	389	82.74	58	289.86	1220	310.13	68	418.22	1250	316.673	19	20.71	24	1.18
Khash	28	35.2	127.16	347.2	200.49	49	252.83	1100	176.46	57	285.39	800	178.49	20	21.54	24	1.26
Zahedan	35	18	119.18	437	112.57	48	409.70	1310	345.23	30	509.62	1600	397.11	20	22	23	0.87
Zehk-Zabol	20	35.2	56.28	110	13.65	65	98.05	549	120.07	150	170	720	137.89	20	21.83	23	0.92
Saravan	61	32.2	73.17	800	62.97	39	179.26	768.81	133.05	40	276.08	1150	198.84	18	21.6	24	1.24
Sarbaz	45	15.4	54.62	160.6	21.17	35	89.75	640	89.36	29	108.59	850	105.56	20	21.45	24	1.10
Konarak	32	46.4	136.02	319.6	63.75	167	297.28	560	178.49	86	423.89	900	127.16	19	20.14	21	0.72
Nikshar	17	26.4	68.8	157.6	26.88	58	149.73	410	98.29	36	168.69	590	104.94	19	21.86	24	1.33

Table-2. Max, Min, Average and Standard deviation of the chemical parameters.

Total	**357**	**Sodium (mg/l)**				**Magnesium (mg/l)**				**Potassium (mg/l)**				**Nitrate & Nitrate (mg/l)**			
cities	No	min	average	max	STDEV	min	average	max	STDEV	min	average	max	STDEV	min	average	max	STDEV
Iranshahr	74	40	318.69	1165	223.94	5.8	19.32	65.4	12.71	2	5.57	30	4.24	6	15	49	6.41

Chabahar	45	68	273.17	691	52.74	11.56	42.78	269.6	54.74	3	8.24	13	2.54	2.5	12.08	74.8	17.22
Khash	28	23	238.61	702	151.98	8.68	36.18	98.96	31.33	2	7.13	30.73	4.58	6	15.72	35.52	8.36
Zahedan	35	46	415.69	1228	295.30	13.92	46.71	125.40	34.47	3	7.51	13	3.12	5.5	17.43	67	12.02
Zehk-Zabol	20	67	116.94	548	114.56	12.40	31.50	56.28	16.74	3	4.94	6	0.87	8	11.81	19.5	2.62
Saravan	61	6	216.17	619	128.64	5.12	28.85	65.84	17.60	2	4.7	30	2.83	1.7	13.95	56	8.9
Sarbaz	45	42	109.01	420	65.38	6.64	19.29	41.68	6.35	2	4.56	10	1.55	5	15.57	54.5	9.13
Konarak	32	190	239.76	320	59.69	12.44	31.37	119.92	31.59	6	8.38	13	1.88	5	11.69	23.3	4.55
Nikshahr	17	15	159.04	376	85.76	10.6	22.66	54.36	9.81	1	4.53	10	2.318	5	14.58	67.55	9.2

Table- 3. Max, Min, Average and Standard deviation of the chemical parameters

Total	**357**	**Phosphorus**				**pH**				**TDS (mg/l)**			
cities	No	min	average	max	STDEV	min	average	max	STDEV	min	average	max	STDEV
Iranshahr	74	0.002	0.005	0.016	0.002	7.3	7.86	8.32	0.276	289.48	13400.74	390.6	66.52
Chabahar	45	0.001	0.004	0.034	0.007	7.1	7.78	8.33	0.319	369.44	1238.307	5389.80	1043.07
Khash	28	0	0.006	0.05	0.008	7.07	7.71	8.31	0.263	220.52	289.23	689.51	110.62
Zahedan	35	0	0.012	0.06	0.004	5.83	7.78	8.28	0.490	278.618	1985.607	6289.400	1455.20
Zehk-Zabol	20	0.002	0.004	0.006	0.001	7.14	7.91	8.22	0.236	398.60	600.124	2105	367.50
Saravan	61	0.00	0.005	0.019	0.003	6.8	7.84	8.3	0.288	389.64	1159.30	2248.6	470.07

		1				1		1					
Sarbaz	45	0.00 2	0.005	0.001 7	0.003	7.4 2	7.81	8.2 3	0.289	287.92	675.10	18.98.8 0	268.25 1
Konarak	32	0.00 2	0.004	0.008	0.001	7.7 3	7.73	8.1 5	0.267	1102.1 6	1345.30	2178.40	378.25
Nikshar	17	0.00 2	0.005	0.022	0.003	7.2	7.75	8.3 3	0.303	367.56	700.48	1356.40	291.92

Conclusion

In this study hydrochemical properties and Health effects of it in Sistan and Baluchistan groundwater's, Iran Reviewed. The Result showed that maximum concentration of Calcium in Konarak with 136 mg/l, Potassium in Konarak with 8.38 mg/l, Potassium in Konarak with 8.38 mg/l, Sodium in Zahedan with 416 mg/l, Chloride in Zahedan with 410 mg/l, Nitrate & Nitrate in Iranshahr with 15 mg/l, Phosphorus in Zahedan with 0.012 mg/l, Sulfatein Zahedan with 509 mg/l and Magnesiumin Zahedan with 47 mg/l. Groundwater quality (Phosphorus, Magnesium, , Nitrate & Nitrate, Calcium, Chloride) of Sistan Baluchistanis good except sodium, Chloride and Sulfateparameter that need attention and treatment in some city such as Zahedan and Chabahar.

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