Estimation of Bacterial Content of Water from some Wells South of Samarra City

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Abstract

The study was conducted in the south of Samarra, and the city of Dhuluiya with its suburbs south of the city of Salah al-Din for the period from 15/11/2021 to 15/4/2022. The study included conducting a field study to estimate the bacterial content of water of some wells south of Samarra. Water samples were taken for six wells in the areas where the study was carried out. The results of the study show that the air temperature in the study area during the collection of samples was characterized by wide seasonal ranges amounting between (4) -39) degrees Celsius, while the temperature ranges of the groundwater samples reached (19-30) degrees Celsius. The total number of bacteria Total Plate Count (T.P.C) ranged between (75-335) CFU / ml, where the highest number of bacteria in Well 6 is in March, and the lowest number is in Well 2 in April. While the number of Total Coli from Bacteria (T.C.B) ranged between (7.4-1100) cells/100 ml, the highest value was in the well 1.2 in the month of February, and the lowest value was in the well 2.3 in the month of March.

1. Introduction

Water represents the vital element that cannot be dispensed with on earth, and it is one of the most important and widespread substances in nature. Water covers approximately 71% of the Earth's area, and the amount of water is estimated at 1973 billion square kilometers, where the proportion of salty water is approximately 97% of the total volume of water, as for fresh water, it constitutes approximately 3% distributed in rivers, ponds, lakes and groundwater. Groundwater is exposed to a number of pollutants, including bacterial pollution of groundwater, where this type of pollution is less than it in surface water and that the low level Bacterial pollution in groundwater does not mean its suitability for drinking and human uses, groundwater may contain huge numbers of some types of microorganisms, especially in highly polluted areas due to the presence of sewage or reservoirs close to them (Al-Nadawi, 2010). The problem of bacterial contamination is serious when it exists. In water, because water is the source that carries and transmits many microorganisms, so it is the main source of many diseases, as pollutants seep into the sewage water. To groundwater, sewage is the main source of bacterial contamination of water, especially in places where large population concentrations are located (Hammadi, 2015). This water contains millions of microorganisms, whether they are pathogenic or unsatisfactory, such as protozoa, bacteria and fungi, and the main part in these groups is Coliform Bacteria, Clostridium Perfigens and Faecal Streptococa (AL-Tamir, 2005). The World Health Organization reports that 80% of the diseases that afflict humanity are caused by water contamination with pathogenic microorganisms. Water is a general indicator of faecal contamination, which can be from nature or feces. E. Coli bacteria is one of the most important indicators of pollution, which can be from nature or feces. and others, 1987).

2. Materials and methods

Samples were collected in the study area within the borders of Salah al-Din Governorate in the south within the districts of Samarra and al-Dhuluiya on the left side of Tigris River, where the study of bacteriological and chemical tests for well water samples was carried out, respectively.

2 -Calculating the total number of live aerobic bacteria

Total plate count of aerobic bacteria

The Pour Plate method was adopted to estimate the total number of live bacteria, as the water sample was shaken, then a series of dilutions were prepared up to 104. 1 ml using a clean and sterile pipette from each dilution and from the original sample to sterilized Petri dishes, then pour the Nutrient agar media after its temperature has reached a temperature of 45-50 ° C, then move the food medium by rotating the plate softly in the shape of No. 8 with the food medium in an image Then it was left to harden and then the plates were incubated upside down at a temperature of 37 °C for 24 hours in the incubator. -300 colonies and then multiply the number of colonies in the inverted dilution and expressed as CFU/100 ml (WHO, 1996).

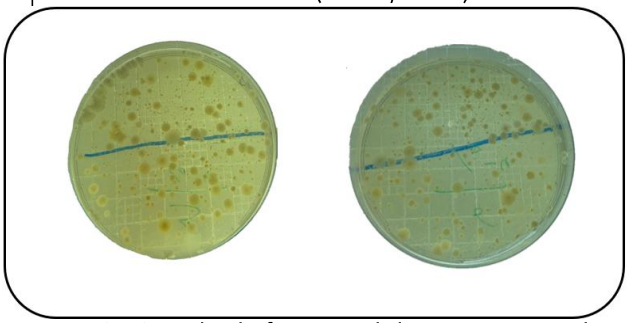

Figure (2-1) method of casting dishes to estimate the total number of live aerobic bacteria

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3 -Calculate the total number of colon bacteria

Total count of coliform Bacteria

The most probable number (MPN) method was used to determine the total number of coliform bacteria contained in APHA, 2003), where three groups were inoculated and each group consisted of three 25 ml test tubes containing MacConkey broth culture medium inside each test tube. Among these groups is Durhams tube (to detect the liberated gas), as it was:

presumptive test

By adding 10 ml of single strength MacConky broth medium in two sets of double strength test tubes in a third group, these tubes were inoculated with water samples through sterile pipettes. Sample water and double-concentration tubes with a volume of 10 ml of sample water. The inoculated tubes were incubated at a temperature of 37 °C for 24-48 hours. It was observed that the color of the medium in the test tube changed from pink to yellow, as well as the accumulation of gas in Durhams tubes by 10%. Or more than the size of the test tube indicative of the positive result. And to confirm that the bacteria that fermented the culture medium (the color of the culture medium changed to yellow) and formed gas inside the Durhams tube tubes, is a net of intestinal origin.

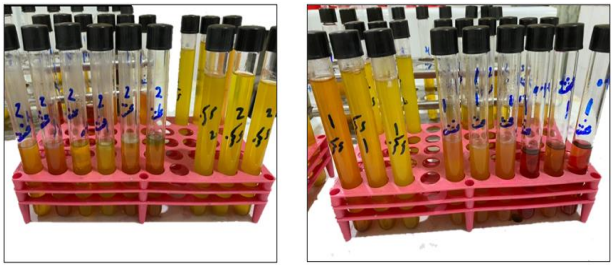

Figure (3-1) test tubes to calculate the total number of colon bacteria

4 -Chemical tests

4.1 Measurement of dissolved oxygen

By following the modified (Winkler Azide) method, the oxygen bottles were filled with a volume of 250 ml by immersing them in the water that was taken in an ethylene container designated for this purpose and directly from the pump tubes nozzles. KL-KOH ALKaline potassium Iodide Then the sample was shaken well, and after ten minutes, 2 ml of concentrated sulfuric acid was added, and the results were expressed as mg / liter.

4-2 Biological Oxygen Demand

The biological oxygen requirement was calculated in the same way as the dissolved oxygen measurement, by placing the samples in opaque and unfixed Winkler artists for five days at a temperature of 25%, then determining the dissolved oxygen (DO5) and that the difference with the initial dissolved oxygen DO is a triangle of the value of BOD5.

BOD5=DO0-DO5

3. Results and discussion

5 -Bacteriological examinations

5-1 total number of bacteria

The results of the study for Table (5-1) showed that the aerobic rates ranged from (120-193) CFU/1ml in the wells (1.6), respectively, where the highest value was recorded 335 CFU/1ml in the water of the sixth well in March and the lowest value was 75 CFU/1ml in well water in April. The discrepancy in the wells in the current study in terms of bacteria numbers may be attributed to several reasons, including the proximity of some wells to the sources of pollution, and the increase in the number of bacteria in well 6 in March to rain and the arrival of pollutants from the soil In addition to the fact that the well is located within an agricultural area and fields for raising sheep. As for well No. 1, the decrease in the number of bacteria in it may be attributed to the depth of the well and its distance from the sources of pollution. The reason for the increase in the number of bacteria in some wells may be attributed to the agricultural activity in the study area and the farmers' use of organic fertilizers and animal waste, which find their way into well water through leakage. With rain and irrigation water, in addition to the wastes resulting from human activity that inhabit the study area, and the increase in temperature has an effect on increasing the activity of bacteria and increasing their numbers clearly (Kabalan, 2018), where the current study was less than the results obtained (Ibrahim, 2015).) when studying the bacterial contamination of the water of some wells in Al-Dour district, in which the lowest value of the numbers of these bacteria reached 32.28 in 103 CFU/ml and the highest value was 4.0 in 103 CFU/ml and higher than the results obtained by Mansour (2021) when studying the physical, chemical and biological properties of a number of Of the wells in Kirkuk governorate, where the values reached between (0.00-200.0) CFU/ml and less than the results obtained by Harez (2022) in her study of the quality of groundwater in Al-Dur district, which reached the values for the number of wells Tria (18.0-430.0) CFU/ml. As the highest level of contamination of wells is 3,5,6 in the current study, and the reason for this is due to what reaches the water of these wells from polluted human waste, and the reason for the high percentage of bacterial pollutants in Well 6 is due to the location of the well, which is located in a low area with a high percentage of land. 4 meters from the level of the well site, which leads to the accumulation of more pollutants in the water of this well. The water from the studied wells did not conform to the standard specifications of the World Health Organization (WHO) (2017), which amounted to 100 cells / ml. The results of the statistical analysis were recorded, according to the analysis of variance test, to the presence of significant temporal and spatial differences at the level of significance P≤0.05. The third (March / April)), (spatially) Duncan test divided it into two groups: (the first includes (well 1 / well 2 / well 3 / well 4 / well 5), and the second (well 6.((

Table (1-5) of the monthly and local changes in the number of bacteria							
Wellsmonths	well1	well2	well3	well4	well5	well6	Well rates
November	90	80	120	90	95	85	93.33
December	120	100	180	120	80	130	121.66
January	85	140	200	200	110	190	154.16
February	110	100	185	180	145	160	146.66
March	200	210	200	195	180	335	220
April	115	75	210	175	210	260	174.16
Months rates	120	17.5	182.5	160	136.7	193.33	
Total * 10-1 (CFU/1 ml) during the course of the course							

Total Coli from Bacteria

The results of the current study showed in Table (6-1) that the rates of colonic bacteria count in the study wells ranged between (79.9 - 243.3) cells / 100 ml, where the highest value of bacteria count (1100 cells / 100 ml) was recorded in wells No. 1 and 2 in The month of February, while the lowest value of bacterial numbers was recorded in the wells 1, 2, 3 in the months of January and March. The reason for the increase in the number of bacteria in well 1.2 may be attributed to the fact that these wells are deep and of a closed type, but their opening is not tightly closed, which leads to pollution due to the animal waste that enters them with the air or as a result of the erosion of these wastes with rain water, in addition to the It seeps into these wells from the fish ponds that are scattered and close to them, and this causes the absence of a difference in the number of bacteria between the wells despite their different depths. The contamination of well water by colon bacteria indicates the access of human and animal waste to the well water, and this is evidence of the presence of pathogenic intestinal bacteria (Al-Nadawi, 2010). Where the numbers of these bacteria as shown in Table (6-1) ranged from (7.4-1100) cells/100 ml, the highest value was in the well 1.2 in February, and the lowest value was in the well 2.3 in the month of March. The rise in coli bacteria may be due to the fact that all study wells, even if they are of a closed type, have not closed their openings, which leads to contamination because of what enters them from animal waste with the air, or what rain and irrigation water washes from these wastes, in addition to what leaks of the fish breeding ponds scattered in the region. This explains the lack of significant variation in bacterial rates attributed to the depth of the wells. Where the presence of coliform bacteria in the aquatic environment indicates the general contamination of water by human and animal excreta, and detection is easy because of their large numbers and length of stay in the water, which is an indication of the presence of pathogenic intestinal bacteria in the water (Al-Nadawi, 2010). Where the results of this study were less than the results obtained by (Al-Obaidi, 2010) when studying the water quality in North Salah al-Din, in which the lowest value was 3 cells / 100 ml and the highest value for colon bacteria was 2400 cells / 100 ml during several months, and higher than the results Which was reached by Al-Naqeeb (2021) when studying some of the physical, chemical and bacteriological properties of water samples from some wells in some areas of Salah al-Din, where the number of coliform bacteria in well water samples ranged between (0.0-220) cells / 100 ml, and the results were
wells

Months Well No. 1 Well No. 2 Well No. 3 Well No. 4 Well No. 5 Well No. 6 Wells rates
November 201 210 150 150 210 460 230.16
December 150 210 7.4 210 210 150 156.23
January 7.4 15 15 93 15 120 44.23
February 1100 >1100 150 210 210 150 486.66
March 120 7.4 7.4 210 150 120 102.46
April 210 210 150 150 210 460 231.66
Monthly rates 268.06 292.06 79.96 170.5 167.5 243.33

The current study is an approach to the results reached by Harez in her study of the quality of groundwater in Al-Dour district, where the number of coliform bacteria in well water samples ranged between (3.00-1100) cells / 100 ml, where the studied well water did not conform to the specifications of the Central Organization for Standardization and Quality Control. (1996) and EPA-US (2018) at 0 cells/ml.

Table (6-1) of monthly and local changes in the number of colon bacteria (cells / 100 ml) during the study period							
wellsmonths	well1	well2	well3	well4	well5	well6	Well rates
November	201	210	150	150	210	460	230.16
December	150	210	7.4	210	210	150	156.23
January	7.4	15	15	93	15	120	44.23
February	1100	>1100	150	210	210	150	486.66
March	120	7.4	7.4	210	150	120	102.46
April	210	210	150	150	210	460	231.66
Months rates	268.06	292.06	79.96	170.5	167.5	243.33	

Chemical Properties

7.1 BOD5. Biological Requirement for Oxygen

The biological requirement for oxygen is one of the important criteria that indicate the level of organic pollution when evaluating water quality, as it refers to the amount of oxygen consumed by living organisms during the process of organic decomposition in aerobic conditions at a certain temperature and during a specific period of time (Gupta et al., 2017).). Its value is directly proportional to the organic load

and temperature inversely to the amount of dissolved oxygen in the water. The results shown in the table (7-1) recorded a decrease in the values of the vital oxygen requirement BOD5, its concentration ranged between (0.4-2.8) mg / liter, where it was less. The value in well 2 for January and the highest value in well 1 for the month of February. The reason for the decrease is due to the occurrence of filtration processes through the rocky layers only after these wells are far from the sewage sources. Or the decrease in the concentration of the vital oxygen requirement may be due to the fact that the water from the wells is constantly renewable and not stagnant due to its frequent use to irrigate agricultural crops, which helps to prevent pollution With microorganisms and algae that raise the values of the vital oxygen requirement. Where the results of this study are less than the results obtained by Mahdi (2008) in his study of groundwater in the city of Samarra, in which the values of the vital oxygen requirement ranged between (0.00-10.0) mg / liter, and a similar approach to what was reached by Al-Obaidi (2011). When examining some of the physical and chemical properties of groundwater in Al-Sharqat district, in which these values ranged between (0.3-3.28) mg / liter, Harz (2022) mg/L.

Table (7-1) of monthly and local changes in BOD (mg/L) during the study period

wellsmonths	well1	well2	well3	well4	well5	well6	Well rates
November	1.9	1.2	0.9	0.9	2.1	2.4	1.56
December	1.6	0.7	0.6	0.9	0.9	0.7	0.9
January	0.9	0.4	0.9	1.2	1.1	0.8	0.88
February	2.8	0.9	1.4	1.6	1.8	0.4	1.48
March	1.4	1.1	0.6	2.1	1.7	1.2	1.35
April	1.8	1.2	0.9	2.4	1.5	1.4	1.53
Months rates	1.73	1.18	0.88	1.51	1.51	1.15	

7-2 Dissolved oxygen (D.O)

The low concentration of dissolved oxygen in the water causes many negative effects on the aquatic ecosystem, as it increases the activity of anaerobic microorganisms, causing a change in the course of the reactions of organic substances and the production of substances harmful to the aquatic environment (Talaat and Al-Safawi, 2018). The results showed, as shown in Table (7-2), that the dissolved oxygen concentration ranged between (2.8-8) mg/L, where the lowest value was in well 6 for January, and the highest concentration was in well 5 April. The reason for the high values of dissolved oxygen concentrations in the current study may be due to the proximity of the water level of the wells to the surface of the earth and the large openings of the external open tubes coverings that make the waters of these wells come into direct and significant contact with the external environment, as well as being affected by climate factors such as temperature, relative humidity and pressure. Atmospheric, rain and wind, and this may be due to the source of feeding the wells, as the results of our study gave to determine the depth and direction of groundwater movement. Confirms the impact of the water wells on the waters of the Tigris River because it is not deep, as well as its proximity to the river, which caused the dissolved oxygen values to rise significantly. . Where the results of the current analyzes were higher than the results obtained by Dalaas ana Abduljabar (2018) when they studied the physical and chemical properties of a number of wells in the village of Samra affiliated to Al-Alam District within Salah Al-Din Governorate, where the values of dissolved oxygen ranged between (2.75-5.37) mg/ liters and higher than the results reached by Mansour (2021) when studying the physical, chemical and biological properties and the possibility of treating some wells water in Kirkuk governorate, where the dissolved oxygen concentration rates ranged between (5.23-6.4) mg / liter, and similar to the results reached by Harez (2022).) When studying the quality of the groundwater of Al-Dur district, the dissolved oxygen values ranged between (2.80-9.50) mg / liter. Where the values of the results agreed for the determinants of the Central Organization for Standardization and Quality Control (1996) and the World Health Organization (WHO) (2008), which is greater than 5 mg / liter.

Table (2-7) Monthly and location changes of dissolved oxygen concentration (DO) (mg/L) during the study period

Wells Months	Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	Wells' rates
November	4.5	4.5	5.50	4	4.5	5	4.66
December	4	4	4	4	5.5	5	4.41
January	3	4.6	3	3.5	3.5	2.8	3.4
February	5	4.5	5	5	5.8	5	5.05
March	4.5	5	6	6	6.4	6.2	5.68
April	6.5	7.2	7.5	8	7.6	6.8	7.26
Months' rates	4.58	3.55	5.16	14	5.55	5.13	

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