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Evaluation of some physical, chemical and bacteriological characteristics in Kirkuk city

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ABSTRACT

The present study aimed to conduct a field study on the water of eight wells in different areas of Kirkuk city. The modeling was done on a monthly basis, starting from November 2019 until April 2020. The study included measuring some physical factors (water temperature, electrical conductivity, total dissolved solids) and some chemical factors (pH, dissolved oxygen, biological oxygen demand, total alkalinity, total hardness, calcium hardness, magnesium hardness, sodium ion, sulfate, Chlorides, nitrates, phosphates. Also, a study was conducted on the bacterial contamination of groundwater wells, which included the total number of colonies of the total plate count, the total number of coliforms, and the total numbers of Faecal coliform Bacteria. The results showed that the air temperatures ranged between (16-18.6)C^{o}, while the wells' water temperatures were within the warm water and their rates ranged between (22.5-24.8) C^{o}. An increase in the sulfate values was observed in most of the study wells, while nitrates recorded low values. On the bacteriological side, it was found that most of the wells were not contaminated. The reason is due.to the depth of the wells and their distance from the sources of pollution.

Introduction

The importance of water for humans and living organisms has been known since ancient times, as human survival is linked to the survival of water and its purity, and as a result of the increase in agricultural and industrial activities near the sources of this water, this water has become vulnerable to pollution and a source of diseases and epidemics [1]. At a rate of 75-95% of the protoplasmic mass of each cell, and any of the processes of digestion, absorption and metabolism are not carried out except in a water medium [2] . Groundwater is considered an important water resource in desert areas and is found in the ground at different depths and changes from one site to another. The geological formation of the region[3]. Groundwater is the second main source of water after rivers. This water reaches the surface of the earth by drilling wells and where people can benefit from it for drinking and other uses [4]. Groundwater is characterized by being pure, with stable and colorless composition, and has the ability to reduce micro-organisms through its passage in the earth's layers, which leads to the filtering of suspended solids, including micro-organisms [5]. Groundwater contains different concentrations of salts, including calcium and magnesium salts, as well as the salts transported to it, which makes the water hard [6]. The current study aims to know the quality of groundwater in the city of Kirkuk and the surrounding areas, in order to determine the suitability of wells for human uses and various uses.

Materials and Methods

The current study was conducted in northern Iraq in Kirkuk city and its outskirts, as it is 273.22 km away from the capital, Baghdad, and it is located between longitude (43.18) and (44.57) and latitude (34.45) and (35.48). Eight wells were selected for the current study in different areas of the city. Kirkuk, where the sampling process began in the morning and until the evening, starting from well No. (1) until well No. (8), at a rate of once a month, and from November 2019 until April 2020, when well water was pumped for ten minutes by an electric pump in order to be able to get rid of The contaminated or stagnant water then filled the bottles with the least possible air space to

preserve the physical, chemical and bacteriological properties of the sample water during transportation. As some environmental factors were measured directly at the sample collection sites (in the field), and included measuring the temperature using an electronic thermometer, the pH using a field pH measuring device, and the electrical conductivity using the field device supplied by Lovibond, and the total dissolved solids using a TDS device from HANNA And measuring dissolved oxygen using EZ DO device made in Taiwan. As for the rest of the factors, it included measuring salinity depending on the electrical conductivity values according to the method shown in [7]. and measuring the total hardness according to the method described in [8] after adding 1-2 ml of ammonia buffer solution to raise the PH value, then adding the dry detector Erichrom Black - T and then sweeping With EDTA-2NA solution until the color turns blue, and the same method described in [8]. was followed by patching with EDTA-2NA solution and adding a standard hydroxid Sodium solution at a concentration (2.5N). Then drops of Calcium Guide were added to Murexide until the color changed to blue Then calculate the magnesium ion concentration by subtracting the calcium ion concentration from the total hardness, The total base was calculated according to the method [8]. where 100 ml was taken and drops of methyl orange were added to it, then washed with sulfuric acid methyl orange, then the sodium and potassium ion were estimated using the Atomic Absorption spectroemeter made in England, the chloride ion was measured by following the method described In [9], sulfates, phosphates, and nitrates were measured using a Spectrophotometer, with a wavelength of 420, 885,543 nanometers, according to the method described in [10] As for the bacteriological examinations, the method described in [11]. was used in calculating the total number of bacteria (TPC) using the standard plate count expressing the unit CFU/ml and calculating the total number of coliforms by the method of the most probable number and the multiple tubes method according to [12]. where three groups were inoculated, and each group consisted of five 25 ml test tubes containing the two-concentration liquid culture medium Lauryl tryptose broth in the five tubes. The tubes were inoculated with water samples with a sterile pipette, then (0.1,1,10) ml of sample water was injected, and placed The Durham's tube is inverted, then the tubes are gently shaken and incubated at (35-37) C^o for a period of 24-48 hours. At the end of the 48-hour incubation period, each tube is examined for the presence of any growth or gas in the Durham's tubes tube. Confirmed test to ensure that the bacteria had fermented the culture medium with the previous test and the production of gas. A full loop drop was transferred from the positive tubes that produced the acid and gas to 5 tubes containing the culture medium Brilliant Green lactose broth (BGB) and incubated at (35-37) C^o. for a period of 24-48 hours, then each tube is examined to detect the presence of gas after the end of the 48-hour incubation period and the results are recorded, then the Completet Test was performed. The Taoist On the medium of (BGB) and incubated at 35 C^o in an inverted manner, it is observed that small circular colonies are formed in an opaque color indicative of the colony's relevance to the intestinal family, then the total number of Fecal coliform Bacteria (FC) was calculated, where the same steps were followed to calculate the total number of coliforms as the tubes were inoculated It was incubated at 44.5 C^o in the water bath for 48 hours. The number of tubes that formed the acid and gas was calculated according to [12]. Then a supplementary test was performed for the colonies suspected of being pure E. coli developing on (EMB) and Pepton water medium to examine the formation of ondole. The tubes were incubated in a 44.5 degree water bath for 24-48 hours, since at this temperature the fecal coliform bacteria grow according to [13].

Results and discussion

Temperature

The temperature of water is of great importance in the life of living organisms, and the groundwater is characterized by that the range of temperature variation is narrow according, the lowest temperature for well water during the study period was 18 C^o in the month of January, while the highest temperature for the studied well water was 27 C^o in The month of April, the waters of the study wells were classified among the warm waters, according to the classification [14]. The groundwater during its incursion works to dissolve and dissolve the minerals that make up the rocks, and this leads to an exothermic reaction, which leads to an increase in the temperature of the water in the far depths [15].

Table 1: The highest and lowest value of water temperature during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
W.T C^o	H	26	25	25	26	27	26	25	26	25.7
	L	22	21	20	20	23	22	18	22	21
	R	23.6	23.3	23	24.3	24.8	24.1	22.5	24.6	23.7

(H higher value - L lower value - R Rate)

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Electrical conductivity

The rates of electrical conductivity ranged between (424.66-1657.6) microsimens / cm in well water in well water (1, 6) respectively, and these results came close to the results reached by [16] and that this difference in the electrical conductivity values is due to a difference in the water path In the lower layers of the earth. The Pearson correlation coefficient recorded a positive significant correlation with total dissolved solids with a value of r = 99 $^{++}$ at the level of significance P≤0.01, which shows the positive relationship between them.

Table 2: The highest, lowest, and average value of the electrical conductivity of water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
E.C µs/cm	H	1760	1136	780	1250	468	440	520	655	876.1
	L	1641	1114	724	1200	448	419	448	646	830
	R	1657.6	1124.33	739.5	1214.66	455.33	424.66	481	651	843.5

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Total dissolved solids

The concentration rates of total dissolved solids ranged between (253-1170) mg / liter, with the highest value (1176) mg / liter recorded in the month of December and the lowest value (230) mg / liter in the month of November, and where the water of the current study wells was classified as medium Salinity, according to the water quality classification table based on total dissolved solids [17]. The Pearson correlation coefficient recorded a positive significant correlation with total hardness and total base hardness and hardness of calcium, magnesium, sodium and sulfate. The reason for the high rates of total dissolved solids values is due to the speed of melting of the rocks through which the water passes, and to the geological nature of the study area. As for the reason for the low concentrations of total dissolved salts, it is due to the specific reservoir formations that pass water.

Table 3: The highest, lowest, and average values for total dissolved solids in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
T.D.S	H	1176	710	482	780	318	320	364	444	574.2
	L	1166	696	420	758	280	230	312	430	536.5
	R	1170	704	430.6	762.3	308	253	323.6	438	548.6

The months of research are from November, December of 2019, and January, February, March and April of 2020.

PH

The pH is an important indicator of chemical, physical and biological systems and a measure of the acidity and base of normal temperature and pressure [18]. Where the pH rates ranged between (7.4-7.8) in the water wells, and the wells of the current study were of light basicity and were in conformity with the standard specifications of Iraqi drinking water [19]. The reason for the pH stability is attributed to the fact that the water of the studied wells was of light alkalinity depending on the pH levels, due to the remoteness of its water from direct atmospheric changes which causes it to dissolve the carbon dioxide gas, as well as the regulatory capacity of hard and alkalinity water rich in bicarbonate, which resists the change in the pH.

Table 4 : The highest, lowest and average pH value

		W1	W2	W3	W4	W5	W6	W7	W8	R
PH	H	7.9	7.9	7.9	7.9	7.9	7.9	7.8	7.9	7.88
	L	7.5	7.6	7.7	7.4	7.5	7.8	7.2	7.6	7.53
	R	7.6	7.7	7.8	7.6	7.7	7.8	7.4	7.7	7.66

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Dissolved oxygen (D.O)

The dissolved oxygen in the water is one of the determinants of water quality and the degree of contamination [20]. and is necessary for the breathing and living of aquatic organisms as well as its importance in the self-purification process [21]. and the dissolved oxygen concentrations ranged between (5.23-6.4) mg / liter and the results of the study matched the permissible limits. For drinking water, which is (4-6.5) mg / liter, according to [19].

Table 5: The highest, lowest and average values of dissolved oxygen in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
D.O	H	5.6	5.9	7.6	5.4	6.4	6.6	6.5	6.5	6.31
	L	4.8	5.1	6.00	5.2	6.00	6.2	6.00	6.00	5.66
	R	5.23	5.30	6.26	5.26	6.25	6.4	6.31	6.28	5.91

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Biological Oxygen Demand (BOD_5)

The BOD is a measure of the amount of oxygen consumed in the analysis of organic matter in the water, which negatively affects the water quality [22]. The BOD levels were between (1.21-2.53) mg / L. The values of BOD5 are directly proportional to the temperature and the degree of pollution and inversely with the amount of dissolved oxygen in the water [23] and the results of the study were that the water of the wells was within the limits of (clean - average cleanliness) according to classification [24].

Table 6: The highest, lowest and average BOD values for water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
BOD_5 mg / l	H	2.9	1.6	1.8	2.9	2.1	1.8	1.5	1.6	2.025
	L	1.7	1.2	0.1	1.4	1.1	0.1	1.00	1.4	1
	R	2.53	1.46	1.4	2.1	1.35	1.21	1.26	1.31	1.577

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Total Alkalinity

Bicarbonate is one of the main ions in natural water and it is found in water as a result of melting limestone and salt deposits of geological formations [25]. and the rates of Total alkalinity values during the study period ranged between (157.33-201) mg / liter, and the highest value was 210 mg / liter in November. The lowest value is 151 mg / liter. The reason for the high total base values in some wells is due to the decomposition of organic matter by bacteria and the resulting increase in carbon dioxide CO2, which in turn leads to the formation of bicarbonate HCO3 [26]. The results of the study were in conformity with the standard specifications for Iraqi drinking water [19]. which are (170-250) mg / liter.

Table 7: The highest, lowest, and average value of the total base water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
T.Alk mg/l	H	200	179	170	210	188	178	162	187	184.25
	L	145	175	164	198	180	168	150	180	170
	R	184	176	166	201	184.8	170.6	157.33	181.66	177.67

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Total hardness

The total hardness measurement is an important measure for determining the suitability or inadequacy of groundwater for human use and for other uses [27]. It is the sum total of the concentrations of Ca and Mg, and the hardness concentration varies according to the water resource, as the surface water is less hard than the groundwater, and this follows the geological characteristic of the land through which the groundwater passes [28]. The highest value of (760) mg / liter was recorded in January, and the lowest value for hardness was (173) mg / liter in November, and the results of the study were less than the results reached [29]. In some wells which exceeded the permissible limits according to what is mentioned in the classification [5]. the abundance of calcium and magnesium ions in addition to other ions such as iron, barium, manganese and zinc that make the water hard [27]. and the well water was in conformity with the standard specifications of the Iraqi drinking water and the adult (250-500) mg / liter according to [19].

Table 8: The highest, lowest, and average value of total hardness in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
T.H mg/l	H	760	514	313	378	212	180	228	252	354.62
	L	510	502	310	370	210	173	214	247	317
	R	716.5	507.83	310.83	374.83	210.83	175.66	219.5	250	735.74

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Calcium hardnes

The presence of calcium ions is one of the most difficult ions in natural waters [30]. and the results of the current study ranged from (36.16-115.33) mg / liter, while the highest value was recorded at 122 mg / liter in December, and the lowest value was recorded in November 34 mg / liter and these results were less than the results reached [15]. and the reason is due to the variation in the decrease and rise in calcium concentrations due to the geological nature of the regions through which the groundwater passes, where the percentage of calcium constitutes (30.23)% of gypsum soils and sedimentary rocks [31]. The wells of the current study were not in conformity with the standard specifications of Iraqi drinking water [19]. which ranged between (25-50) mg / liter.

Table 9: The highest, lowest, and average calcium hardness values for water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
T.H mg/l	H	122	106	41	66	42	38	62	44	65.125
	L	94	97	38	55	40	34	44	39	55.125
	R	115.3	100.66	38.83	63.83	41	36.16	50.83	40.66	60.908

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Magnesium hardnes

Magnesium ions are among the most difficult ions in natural water after calcium ions [32]. The results of the present study showed rates of magnesium ion concentration ranging between (20.5-104.5) mg / liter in drinking water, with the lowest value being 18 mg / liter and the highest value (113) mg / liter, and the results were close to the results [15]. The reason for the high magnesium ions in some wells is that the pH is close to neutral and the water is rich in sulfates, as well as the abundance of limestone and dolmite rocks. The Pearson correlation coefficient recorded a positive significant correlation with electrical conductivity and total hardness Calcium hardness is at the level of significance P≤0.01, which indicates that magnesium is one of the factors that cause high values of hardness and electrical conductivity. The magnesium concentrations in the wells of the current study matched the standard specifications of Iraqi drinking water which ranged between (25-125) mg / liter [19].

Table 10: The highest, lowest and average values of magnesium in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
Mg mg/l	H	113	66	53	58	27	21	25	37	50
	L	67	58	50	50	26	20	18	34	40.37
	R	104.5	62.33	51.5	52.33	26.5	20.5	22.83	36.16	47.01

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Sodium ion

The sodium ion is one of the main positive ions in nature due to its high solubility in water and is considered one of the most common metals in water. The sodium ion concentration changes significantly according to the geological nature of the study area [33]. Sodium concentration rates were recorded in the current study, ranging between (11.6-116.33) mg / liter and the results of the statistical analysis showed that there were significant spatial differences and the absence of significant temporal differences between the wells studied at the significance level P≤0.05 and the results of the current study were in conformity with the standard specifications of some determinants of drinking water of 200 mg / liter [19].

Table 11: The highest, lowest, and average values for sodium in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
Na mg/l	H	180	25	25	125	13	29	14	39	56.25
	L	47	24	23	109	11	20	10	36	35
	R	71.83	24.33	23.83	116.33	11.83	25	11.66	37.83	40.33

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Chloride ion

The chloride ion is one of the most common salts present in natural water, and it gives the water a salty taste, especially when linked with the sodium ion, forming the sodium chloride salt (table salt) [23]. The results of the current study indicated that the chloride concentration rates in well water ranged between (16.6-50.16) mg / liter, and these results were less than what the researcher reached [34]. The reason for the high concentration of chloride in some wells is due to the fact that well water is in direct contact with Geological formations containing sodium chloride deposits [35] and the results of the current study were in conformity with the standard specifications for Iraqi drinking water of 250-350 mg / liter [19].

Table 12: The highest, lowest and average value of chloride in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
Cl mg/l	H	98	41	24	52	24	35	18	25	39.62
	L	40	39	20	46	20	24	15	24	28.5
	R	50.16	40	22.1	48	22	27.1	16.6	24.5	31.30

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Sulfates ion

Sulfate ions are among the most common forms of sulfur compounds in natural waters [36]. and the most important sources of sulfate ion in groundwater are deposits of calcium and magnesium sulfate as well as sodium sulfate present in the soil [37] and the results of the current study showed that the concentration rates of the sulfate ion ranged between (23.33-589.6) mg / liter, as the highest value of 600 mg / liter was recorded in December, which was not in conformity with the drinking water standard specifications [19] amounting to (250-500) mg / liter. Sulfates are considered among the factors that cause diarrhea when present in the form of sulfates. Magnesium and sodium are an important factor in determining the viability of water [38].

Table 13: The highest, lowest and average values of sulfate in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
So_4 mg/l	H	600	520	150	352	26	32	74	120	234.25
	L	584	314	145	312	20	25	45	117	195.25
	R	589.6	351.8	148.3	343	23.33	29.1	51.3	118.8	206.90

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Nitrates ion

Nitrates are the dominant form of inorganic nitrogen in water [21]. and are involved in the synthesis of amino acids, proteins and enzymes [39]. The results of the current study indicated that the rates of nitrate concentration in studied well water ranged between (21.6-35) micrograms atom nitrate / liter, where the lowest value was recorded. 18 micrograms corn nitrate / liter in the month of December and the highest value of 38 micrograms corn nitrate / liter in February. The reason for the increase in nitrates is due to the availability of the amount of dissolved oxygen in the water, which converts the nitrite into nitrate [35]. as well as the high concentration of nitrates due to human and agricultural activities and the use of fertilizers And its lack of sanitation networks [2]. The results of the current study were in conformity with the standard specifications of 50 micrograms / liter [19].

Table 14: The highest, lowest and average value of chloride in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
No_3 µ/l	H	32	34	30	30	26	44	26	28	31.25
	L	38	30	26	26	18	18	19	22	24.62
	R	35	31.3	27.8	28	22.1	26	21.6	25.1	27.11

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Phosphates ion

Phosphate is one of the most important determinants for the growth of living organisms, especially plants and phytoplankton [40]. and despite its importance, it is the least element present in the aquatic environment. Phosphorus is found in nature in the form of phosphate ions used as dissolved inorganic phosphate by living organisms [21]. and phosphates tend to accumulate in The sediments are also highly adsorbed, and this explains the low values of phosphates in the wells of the current study, as they ranged between (0.002-0.0163) mg/liter and Phosphate values increase due to human activities, as well as the climate factor, which has a role in the rise in phosphate values, which coincides with the amount of precipitation and temperature retention, which works to dissolve some components of soil and rocks that contain phosphates.where the wells of the current study conformed to the standard specifications for drinking water as stated in of 0.4 mg / liter [19].

Table 15: The highest, lowest and average values of phosphates in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
Po_4 mg/l	H	0.005	0.007	0.035	0.01	0.005	0.024	0.0112	0.022	0.014
	L	0.001	0.001	0.002	0.003	0.002	0.003	0.005	0.002	0.002
	R	0.002	0.003	0.016	0.009	0.003	0.0163	0.008	0.015	0.009

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Bacteriological examinations

Total plate count (TPC)

The total number of bacteria in groundwater represents an important measure of contamination with bacteria. Most of the natural water contains aerobic, selective anaerobic and non-autotrophic bacteria [8]. The results of the current study indicated the rates of the total numbers of bacteria, whose rates range between (30-102) CFU / ml after preparing a series of dilutions up to 10^{-5} using 0.85% Saline solution . The reason for the relative increase in the numbers of bacteria in the wells of the current study is due to the rise in water levels when the rains fall and the entry of organic materials, including animal fertilizers, as a result Dredging and washing agricultural lands are a source of bacterial and microorganisms' arrival to groundwater [41]. It was found that some of the study wells were contaminated and did not meet the drinking water standards of 50 cells / 100 ml [19].

Table 16: The highest, lowest and average values of the total number of bacteria in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
TPC CFU/**L**	H	200	100	130	130	100	80	100	70	113
	L	45	0	0	0	0	0	0	0	0
	R	102	45.3	66.6	67.5	58.3	45.8	58.3	30	59

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Total coliform Bacteria (TCB) count

Coliforms are considered an indication of contamination of water with pathological bacteria and an assessment of the health status of the water, as their presence in humans, animals, soil and decomposing plant residues and their presence in food is evidence of contamination with feces and this bacteria has the ability to produce intestinal toxins [42]. The results of current study showed that rates of the total number of coliform bacteria ranged between (0.7 -6.1) cells / 100 ml where the highest value was recorded at 16 cells/ 100 ml and the lowest value (0.0) cells / 100 ml.

Table 17 is the highest, lowest, and average value for the total number of coliform bacteria in water

		W1	W2	W3	W4	W5	W6	W7	W8	R
TCB cell/100ml	H	9.2	5.1	9.2	16	2.2	9.2	9.2	2.2	7.7
	L	0	0	0	0	0	0	0	0	0
	R	2.2	1.2	3.1	6.1	0.7	3.1	2.2	0.7	2.4

The months of research are from November, December of 2019, and January, February, March and April of 2020.

Total coliform Bacteria (FC) count

Fecal coliform bacteria are considered from a group of bacteria that grow at (44-45)C^{o}. lactose fermentation, acid and gas production [43]. Fecal coliform bacteria, including Escherichia Coli, are considered evidence of fecal contamination with sewage droppings, with other pathological bacteria in the water [44]. The results of the current study showed that there is a clear variation in the numbers of fecal coliform bacteria in the studied well water, whose rates ranged between (0.7-5.2) cells / 100 ml, and the highest value was 10 cells / 100 ml in December, and the lowest value was recorded (0) cells / 100 ml. The fecal coliform bacteria is distinguished by its long stay outside the human or animal body, which distinguishes it from the rest of the other pathogenic intestinal bacteria, which made it easy to detect it during the periodic examination of the studied well water [46]. Some study wells were not in conformity with the standard specifications according to amounting to 1-2 cells / 100 ml [19].

Table 18: The highest, lowest, and average value of faecal coliform bacteria in water during the study period

		W1	W2	W3	W4	W5	W6	W7	W8	R
FC cell/100ml	H	9.2	5.1	10	9.2	2.2	2.2	9.2	9.2	7.7
	L	0	0	0	0	0	0	0	0	0
	R	4.2	1.95	5.2	4.65	0.7	1.46	3.11	3.11	3.1

The months of research are from November, December of 2019, and January, February, March and April of 2020.

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تقييم بعض الصفات الفيزيائية والكيميائية والبكتريولوجية في مدينة كركوك

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الملخص

هدفت الدراسة الحالية إجراء دراسة ميدانية على مياه ثمان آبار في مناطق مختلفة من مدينة كركوك. تمت النمذجة بشكل شهري إبتداءاً من شهر تشرين الثاني 2019 ولغاية شهر نيسان 2020. شملت الدراسة قياس بعض العوامل الفيزيائية (درجة حرارة الماء، التوصيلية الكهربائية، المواد الصلبة الذائبة الكلية) وبعض العوامل الكيمياوية (الأس الهيدروجيني،الأوكسجين المذاب،المتطلب الحيوي للأوكسجين، القاعدية الكلية، العسرة الكلية، عسرة الكالسيوم، عسرة المغنيسيوم، أيون الصوديوم، الكبريتات،الكلوريدات، النترات، الفوسفات). كما أجريت دراسة على التلوث البكتيري لمياه الآبار الجوفية والتي تضمنت أعداد المستعمرات الكلية للبكتريا Total plate count والعدد الكلي للقولونيات Total coliform Bacteria والأعداد الكلية لبكتريا القولون البرازية Fecal coliform Bacteria. وبينت النتائج أن درجات حرارة الهواء تراوحت معدلاتها بين (16–18.6) م°أما درجات حرارة مياه الآبار كانت ضمن المياه الدافئة وتراوحت معدلاتها بين (22.5–24.8) م°وقيم الكدرة كانت منخفضة نسبياً أماقيم الأس الهيدروجيني تميزت بأنها ذات قاعدية واطئة ولوحظ أرتفاع في قيم الكبريتات في معظم آبار الدراسة في حين سجلت النترات قيماً منخفضة، أما في الجانب البكتريولوجي فقد وجد أن أغلب الآبار كانت غير ملوثة والسبب يرجع إلى عمق الآبار وبعدها عن مصادر التلوث.