Research Article

"The Analysis and the evaluation of the qualitative characteristics of surface water in the "Shabala" valley basin in Al-Anbar Governorate"

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Abstract:
The quality of water varies according to its location in the basin, as the geological conditions, topography and climatic a prominent role in determining the quality of water and the extent to which it can be used by humans for various purposes. It is located between latitude (34 ° 30'37 ") and (34 ° 49'38") north and between longitude (41 ° 39'3 ") and (41 ° 52'17") east, As for the location of the spatial study area, it is located within Al-Anbar Governorate, it is bounded on the north by the Valley of Al-Tayyarat and on the east by the Valley of Al-Safia, while on the south it is bordered by the Euphrates River, and by the Valley of Al-Aquod to the west, and its area is (356) km2.

The results of the evaluation showed that all surface water samples located to the north of the study area are not suitable for human drinking, which are represented by samples (S1, S2, S3, S4, S5, S6) because they do not conform to the internationally approved specifications, As a result of the high concentration of salts in it. While the results of the samples located south of the study area are within the specifications, they can be used for human drinking as well as for other uses.

Introduction:

The study of analyzing and evaluating the suitability of surface water for multiple uses in the Valley of Shabala basin is of great interest, as it represents an important natural wealth that can be relied upon in the development of water resources in these areas, Especially since the study area has less surface water resources, is seasonal runoff, and cannot meet the population's water needs.

The basin in the study area represents an important source of surface water, which is characterized by its seasonality, so its discharges increase during the rainy season and it is exposed to complete drought in the summer. This has a clear impact in the region, as its residents suffer from scarcity of water, which has led to a shrinking of agricultural areas and a decrease in their production. Accordingly, it became necessary to compensate for the shortage of water from the Euphrates River, especially since the region is characterized by surface water flow during the rainy season.

Research problem:

Do the qualitative characteristics of the surface water differ in the study area basin? How suitable is it for various uses?

Research hypothesis:

Are the qualitative characteristics of the surface waters of the Valley basin of the study area varying spatially from one site to another? And differ in the extent of suitability for different uses?

Research objectives:

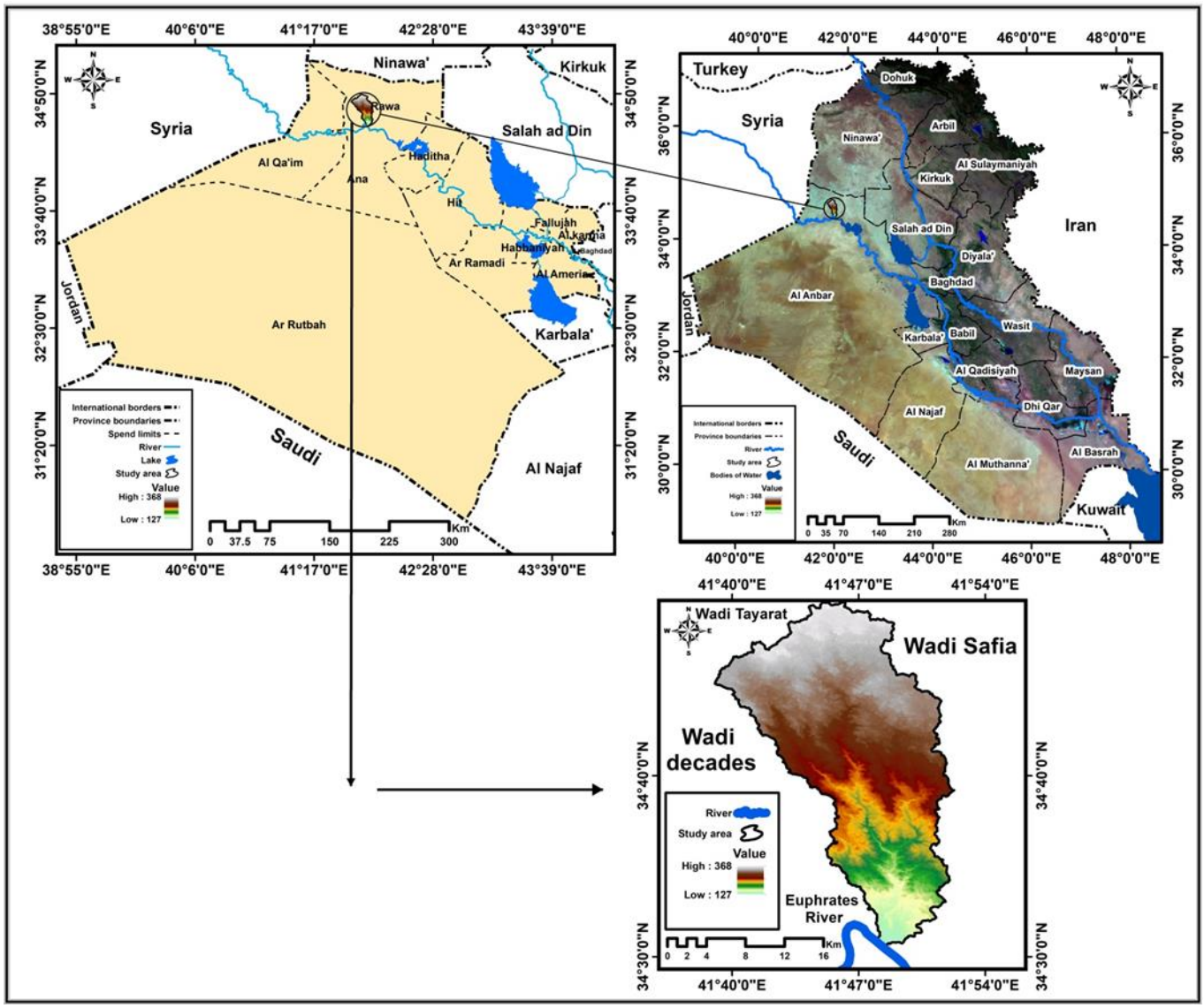
Evaluating the surface water characteristics in the valley of the study area and comparing it with international and local specifications to see its suitability for different uses.

The limits of the study area:

The study area is located astronomically between latitude 34 ° 30'37 ") and (34 ° 49'38") north and between longitude (41 ° 39'3 ") and (41 ° 52'17") east. Geographically, it is located in the western part of Iraq, in the northwest of Al-Anbar Governorate, Map (1).

Map (1)

The location of the study area at Iraq



Source: depending on:

1-General Survey Authority, topographical maps of the study area, scale 100000: 1.

2-Visible Imagery of the satellite (Land sat8) for the year (2018), with an accuracy of (30 m).

Qualitative characteristics of water:

The qualitative characteristics vary in time and place according to several factors, including climatic factors, the volume of water discharges to the area, as well as the type of water that feeds it. The physical properties of water are one of the basic factors for diagnosing the degree of water validity for various uses, specifically in the areas of human and animal consumption as well as the industrial aspect (Ali Hamid, 2018).

1. **Physical properties:**

It is represented by color, taste, turbidity and temperature that will be taken as follows:

A. The color:

Pure water has several characteristics, one of which is colorless, except for the organic materials present in the water, which are represented by algae in relation to surface waters. (Mehdi Hatem,

2010). Water does not have a specific color, and when it is present in a large amount, its color tends to be blue, because it contains magnesium and calcium compounds. It also tends to be green when it contains hydrogen sulfide. As for manganese, it takes a black color. (Jihad Ali, 2003). And by analyzing the results of the samples, it was found that most of the samples were colorless except for the sample (1,2), so they were light yellow and yellowish, respectively, due to the presence of humic compounds.

B. **The taste:**

Pure water has a palatable taste, and every gas or chemical compound, organic or inorganic, works during dissolution in water to give the water a specific taste that depends on the quality and quantity of the substances dissolved in the water. It is known that taste is the method used to identify the special taste of this water. After tasting the water samples for the study area, it became clear that all of them were tasteless except for the sample (2S), so it tasted unpalatable. The reason for this is that the open water, although it does not contain any reactive compounds, absorbs a few parts of "carbon dioxide" in the air, which makes its taste change in a very small rate as it tends to acidity, but it does not spoil it.

C. **Turbidity:**

The water turbidity is one of the measures of the degree of purity and permeability of surface water, because it contains suspended particles that represent mud, silt and other organic materials and microorganisms that adhere to the water of streams and tributaries, (Yahya Abbas, 1989). The limit permitted by the World Health Organization and the Iraqi standard specifications is (5-25 NTU), (Maher Ahmad, 2007). From what we note from Table (1), the turbidity values are low in all samples. It is within the permissible limits, but it must be noted that the turbidity values are variable. Because of the speed of the water flow, and the suspended substances carried by the water, which determine the turbidity value.

D. **Temperature:**

The temperature of the water varies in time according to the change of climate elements, including: solar radiation, wind movement, relative humidity and evaporation that lead to its rise and fall, according to the rates of temperature, The temperature of surface water is low in the winter season and relatively high in the summer, and in a different way from the groundwater, in which the temperature increases relatively in the winter and is relatively low in the summer (Qasim Obaid, 2010). The temperature affects the physical, chemical and biological balance, in addition to its effect on the increase in the water temperature on the life of aquatic organisms, as the high temperature reduces the amount of dissolved oxygen in the water and increases the activity of bacteria. (Khalaf Hussein, 2020). By looking at Table (1) for the temperatures of the samples of the study area, it was found that there is a variation in the surface water temperatures, so the highest temperature was (19.9) in the sample (1S), and the lowest temperature was (18.8) in the sample No. (12S).

E. **Electrical connection (EC):**

It is a measure of the amount of salts dissolved in water (Khalaf Hussein, 2020). The importance of this feature is in knowing the volume of dissolved materials in surface water. Where it indicates the degrees of salinity, and there is a direct relationship between the total percentage of dissolved materials and electrical conductivity. When the quantities of salts increase, the electrical conductivity increases with it. Through Table (1) it was found that the values of (Ec) in the samples of the study area ranged between (0.673 - 10.95) and that all of them are within or below the rate, except for the samples (s1, s2,3s, 4s, 5s, 6s), where the conduction reached (7.326, 10.951, 5.823, 4.963, 5.001, 2.699).

2. Chemical properties:

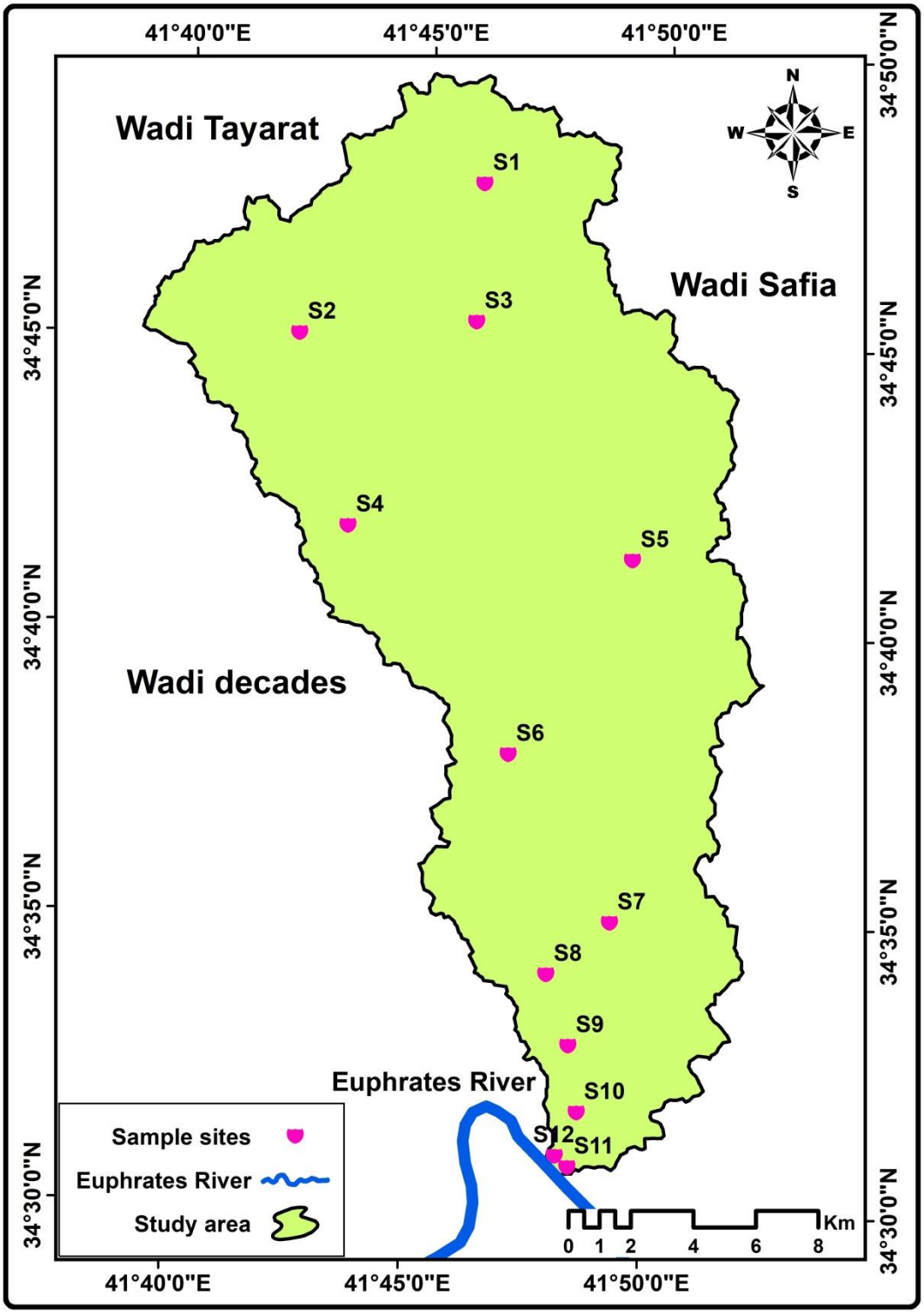
The chemical composition of water consists of many ions, minerals, and organic and inorganic materials that mix with running water during the period of water contact with rock formations during the water flow. Through my field study, (12) samples were selected for different locations within the study area for analysis. Map (1) notes, and the analysis of the surface water characteristics was done according to this basis, and the chemical properties analysis was divided into:

Table (1)
Physical and chemical properties of surface water samples in the study area

CO_3^{--}	HCO_3^-	SO_4^- 2	NO_3^-	CL^-	Ca^{++}	Mg^{++}	K^+	Na^+	TH	TDS	TURB.	EC	pH	Temp. C^0	ت
328	535	576	54.8	923	380	210.7	18.3	243	579	3660	1.31	7.326	8.75	19.9	1
427	524	785	56.4	1562	420	243.4	35.8	253	512	5480	2.21	10.951	8.40	19.6	2
273	591	334	53.1	561.5	385	189.2	14.3	245	554	3410	1.98	5.823	8.93	19.8	3
187	489	254	47.1	583	332	161.5	17.53	206	510	2568	1.61	4.963	8.80	19.6	4
193	534	287	32.6	342	349	150.1	20.0	213	527	2351	1.41	5.001	8.63	19.4	5
113	387	252	9.3	306.5	395	153.8	13.45	205	434	1525	1.27	2.699	8.59	19.2	6
134	126	183	7.4	0.90	12.5	10.5	1.23	10.09	127	448	1.32	0.724	7.20	19.5	7
115	146	187	6.1	105	88	29.5	1.45	18.9	123	336	1.35	0.673	7.51	19.3	8
128	173	179	6.9	106	92	30.8	1.53	19.6	126	481	1.23	0.959	7.61	19.2	9
141	125	201	4.2	142	84	28.1	1.36	18.8	109	439	1.46	0.877	7.61	19.2	10
34	129	207	3.2	156	86	27.9	1.19	17.8	115	440	1.86	0.879	7.08	19.0	11
141	131	184	3.1	148	81	26.5	1.28	9.5	95	416	1.73	0.831	7.55	18.8	12

Source: the researcher and based on laboratory analyzes of the samples in the study area.

Map (2)
Surface water sample locations



Source: The researcher, depending on the G.P.S device in the spatial survey during the field study.

A. Power of Hydrogen (pH):

Its values vary between (0-14). If the water is acidic, the PH values are less than (7), while the water becomes basic if the PH values are more than (7). The water is neutral when the pH values are (7),

(Zeina Khaled, 2017), and from reviewing the results of the laboratory analyzes of the pH values of the surface water samples for the study area: It turned out that the majority of the study samples were basic, but all the spatial categories within the Iraqi standard standards were observed in which the sample values (s1, s2,3s, 4s, 5s, 6s) exceeded the limits due to their height and the recording of all the study samples as base water due to the flow of the feeding water on Gypsum rocks, Increasing concentration causes headache, nausea, vomiting and numbness in the face and extremities. As for the validity of the PH values for human drinking, all surface water samples were within the limits of international, American and Iraqi standards and could be used for human drinking, except for the above samples, which exceeded the approved specifications. It can be used for various industries, most notably chemical and petroleum, canning and food industry, cement, textile and paper industries.

B. **Total hardness (Th):**

The analysis of total hardness was based on the classification of the scientist Tood, in which he divides hardness into (Tood, 2005):

- Non-hard water, The TH value is less than (75 mg/ liter).
- Water is of medium hardness and ranges between (75 - 150 mg / liter).
- The hard water ranges between (150-300 mg / liter).
- Very hard water where TH is more than (300 mg / liter).

It was noticed that hard and non-hard water did not constitute any percentage of the water in the study area. As for the water of medium hardness, it is represented by samples (7,8,9,10,11,12), where the hardness is (127,123,126,109,115,95) respectively. As for the samples with very hard water, they were represented by samples (S1, S2, S3, S4, S5, S6), where the hardness reached (579, 512, 554, 510, 527, 434) respectively. To track the spatial dimension, it appears that the total hardness ranges in its values from samples of medium-hard surface water in the south of the study area, and to very hard water at the sites of the northern region samples of the study. As for the validity of hardness (TH) for human drinking, all surface water samples were within the limits of international, American and Iraqi standards, except for the above samples, which exceeded the approved specifications. It can also be used to drink animals, and it is in a very good rating. Note the tables (2,3).

C. **Total dissolved solids T.D.S:**

Through looking to the results of laboratory tests in (Table 1) shows that the majority of the samples north of the study area has exceeded the approved specifications, The samples are represented by (S1, S2, S3, S4, S5, S6), where the value of (TDS 3660, 5480, 3410,2568,2351,1525) was recorded, respectively, and they occupy the spatial dimension north of the study area. It is the same geographical area recorded for the total hardness height. As for its validity for human drinking, all samples were within the limits of the permissible specifications except for the samples above, as they exceeded the limits of the specifications, reaching (3660, 5480, 3410, 2568, 2351 and 1525) respectively. It can be used for animal drinking and most of them fall within the very good category, except for sample No. (2S), which falls within the good classification and can be used. The following sample values (s1, s 2, 3s, 4s, 5s, 6s) cannot be used in all industries, As for the textile industry, there are some surface water samples suitable for use, including (S7, S8, S9, S10, S11, S12), As for paper industries, some samples are suitable for this industry except for the following samples (S1, S2, S3, S4, S5, S6).

Table (2)
American and Iraqi international standards in units (mg / liter) for human drinking
And comparing it with the surface water in the study area

Iraqi specifications	American specifications	international specifications	Element
8.5-6.5	8.5-6.5	8-7	PH
500	500	500	TH
1000	1000	1000	T.D.S
200	200	200	Na^{+}
50	50	50	Mg^{++}
50	50	75	Ca^{++}
-	-	12	K^{+}
250	250	250	Cl^{-}
250	250	250	SO_4^{-}

Source:

1. U.S.P.H.S., Ground water Hydrology, John Wiley, New Yourk, 1962, p. 535.
2. WHO, International Standards for Drinking water world Health Organization, 4 Edition, Switzerland, 1999, p.36.
3. Central Agency for Standardization and Quality Control, Iraqi Drinking Water Standard Specifications No. 417, 2001.

The main ions are divided into two types:

- **Positive ions:**

1. Calcium (Ca^{+}):

Through carefully looking at the results of the analyzes values shown in the previous table (1): it was found that the value of (Ca^{+}), ranged between (81-420) mg / liter, It is within the acceptable limits except for samples (s1,2s, 3s, 4s, 5s, 6s) respectively, as their values reached (380,420,385,332,349,395) mg / liter. They are all located in the north of the study area. As for its suitability for human drinking, all surface water samples exceeded the approved specifications. It can be used for animal drinking and falls within very good water except for samples (s1, s2, 3s, 4s, 5s, 6s), which fall within good water. And that most of the above surface water samples cannot be used in all industries because they exceeded the approved specifications, and are located in the north of the study area. As for the rest of the samples located south of the study area, they are valid for all industries, and all samples can be used in the construction and building industries for the low values of ion concentrations in them. Tables (2,3,4).

Table (3)

Specifications of the safe drinking water for animals and comparing it with the water of the study area

the highest rate	water that can be used	Water allowed	Very good	Very good water	Elements
54,000	4700	4000	3200	1500	T.H
1500	10000	7000	5000	3000	T.D.S
4000	2500	2000	1500	800	Na
1000	900	800	700	350	Ca
700	600	500	350	150	Mg
6000	4000	3000	2000	900	Cl

15000	**10000**	**7000**	**2500**	**1000**	**So4**

Source: A Hoviski, M.E, Hand book of hydrogeology, Gosgeolitzdat Moscow, USSR (in Russian) 1962. P. 614.

2. Magnesium (Mg):

Through looking at the values of the laboratory tests for the magnesium ion in Table (1), we find that some sample values fall within the permissible limit except for the samples (s1, s2,3s, 4s, 5s, 6s) and they reached (210.7,243.4,189.2,161.5, 150.1,153.8) respectively, They are all located to the north of the study area. As for its potency for drinking, all samples fall within the limits of the approved specifications, except for the above samples, which exceeded the limits of the approved specifications. It can be used to drink the animal as it falls within the (very good) classification, except for the above samples, which are located in good water. And that all surface water samples can be used in the oil industry, except for the above samples, As for the chemical industries, the majority of samples are valid for this industry except for samples (s1, s2), and all samples can be used in the construction and building industries for the low values of ion concentrations in them, note the tables (2,3,4).

Table (4)

Specifications and standards for water suitability for industrial purposes (mg / liter)

Paper industry	Textile industry	Cement industry	Food Industry	chemical industries	oil industries	Elements	No.
9.4 – 4.6	**8 - 2**	**8.8 -6.9**	**no more 8.5 than**	**9 – 5.5**	**9.0 -6.0**	**PH**	**1**
no more 1080 than	**no more than 1000**	**200**	**no more 120 than**	**no more 10000 than**	**no more 500 than**	**TDS**	**2**
			no more 120 than	**no more 200 than**	**no more 220 than**	**Ca**	**3**
			no more 0,2 than	**no more 200 than**	**no more 85 than**	**Mg**	**4**
					no more 230 than	**Na**	**5**
					no more 230 than	**K**	**6**
no more 1000 than		**100**	**no more 300 than**	**no more 500 than**	**no more 1600 than**	**CL**	**7**
		235	**no more 250 than**	**no more 850 than**	**no more 570 than**	**SO4**	**8**
				no more 600 than	**no more 480 than**	**HCO3**	**9**
			no more 45 than		**no more 8 than**	**NO3**	**10**
no more 05 than	**no more 0.3 than**	**1.8**	**no more 120 than**	**no more 5 than**	**no more 15 than**	**Fe**	**11**
	no more 1 than	**5**		**no more 2 than**		**Mn**	**12**
	no more 0,5 than					**Cu**	**13**

Source: The researcher, and based on Muhammad Mahdi Al-Sahaf, Water Resources in Iraq and their Maintenance from Pollution, Ministry of Information Publications, Iraq, 1976, p.170.

3. Sodium (Na):

The results of the sodium ion analyzes in the study area show in Table (1): that some of the samples values located north of the study area exceeded the permissible limits and are represented by samples (1s, 2s, 3s, 4s, 5s, 6s) whose values amounted to 243,253 245,206,213,205) mg / liter. As for the samples located in the south of the study area, they did not exceed the permissible limits. As for its suitability for human drinking, the majority of the samples did not exceed the limits of the approved specifications except for the above samples and are suitable for animal drinking, It falls under the (very good) rating. Most of the samples are suitable for use in the petroleum industries except for the samples (S1,2S, S3), which are not valid. All samples can be used in the construction and building industries to have low values of ion concentrations in them, see Tables (2,3,4).

4. Potassium (K):

through the observation of Table (1) related to the values of the laboratory analyzes of potassium ion, it becomes clear that: Some results of samples that occurred in the north of the study area exceeded the permissible limits. The samples are represented by (s1, s2, s3,4s, 5 s, 6s), as their values reached (18.3,35.8,14.3,17.53,20.0,13.45) mg / liter, respectively. It is located in the south of the study area and did not exceed the permissible limits. As for its suitability for human drinking, most of the samples fall within the limits of the approved specifications, except for the samples above, which have exceeded them. All of them can be used in the petroleum industry to reduce the concentration ratios of this ion. See tables (2,3).

- **Negative ions:**

1. Sulfate (SO_4):

through viewing Table (1) related to the laboratory analysis section for the sulfate ion, it is clear: Some samples located north of the study area exceeded the permissible limits (S1, S2, S3, S4, S5, S6), as their values reached (576, 785, 334, 254, 287, 252) mg / liter, respectively, As for the samples located in the south of the study area, they did not exceed the permissible limits. It can be used to drink the animal which falls within a very good rating. The majority of surface water samples are valid for use in the petroleum and chemical industries, with the exception of samples (S1, S2), and they can be used in the chemical industries as they fall within the permissible limits. As for the food industry, some samples of surface water are suitable for use except for samples (S1, S2, S3, S4, S5, S6). As for the cement industry, all samples are suitable for use except for the above samples. All samples can be used in the construction and building industries for the low values of ion concentrations in them.

2. Chlorine(Cl^-) :

Through noting Table (1), we find: that the majority of samples of this ion in the north of the study area exceed the permissible limits at the global and local levels, and as in the samples (s1, s2, s3, 4s, 5s, 6s), their values reached (923) 1562,561.5,583,342,306.5) mg/ liter; The reason is due to the rapid dissolution of sedimentary rocks by waterways, due to the increase in evaporation as a result of the increase in temperature and precipitation. As for the samples located in the south of the study area, they did not exceed the permissible limits. As for their portability, most of the samples fall within the limits of the approved specifications, except for the above samples, which exceeded the limits of the approved specifications. It can be used for animal drinking as it falls within the very good classification except for samples (1s, s2, s3), which fall within the good water. Most of them can be used in the oil industries, as for the chemical industries, all of them are valid for use except (s1, s2, 3s, 4s) because they have exceeded the limits, As for the food industries, some samples are valid for use except for samples (s1, s2, 3s, 4s, 5s, 6s), As for the cement industry, some of them are not suitable for use. As for the paper industry, all samples are valid for use except for the sample (S2). All samples can be used in the construction and building industries for low values of ion concentrations, seen tables (2,3,4).

3. Carbonate (CO_3^{-2}):

Through looking at the values of the analyzes related to the carbonate ion CO3, we find: They are different values that ranged between (34) mg / liter for the sample (11S) and (427) mg / liter for the sample (S2), which recorded the highest rate of carbonate ion, Thus, all samples exceeded the permissible limits, the most severe in the north of the study area. One of the most important causes of CO3 decline is the prevalence of dry and semi-arid climate conditions and fluctuations in rainfall in the study area. As for their drinking validity, most of the samples fall within the limits of the approved specifications except for the samples (s1, s2, s3, 4s, 5s, 6s) that have exceeded the limits of the approved specifications. seen table (2).

4. **Nitrate (NO_3^-):**

It is clear from the values of the laboratory analyzes of nitrate ion that all surface water samples in the north of the study area exceeded the approved Iraqi specifications and some of them exceeded international standards as well. In contrast to the samples from the south of the study area, all of them are within the permissible limits, and the values ranged between (3.1) in the sample (12s), which are the lowest values. While the value (56.4) in the sample (2s) represented the highest values, Most of the water samples can be used for petroleum industries except for samples (1s, s2, s3,4s, 5s, 6s), and some of them are suitable for use in the food industry except for samples (s1, s2,3s, 4s), which are not valid.

5. **Bicarbonate HCO_3:**

It is evident by observing the values of laboratories analyzes in the previous table (1): that the majority of surface water samples that take a spatial position in the spatial scale of the north of the study area exceeded the permissible limits, In contrast to the samples from the south of the study area, all of them are within the permissible limits. The values range between (125,591), as for their suitability for industry, some samples can be used in the oil industries except for samples (s1, s2, 3s, 4s), As for the chemical industries, all water samples are suitable for use.

Table (5)
The permissible limits of ion concentrations for construction and building purposes

Permissible proportions mg / l	Elements
1160	Na^+
437	Ca^+
271	Mg
2178	CL^-
1460	$SO4^{-2}$

Altoviski , M. E: Handbook of Hydroheollgy goegoelitzet , Moscow ,(In Russian). 1962.

The Results:

This research is concerned with studying the analysis and evaluation of surface water validity in the Valley of Shabala basin. The research revealed that the water of the valley basin is collected from rain water. It reflects the prevailing climatic conditions, and interacts with the rocks and the nature of the earth's structure. The researcher also found that it has multiple uses, which is what prompted us to evaluate it.

In order to analyze the characteristics of specific water (physical and chemical), we took samples from surface water, which were (12) samples and for different areas. We conclude that the surface water

is colorless, tasteless and odorless, with a temperature that reflects the prevailing climatic conditions. Most of the samples are basic, and they are of medium hardness, with the exception of the parts in the north of the study area, and the positive and negative ions vary within the permissible limits, with an exception to that in the north of the study area.

The results of the evaluation showed that some surface water samples are suitable for human drinking except for samples (s1, s2, 3s, 4s, 5s, 6s), because they do not conform to international standards. As for their suitability to the industrial aspect, some samples of surface water are suitable, except for the samples above, and some of them are suitable in some industries. As for their suitability for animal drinking, all of them are suitable for animal drinking. As for the construction and construction purposes, all surface water samples in the study area can be used in the construction and building industries due to the low values of ion concentrations in them.

The Sources:

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