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عدد خاص بنشر بحوث المؤتمر بعنوان (مستقبل الأداء الأكاديمي في ضوء أبعاد التنمية المستدامة) المنعقد حضورياً في بغداد
بتاريخ ٦/ ٧(تموز) /٢٠٢٤م.

التلوث البيئي والخصائص الهيدروكيميائية وتأثير الأنشطة البشرية على المياه الجوفية في محافظة واسط – بدرة ومعرفة استعمالات المياه للأغراض المختلفة

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الملخص :

تم أخذ ثلاثة وعشرون عينة من منطقة بدرة في محافظة واسط لتحديد خصائص المياه وبعض المتغيرات الكيميائية والفيزيائية. وقد تبين أن المياه الجوفية في مناطق الدراسة حمضية. وقد تم اخذ الأيونات الموجبة : الكالسيوم، والصوديوم، والبوتاسيوم، والكبريتات، والمغنيسيوم، والأيونات السالبة مثل البيكربونات، والنترات، والكلوريد. الكيمياء الهيدروكيميائية في العينة هي ($Na-SO_4$)،($Ca-SO_4$)، و(Na-Cl) نظراً لوجود هذه الأيونات بكميات كبيرة وبعد مقارنة النتائج في العراق ومنظمة الصحة العالمية تبين أن هذه المياه غير صالحة للشرب البشري. ولأن نسبة الملح كبيرة، وهي صالحة لشرب الحيوانات، وفي حين أن هذه المياه صالحة لأغراض البناء، إذ أن جميع عناصرها لم تتجاوز الحدود المسموح بها، فقد وجدت الدراسة أن هذه المياه غير صالحة لأغراض الري،

الكلمات المفتاحية : نوع الماء، المياه الجوفية، مياه الري، الصيغة الكيميائية:

Environmental pollution, hydro chemical characteristics, and the effects of human activities on groundwater in Waist Governorate - Badra, and knowledge of water uses for various purposes.

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Abstract:

Twenty-three samples were taken from the Badra area in Wasit Governorate to determine water characteristics and some chemical and physical variables. It has been shown that groundwater in the study areas is acidic. You took positive ions: calcium, sodium, potassium, sulfate, and magnesium, and negative ions such as bicarbonate,

nitrate, and chloride. The hydrochemical chemistry in the sample is ($Na\text{-}SO_4$), ($Ca\text{-}SO_4$), and (Na-Cl) due to the presence of these ions in large quantities, and after comparing the results in Iraq and the World Health Organization, it was found that this water is not suitable for human drinking. Because the percentage of salt is large, and it is suitable for drinking animals, and while this water is suitable for construction purposes, as all of its elements did not exceed the permissible limits, the study found that this water is not suitable for irrigation purposes**.**

Keywords: water type , groundwater , irrigation water, chemical formula

introduction :

Groundwater is an additional major source of water for all parts of the world, as the formation of this water is due to climatic factors and natural changes in addition to the hydrographic nature of the earth. Groundwater can be accessed through weakly permeable separation layers (1). One of the most important objectives of the study is the hydrochemical formula of the water in the study areas, its physical properties, chemical properties, chemical composition, and the most important uses of this water.

Previous studies:

1- (Aziz, 2018): this deliberate aim to discover the west in groundwater in Karbala city , originate that the salts fraction and conductivity of electrical is tall and that hydrochemical formula to all sample($CaSO_4$)and the water in all this sample not suitable to drinking human and animals (3).
2- (Mahmoud and Nassif , 2015): this deliberate several wells in Samarra city, the study results that (pH) inclines the alkaloid is light and the ions of positive have unlike attentions and ions of negative are situated in the waters of natural (2).
3- (Al-Khafaji et al., 2020) this study of groundwater in Maysan city, it founded the water inclines slightly of acidic, upsurge in sald and conductivity of electrical was present , the water in all sample wasn't appropriate for drinking of human (4).

Study area: Badra is an Iraqi town and district center in Wasit Governorate near the Iraqi-Iranian border. Its area is estimated at about 1794 km2, located between

the lines (33.116667 ON & 45.95OE). Its height is estimated at about 94 meters, specifically about 200 km southeast of the capital, Baghdad, to the east of the city of Kut. (70) km away, and (20) km away from the Iraqi-Iranian border, where it meets on the Iranian side the Pashtakuh Heights of Mehran Governorate (5) Figure (1) the location of Badra.

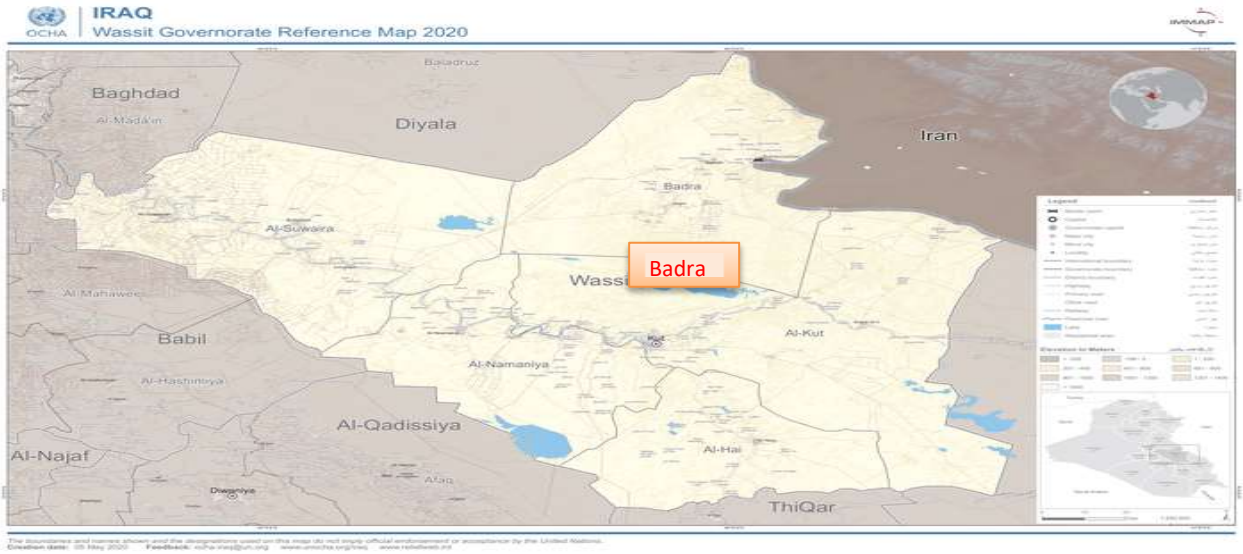

Figure (1) shows the geographical location of Badra (6)

Geology of the area

The geological system in the Badra Basin is characterized by the presence of two types of underground reservoirs. The deposits of the Quaternary period (Pleistocene) represent an open reservoir in some locations, and confined in other locations in the basin. These deposits, represented by sedimentary fans and flood plains, descend towards the south and southwest and spread throughout Large areas to cover most of the area of the basin, characterized by the presence of rocks consisting of a succession of gravel, silty sand and clay, and a succession of sandstone, which contains in several levels fine gravel, and an succession of siltstone and mudstone, and its depth increases towards the south and southwest due to the increase in the thickness of the Quaternary sediments.(7) Figure (٢) the geological system of Badra.

Figure (2) illustrates the geological study area (8)

Working methods and materials:

Twenty-three wells were taken from different wells in the Badra area in the center of Wasit city. The wells were identified according to laboratory conditions according to what was available. Which was excavated by the Ministry of Water Resources (Groundwater Corporation) in 2014. The analyzes included electrical conductivity, total dissolved salts, pH, and cations. (K +, Na +, Mg + 2, Ca + 2) The negative ions are (H-CO3-, SO42, Cl-), and they are analyzes approved by the General Authority for Drilling Wells and Groundwater in the Ministry of Water Resources. The indicator is meroxide and aerochrome (ebt), and the indicator is a device. Measure sodium, potassium and chloride with correction. (AgNO3) The dissolved salts are used by gravimetric method by electrical conductivity and drying to the conductivity of an electrical device with the function of an acidic device (Ph Meter). Figure (3).

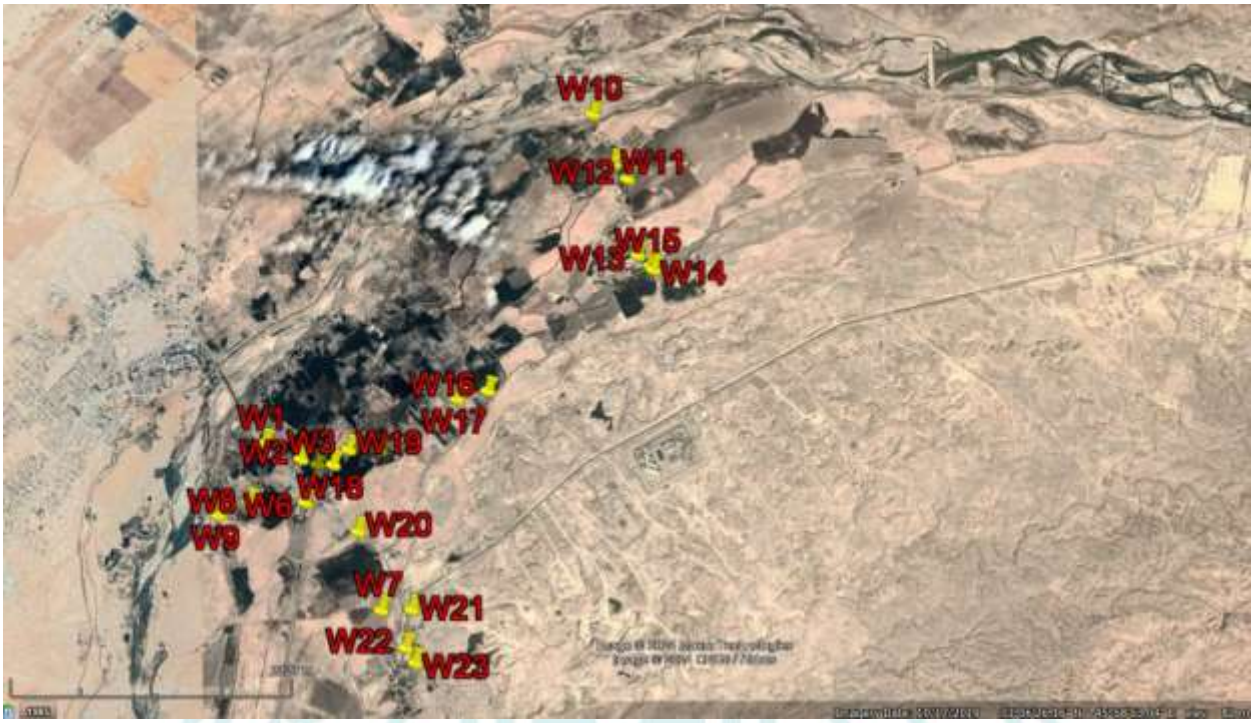

Figure (3). **shows the sites for taking samples**

Discussion and Results :

Properties of Physical:

1- (pH) acidic function : it is the logarithm of negative to hydrogen ion attentiveness considered scale the basicity of acid in the temperature is normal and weight (6), The lowest value was swallowed in well No. (15). The highest value was (7.11) in well No. (20), reaching (7.22).Table No. (1) illustrates this.

2- (EC) conductivity of electrical: It refers to the ability of water to conduct an electric current in a solution over a certain distance, usually measured in Siemens (S) per distance. Water's ability to conduct electricity comes from the concentration of ions within the water, which comes from dissolved solids and inorganic material (25) The lowest value was in well No. (18), where it reached (5700 microseconds/cm), and the highest value was in well No. (2), when it reached (3050 microseconds/cm). This increase in electrical connections in groundwater area of study is due to increase in the percentage of salts and impurities in these waters. To classify the water samples in the study areas as highly mineral (table 1&2)

3- (TDS) Total Dissolved Solids: It is the total amount of solids dissolved in water, including soluble hydrogen carbonate ions, chloride salts, sulfates, calcium, magnesium, sodium, potassium, volatile solids, and non-volatile solids. Its concentration will affect the taste of drinking water. One way to measure it is to filter the water sample (0.45 μm), dry the solution at 103°C to 105°C and then weigh the remaining residue. (15) . Its highest value in Well No. (١٨) reached (3730), and its lowest value in Well No. (2) reached (2020). The reason for the high concentrations in dissolved solids (TDS) is that the water in the area of this study is affected by evaporation processes due to Due to its small depth area (Table 1) shows this

Table. (1) features of bodily wells in study area

N,	pH	EC (μs\Cm)	TDS (mg/L)
1	7.17	4960	3250
2	7.19	3050	2020
3	7.18	3060	2025
4	7.18	4330	2800
5	7.16	3810	2470
6	7.20	3430	2230
7	7.14	3590	2620
8	7.18	3610	2360
9	7.19	3720	2465
10	7.14	3600	2350
11	7.21	4430	2900
12	7.18	3940	2570
13	7.12	4410	2870
14	7.14	4000	2583
15	7.11	3670	2370
16	7.22	3540	2293
17	7.18	4350	2820
18	7.14	5700	3730
19	7.16	3950	2590
20	7.22	3770	2480
٢١	7.20	4090	2640
٢٢	7.20	4080	2630
٢٣	7.17	3790	2500

Chemical properties:

Cationic ions (cations)

1- **Calcium** Ca^{2+}

It is one of the most important alkali elements, and it is considered a necessary element for animals as it is involved in the formation of bones as well as in the growth of plants. It is found in minerals and rocks, and is found in igneous rocks and minerals such as pyroxene, feldspar, and amphibole, as well as sedimentary mineral rocks such as dolomite, aragonite, calcite, gypsum, and fluorite (13). . The highest percentage of this ion in the well is (340) mg/L. Sample No. (18) the lowest value is (130) mg/L. Sample No. (13) and the average concentration is (241.5) mg/L. Table No. (3) shows

2- **Mg^{+2} (Magnesium)**

It is found in dolomite, which is considered a carbonate mineral, and calcite, which originates from magnetic and iron igneous rocks. It is also found in olivine, amphibole, and pyroxene, and clay is considered the most important source of this ion (10).). The results showed that the highest value is (154) mg/L in Well No. (8), the lowest value is (86) mg/L in Well No. (5), and the average is (129.1) mg/L. to. Table No. (3): High concentration of this ion in water as a result of the effect of evaporation processes. The basis of this ion is agricultural areas (20)

3- **Potassium k^{+}**

Alkali metals are less abundant than the ion of sodium. It come in metals like orthoclase, microcline and feldspar, and is originate in rocks of evaporite like sulfite (13). It was found in highest attention of ion of potassium It reached (110) mg/l sample number (18) and lowermost attentiveness was (6) mg/l sample number . (14), rate (31.9) mg/l (T.3)shows that). Due to the reason for the increase in the concentration in potassium in the groundwater. It may be due to the result of using biochemical manures or usual evaporite excellence rocks in reservoir of water.

4- **Na^{+1}**

It is formed in wells as a result of the dissolution of plagioclase minerals with evaporated materials such as halite, and as a result of the weathering of clay minerals (15). (The highest percentage of these ions is (563) mg/L sample number. (11) and the lowest percentage is (212) mg/L sample number. (6) The percentage is (396.9) mg/L (T.3)) This indicates that The

high percentage of these ions in the water is the result of the dissolution of this salt in the soil (23)

(T,3) ions of cationic attentions of wells of studied sites of area

N.		Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	∑Cations
1	PPm	296	137	459	100	992
	Epm	14.8	11.4	19.9	5.2	51.3
	epm%	28.8	22.2	38.7	10.1	100
2	Ppm	198	115	280	12	605
	Epm	9.9	9.5	12.1.	0.6	32.1
	epm%	30.8	29.5	37.6	1.8	100
3	Ppm	199	116	282	13	610
	Epm	9.9	9.6	12.2	0.6	32.3
	epm%	30.6	29.7	37.7	1.8	100
4	Ppm	250	125	475	10	860
	Epm	12.5	10.4	20.6	0.5	44
	epm%	28.4	23.6	46.8	1.1	100
5	Ppm	307	86	336	24	753
	Epm	15.3	7.1	14.6	1.2	38.2
	epm%	40	18.5	38.2	3.1	100
6	Ppm	254	141	212	10	617
	Epm	12.7	11,7	9.2	0.5	34.1
	epm%	37.2	34.3	26.9	1.4	100
7	Ppm	190	125	470	35	820
	Epm	9.5	10.4	20.4	1.8	42.1
	epm%	22.5	24.7	48.4	4.2	100
8	Ppm	272	154	239	16	681
	Epm	13.6	12.8	10.3	0.8	37.5
	epm%	36.2	34.1	27.4	2.1	100
9	Ppm	172	115	452	38	777
	Epm	8.6	9.5	19.6	2	39.7
	epm%	21.6	23.9	49.3	5	100
10	Ppm	270	152	237	15	674
	Epm	13.5	12.6	10.3	0.7	37.1
	epm%	36.3	33.9	27.7	1.8	100

11	**Ppm**	132	111	563	92	898
	Epm	6.6	9.2	24.4	4.8	45
	epm%	14.6	20.4	54.2	10.6	100
12	**Ppm**	240	130	390	17	777
	Epm	12	10.8	16.9	0,8	40.5
	epm%	29.6	26.6	41.7	1.9	100
13	**Ppm**	130	110	560	90	890
	Epm	6.5	9.1	24.3	4.7	44.6
	epm%	14.5	20.4	54.4	10.5	100
14	**Ppm**	220	101	450	6	777
	Epm	11	8.4	19.5	0.3	39.2
	epm%	28	21.4	49.7	0.7	100
15	**Ppm**	275	156	242	17	690
	Epm	13.7	13	10.5	0.8	38
	epm%	36	34.2	27.6	2.1	100
16	**Ppm**	262	150	227	12	651
	Epm	13.1	12.5	9.8	0.6	36
	epm%	36	34.7	27.2	1.6	100
١٧	**Ppm**	252	126	477	١١	866
	Epm	12.6	10.5	20.7	0,5	44.3
	epm%	28	23.7	46.7	1.1	100
18	**Ppm**	340	145	560	110	1155
	Epm	17	12	24.3	5.7	59
	epm%	28.8	20.3	41.1	9.6	100
19	**Ppm**	242	131	394	18	785
	Epm	12.1	10.9	17.1	0.9	41
	Epm%	29.5	26.5	41.7	2.1	100
20	**Ppm**	175	117	455	39	786
	Epm	8.7	9.7	19.7	2	40.1
	epm%	21.6	24.1	49.1	4.9	100
21	**Ppm**	225	104	457	9	791
	Epm	11.2	8.6	19.8	0.4	40
	epm%	28	21.5	49.5	1	100

٢٢	**Ppm**	٢٢٣	١٠٣	٤٥٥	٨	789
	Epm	11.1	8.5	19.7	0.4	39.7
	epm%	27.9	21.4	49.6	1	100
٢٣	**Ppm**	١٨٠	١٢٠	٤٦٠	٣٢	792
	Epm	9	10	20	1.6	40.6
	epm%	22.1	24.6	49.2	3.9	100

Anions

1- SO_4^{-2} (Sulfate):

Its presence in groundwater as a result of the liquefaction of Al-Khayrat rocks (molecule, anhydrite) formed by the oxidation of pyrite with marxite minerals in (clay) rocks (25). It reached the highest degree in sample No. (18), which was touched (1296) mg. /L was lower in sample No. (2), where it reached (892.9) mg/L, with a percentage of (905.7). (T.4). The sudden increase in sulfate ion (SO2) is due to the formation of substances whose salts contain sulfur as a result of adding sulfur salts to fertilizers present in the soil (23).

2- Cl^- (Chloride)

The source of this ion in water is marine water, as well as ancient water and the pores of advanced sedimentary rocks resulting from the smelting of halite (26). The highest percentage is sample no. (18) It reached (710) mg/L. The lowest percentage for sample No. (13) is (500) mg/L, with a rate of (553.7) mg/L. (T.4) This high concentration of chloride ion is caused by pollutants such as detergents, household waste, and sewage (24).

3- **Nitrates -: $N0_3^-$**

Much of the nitrate in water originates from the decomposition of carbon-based materials, agricultural activities, and the use of biochemical fertilizer (28). And the activity of some ammonia bacteria present in the soil that convert nitrite into nitrate, and this process is called nitrification (26). The highest concentration of nitrate in the water of the study area (2.2) mg/L sample number. (16) Minimum sample concentration (1.2) mg/L. sample n.(12) The general average concentration of nitrates in intentional water samples is (1.7) mg/L. (T, 4) The reason for the increase in nitrate concentration in some samples is due to the use of agricultural fertilizer (23).

4- Bicarbonate (HCO_3^-)

Bicarbonate is the source of alkalinity, and refers to the ability of water to bond with (H+). As for the total alkalinity as a result of the disintegration

of limestones, the rocks that contain phosphate or borates (15) in their composition have the highest sample number. (562) mg/L minimum sample number. (11) and Minimum sample concentration (111) mg/L. sample n. (23) It reached (325.5) mg/L and (T.4). An increase in the percentage of this ion due to the disintegration of sodium bicarbonate present in the soil (23)

Table. (4) the attentions ions of negative for wells in the located in area

N.		$SO4^{-2}$	Cl^-	NO_3^-	HCO_3^-	∑Cations
1	Ppm	1139	620	1.4	470	2230.4
	Epm	23.7	17.4	0.02	7.7	48.8
	epm%	48.5	35.6	0.04	15.7	100
2	Ppm	686	522	1.7	171	1380.7
	Epm	14.2	14.7	0.02	2.8	31.7
	epm%	44.7	46.3	0.06	8.8	100
3	Ppm	687	523	1.8	171	1382.8
	Epm	14.3	14.7	0.02	2.8	31.8
	epm%	44.9	46.2	0.06	8.8	100
4	Ppm	850	550	1.2	472	1873.2
	Epm	17.7	15.4	0.01	7.7	40.8
	epm%	43.3	37.7	0.02	18.8	100
5	Ppm	859	580	1.2	240	1680.2
	Epm	17.8	16.3	0.01	3.9	38
	epm%	46.8	42.8	0.02	8.4	100
6	Ppm	791	540	2.1	201	934.1
	Epm	16.4	15.2	0.01	3.2	34.8
	epm%	47.1	43.6	0.02	9.1	100
7	Ppm	1010	580	2.1	114	1706.1
	Epm	21	16.3	0.01	1.8	39.1
	epm%	53.7	41.6	0.02	4.6	100
8	Ppm	842	559	2.3	209	1612.3
	Epm	17.5	15.7	0.03	3.4	36.6
	epm%	47.8	42.8	0.08	9.2	100
9	Ppm	993	564	2.4	108	1667.4
	Epm	20.6	15.8	0.03	1.7	36.4
	epm%	56.5	43,4	0,08	4.6	100
10	Ppm	840	557	2.4	208	1607.4
	Epm	17.5	15.6	0.03	3.4	36.5

	epm%	47.9	42.7	0.08	9.3	100
11	Ppm	906	504	1.5	562	1973.5
	Epm	18.8	14.1	0.02	9.2	42.1
	epm%	44.6	33.4	0.04	21,8	100
12	Ppm	990	550	1.2	241	1782.2
	Epm	20.6	15.4	0.01	3.9	39.9
	epm%	51.6	38.5	0.02	9.7	100
13	Ppm	902	500	1.6	561	1964.6
	Epm	18.7	14	0.02	9.1	41.8
	epm%	44.7	33.4	0.04	21.7	100
14	Ppm	800	505	1.6	462	1768.6
	Epm	16.6	14.2	0.02	7.5	38.3
	epm%	43.3	37	0.05	19.5	100
15	Ppm	850	562	1.6	211	1624.6
	Epm	17.7	15.8	0.02	3.4	36.9
	epm%	47.9	42.8	0.05	9.2	100
16	Ppm	920	548	2.2	203	1673.2
	Epm	19.1	15.4	0.03	3.3	37.8
	epm%	50.5	40.7	0.07	8.7	100
17	Ppm	854	552	1.1	473	1880.1
	Epm	17.7	15.5	0.01	7.7	40.9
	epm%	43.3	37.8	0.02	18.8	100
18	Ppm	1296	710	1.3	537	2544.3
	Epm	27	20	0.02	8.8	55.8
	epm%	48.3	35.8	0.03	15.7	100
19	Ppm	995	555	1.2	243	1794.2
	Epm	20.7	15.6	0.01	3.9	40.2
	epm%	51.4	38.8	0.02	9.7	100
20	Ppm	997	566	2.1	109	1674.1
	Epm	20.7	15.9	0.03	1.7	38.3
	epm%	54	41.5	0,07	4.4	100
21	Ppm	814	510	1.3	465	1790.3
	Epm	16.9	14.3	0.02	7.6	38.8

	epm%	43.5	36.8	0.05	19.5	100
22	Ppm	٨١٠	٥٠٨	١.٤	٤٦٤	1783.4
	Epm	16.8	14.3	0.02	7.6	38.7
	epm%	43.4	36.9	0,05	19.6	100
23	Ppm	١٠٠٢	٥٧١	١.٥	١١١	1685.5
	Epm	20.8	16	0.02	1.8	38.6
	epm%	53.8	41.4	0.05	4.6	100

Hydrochemical formula

The hydrochemical formula is determined based on an equation in which we express the hydrochemical formulas in percentage units in mEq/L (%epm) for positive and negative ions whose percentage exceeds (15%), and according to the analysis results of the main positive and negative ions. (29) Table (5) Most of the areas taken from water samples are (Na-SO_4), and in some areas the formula is (Ca-SO_4), while other areas to a lesser extent are (Na – cl) due to the presence of quantities of positive ions from (Ca++) ion,(Na+) ion and chlorine-containing compounds.(T,5)

(T.5)the formula of hydrochemical in sites of wall

S.	Kurlov of Formula	Type of water
1	3250 $\frac{SO4(49)Cl(36)}{Na(39)Ca(29)Mg(22)}$ 7.17	Mg - Ca- Na –Cl – SO_4 $NaSO_4$
2	$\frac{Cl(64.)}{Na(38)Ca(31)Mg(30)}$ 7.19 2020	Mg - Ca- Na –Cl NaCl
3	2025 $\frac{Cl(46)\ SO4(31)}{Na(38)Ca(31)Mg30))}$. 7.18	Mg - Ca- Na –SO_4 -Cl NaCl
4	2800 $\frac{SO4(43)\ Cl(38)HCO3(19)}{Na(47)Ca(29)Mg(24)}$ 7.18	Mg - Ca- Na –HCO_{3-} Cl – SO_4 $NaSO_4$
5	2470 $\frac{SO4(43)\ Cl(38)HCO3(19)}{Ca(40)\ Na(38)Mg(19)}$ 7.16	Mg - Na – Ca- HCO_{3-} Cl – SO_4 $CaSO_4$

6	2230	$\frac{SO4(47)\ Cl(44))}{Ca(37)Mg(34)\ Na(27)}$	7.20	Mg - Na – Ca ـ Cl – SO_4 $CaSO_4$
7	2620	$\frac{SO4(54)\ Cl(42)}{Na(48)Mg(25)Ca(23)}$	7.14	Ca ـ Mg - Na –Cl – SO_4 $NaSO_4$
8	2360	$\frac{SO4(47)\ Cl(43)}{Na(47)Ca(29)Mg(24)}$	7.18	Mg - Ca- Na ـ Cl – SO_4 $NaSO_4$
9	2465	$\frac{SO4(57)\ Cl(43))}{Na(49)Mg(24)Ca(22)}$	7.19	Ca - Mg - Na –HCO_3- Cl – SO_4 $NaSO_4$
10	2350	$\frac{SO4(48)\ Cl43HCO3(19)}{Ca(36)Mg(34)\ Na(28)}$	7.14	Na –Mg - Ca- HCO_3- Cl – SO_4 $CaSO_4$
11	2900	$\frac{SO4(45)\ Cl(33)HCO3(22)}{Na(54)Mg(20)Ca(15)}$	7.21	Ca - Mg - Na –HCO_3- Cl – SO_4 $NaSO_4$
12	2570	$\frac{SO4(52)\ Cl(39)}{Na(42)Ca(30)Mg(27)}$	7.18	Mg - Ca- Na ـ Cl – SO_4 $NaSO_4$
13	2870	$\frac{SO4(45)\ Cl(33)HCO3(22)}{Na(54))Mg(20)Ca(15)}$	7.12	Ca - Mg - Na –HCO_3- Cl – SO_4 $NaSO_4$
14	2583	$\frac{SO4(43)\ Cl(37)HCO3(20)}{Na(50))Ca(28)Mg(21)}$	7.14	Mg - Ca- Na –HCO_3- Cl – SO_4 $NaSO_4$
15	2370	$\frac{SO4(48)\ Cl(33)}{Ca(36)Mg(34)Na(28))}$	7.11	Na –Mg - Ca- Cl – SO_4 $NaSO_4$
16				Na –Mg - Ca- Cl – SO_4

	2293	$\frac{SO4(51)\ Cl(41)}{Ca(36)Mg(35)\ Na(27)}$	7.22	$NaSO_4$
17	2820	$\frac{SO4(43)\ Cl(39)HCO3(19)}{Na(47))Ca(28)Mg(24)}$	7.18	Mg - Ca- Na –HCO_3- Cl – SO_4 $NaSO_4$
18	3730	$\frac{SO4(48)\ Cl(36)HCO3(16)}{Na(41))Ca(29)Mg(20)}$	7.14	Mg - Ca- Na –HCO_3- Cl – SO_4 $NaSO_4$
19	2590	$\frac{SO4(51)\ Cl(39)}{Na(42))Ca(30)Mg(27)}$	7.16	Mg - Ca- Na –Cl – SO_4 $NaSO_4$
20	2480	$\frac{SO4(54)\ Cl(342)}{Na(49))Mg(24)Ca(22)}$	7.22	Ca- Mg - Na –HCO_3- Cl – SO_4 $NaSO_4$
21	2640	$\frac{SO4(44)\ Cl(37)HCO3(20)}{Na(50))Ca(28)Mg(22)}$	7.20	Mg - Ca- Na –HCO_3- Cl – SO_4 $NaSO_4$
٢٢	2630	$\frac{SO4(45)\ Cl(33)HCO3(22)}{Na(50))Ca(28)Mg(21)}$	7.20	Mg - Ca- Na –HCO_3- Cl – SO_4 $NaSO_4$
٢٣	2500	$\frac{SO4(45)\ Cl(33)HCO3(22)}{Na(49))Mg(25)Ca(22)}$	7.17	Mg - Ca- Na –HCO_3- Cl – SO_4 $NaSO_4$

Uses of well water: The uses of well water for various purposes depend on the concentration of ions:

Human drinking: - Evaluating the suitability of the water in the studied samples for human drinking according to the standard specifications in Iraq for the year 2009 (27) and the international specifications (WHO) for the year 2017 (28) (shows T.6.)

Table (6) shows the water cogency models to drives of drinking

	The rate of variables in an area Studying	International specifications (WHO 2017)	Iraqi specifications 2009
PH	7.18	9.5 – 6.5	8.5 – 6.5
EC µs/cm	3951	1530	1530
T.D.S (ppm)	2589.8	1000	1000
Ca^{+2} (ppm)	241.5	75	150
Mg^{+2} (ppm)	129.1	100	100
Na^{+} (ppm)	396.9	200	200
K^{+} (ppm)	31.9	12	12
SO_4^{-2} (ppm)	905.7	250	400
Cl^{-} (ppm)	553.7	250	350
HCO_3^{-} (ppm)	325.5	400	400

The wells in the study area are not suitable for human drinking because their salinity is large and exceeds all the permissible positive limits, negative ions and chlorides, while bicarbonate is within the permissible limits with PH. The permissible electrical conductivity has exceeded, and as a result, the water is not suitable for human drinking

2- For animals drink

Find out cogency to the well rummage-sale for animals drinking for animal farming, Chemical of analyzes results of water in wells replicas on studied were compared in area with stipulations future (29) table. (7) illustrates

T.7water Stipulations used to animals of drinking (31)

E.s (ppm)	R. Studied Area	uppermost rate	Permitted water	Container be Used	Good water	Very decent water
Na^{+}	396.9	400	2000	2500	1500	800
Ca^{+2}	241.5	1000	800	900	700	350
Mg^{+2}	129.1	700	500	600	350	150
Cl^{-}	553.7	6000	3000	4000	2000	900
SO_4^{-2}	905.7	6000	3000	3000	2500	1000
TDS	2589.8	15000	7000	10000	5000	3000

We conclude from this that the studied area is suitable for raising and drinking animals, as all concentrations and dissolved solids did not exceed the permissible limits for animal drinking (31).

3- For industrial purposes:

To determine the suitability of the wells for industrial purposes, the results of chemical analyzes in the groundwater of the study area are evaluated and compared to the standard specifications for water use from various works (14) and (T.8 explains this).

T.8 limits of Suggested to industrial of water drives (14)

I.T / variable (ppm)	Rate Studied Area	Industry Of Paper	Industries Of Textile	Products Of Petroleum	Industry Of Fruit
Ca^{+2}	241.5	20	100	75	-
Mg^{+2}	129.1	12	50	30	-
Cl^{-}	553.7	200	500	300	250
HCO_3^{-}	325.5	-	250	-	-
SO_4^{-2}	905.7	-	100	-	250
TDS	2589.8	-	1000	1000	500
PH	٧.١٨	10 – 6	8 -6.5	9 -6	6.8 – 6.5

The above table indicates that the wells in the study area are not suitable to be used for various industrial purposes..

4- For building and construction purposes

The suitability of the well area for building and construction purposes was studied by comparing water models in the studied area with standard tables (28), explaining this (Table (9) shows this).

T.9shows limit of permissible to purposes of construction for dissimilar ions

I.	The rate in the studied area	Permissible limit
Na^{+}	396.9	1160
Ca^{+2}	241.5	437
Mg^{+2}	129.1	٤١٧
Cl^{-}	553.7	2187
SO_4^{-2}	905.7	1460
HCO_3^{-}	325.5	350

Above table refer groundwater validity wells in area of study for drives of construction due elements are within the permissible limit

5- Irrigation purposes: The suitability of wells in the study area for irrigation was studied and compared to the natural specifications of irrigation water, (28), (T.10).

T.10 shows the range of usual for purposes of irrigation

research values results

T.	Variable	The rate in the studid area	The standard term	Unit
Salinity	**EC**	**3951**	**3000 – 0**	**s/cmμ**
	TDS	**2589.8**	**2000 – 0**	**Ppm**

Positive ions	**Mg^{+2}**	**10.3**	**5 – 0**	**Epm**
	Ca^{+2}	**12.2**	**20 – 0**	**Epm**
	Na^{+}	**18.6**	**40 – 0**	**Epm**
Nutrients	**K^{+}**	**1.5**	**2 – 0**	**Ppm**
Negative ions	**HCO_3^{-}**	**4.6**	**10 -0**	**Epm**
	SO_4^{-2}	**19.7**	**20-0**	**Epm**
	Cl^{-}	**16.2**	**30 -0**	**Epm**
Acidic function	**PH**	٧.١٨	**8.5 -6**	**(14 - 1)**

The table above indicates that the wells in the study area are not suitable for irrigation of plants due to salinity, electrical conductivity, and magnesium higher than the permissible limits. Crops that can tolerate higher ranges of salinity can be grown.

Conclusions:

1- The wells in the study area are not suitable for human drinking due to the salinity of the salinity and the excess of all positive elements as well as negative ions.
2- Most of the water in the study area is alkaline
3- The wells in the study area are suitable for animals to drink for breeding purposes.
4- Well water in the study area is not suitable for industrial purposes.
5- The suitability of the wells in the studied area for construction because the elements are within the permissible limits
6- The wells in the study area are not suitable for irrigating plants due to the salinity of the water

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