MODERN MEDICINE AND PRACTICE
https://inovatus.es/index.php/ejmmp

EUROPEAN JOURNAL OF MODERN MEDICINE AND PRACTICE
Vol. 4 No. 7 (Jul - 2024) EJMMP ISSN: 2795-921X

STUDY OF THE PHYSICAL CHARACTERISTICS OF SOME WELLS IN AL-KHALIDIYA DISTRICT IN ANBAR GOVERNORATE

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Abstract: The current study was conducted to evaluate the quality of groundwater and indicate its suitability for drinking, domestic uses, watering livestock, and irrigation in Al-Khalidiya district and its affiliated villages in Anbar Governorate. Water samples were collected from eight randomly distributed wells, and the study period lasted six months, starting from September 2023 to February 2024. Some physical tests were conducted, such as water temperature, whose rates ranged between (20.8 - 23) C, and turbidity, whose rates ranged Between (0.47 - 47.62) naphthalene is a turbid unit, and the electrical conductivityEC, whose rates ranged between (1598 - 8699.2) microsiemens.cm-1, and total dissolved solid salts, whose rates ranged between (1140 - 6509.5) mg.l-1.

The results indicated that turbidity concentrations increased by 50% of the studied well water, and 50% were within the permissible limits for drinking, with high concentrations of both electrical conductivity and total dissolved solid salts for all the studied well water, and that it was not suitable for drinking because it exceeded the internationally permissible limits. Iraqi.

1. Introduction

Water is the wondrous liquid of life that the Creator, God Almighty, distinguished with many physical, chemical and biological characteristics that made it truly the unique liquid of life. Without water, the earth's temperature would not have been regulated and its soil would not have been cracked for agriculture[1]. Groundwater is considered one of the very important sources for obtaining water, which can be used in several fields, including drinking water, and in the industrial, agricultural and urban fields. Therefore, the subject of studying groundwater has become one of the very important subjects for obtaining fresh water sources[2]. The formation of groundwater. About 96% of the world's non-frozen freshwater resources, 60% of which are used in agriculture[1].

Groundwater can be defined as the water present in the ground. It is stored in the pores of rocks or cracks and filters through its passage through the soil and rocks to the lower layers of the earth's surface, forming groundwater. It is considered one of the important water resources in desert areas and is found in the ground and at depths. Different and changes from one location to another according to the geological formation[3].One of the basic problems facing national security is the scarcity of water, especially in desert and semi-desert areas, whose water sources are from neighboring countries, which adds other strategic challenges in addition to climatic challenges and the lack of rainfall there[4]. The salinitySalinity is the main problem of groundwater in Iraq due to its exposure to geological layers, the geochemical reactions that occur in it, and the possibility of its contamination with agricultural fertilizers and civil and industrial wastes

that can seep into groundwater through soil layers, which determines water uses[5]. Proper planning, management, and dealing with the sources of water wealth available in Iraq represents the first step in enhancing the capabilities of providing the country's water resources. Therefore, it is necessary to manage and monitor the quality of water resources in a good and efficient manner, and to limit the sources of pollution while continuing to conduct qualitative water studies to identify any emergency event[5].

Physical properties of groundwater:

The study of the physical characteristics of groundwater is one of the basic topics of hydrogeology, and is considered one of the important factors in determining the quality and suitability of groundwater and gives an idea of the groundwater content of organic and inorganic elements and compounds[6].

1- Water temperature (°C):Temperature of Water

Temperature is one of the important environmental factors affecting water quality characteristics and affects the physical and chemical interactions of water [7], and it also affects the effectiveness and activity of microorganisms and the processes of decomposing organic matter in the aquatic environment, as it affects the concentration of gases dissolved in the water such as oxygen and carbon dioxide, and has a major role in biological redox processes [7][8], as high temperature increases the activity of microorganisms and this leads to increased depletion of dissolved oxygen depending on the concentration of organic substances present in the water. It also plays a major role in some water properties such as density and electrical conductivity, which are related to Directly related to salinity[9], the rise in temperature helps increase the geochemical interactions of groundwater, and this leads to an increase in the concentration of electrical conductivity and total dissolved solids that determine the distribution of organisms in aquatic environments [10][11]

2- The turbidityTurbidity

Turbidity is one of the important environmental factors for determining the validity and quality of various waters in nature. It is a reflection of the presence of living and non-living suspended materials that cause the reflection of light and thus affect the turbidity of the water. Turbidity can be defined as a measure of the amount of light scattered by suspended particles and zooplankton and plant organisms in the water column instead. from traveling straight through the aqueous sample[12][13], high turbidity leads to a high risk of diseases resulting from microorganisms such as viruses, parasites, and some bacteria resulting from the impact of wastewater [14][15]electrical conductivity (EC) Electrical Conductivity

Electrical conductivity is an indication of the dissolved solids content of waterTDS, which contains inorganic materials and small amounts of organic compounds dissolved in water, and electrical conductivity can be defined as a measure of the concentration of positive and negative ions dissolved in water[16][17], and electrical conductivity depends on temperature, concentration, and type of ions present When the water temperature rises by one degree Celsius, the electrical conductivity increases by 2% because the temperature increases with the speed of the action of salts in the water[18][19].

3- dissolved solids (TDS) Total Dissolved Solids

It represents all dissolved solids in water that remain or precipitate after evaporation and drying at a temperature not exceeding 105 degrees Celsius[20]. Also, groundwater that contains a high percentage of dissolved solids causes severe intestinal disorders and kidney problems. And the heart[21].

2. Materials and working methodsMaterial and Methods

1- temperatureTemperature

Air and water temperatures were measured in the field. The air temperature surrounding the well was measured by placing the mercury thermometer in the shade and at a height of one meter from the ground. As for the water temperature, it was measured using a mercury thermometer within the range 0-100 C, by submerging the mercury end of the thermometer. In the water for a few minutes until the reading stabilizes and the temperature is recorded in degrees Celsius (°C).

2- Electrical conductivity Electrical Conductivity (EC)

Electrical conductivity was measured using an electrical conductivity deviceMicroprocessor conductivity meter type HANNA HI2300 (made in Romania) to measure water samples in microsiemens. cm-1.

3- Turbidity Turbidity

The turbidity was measured using a device(HACH 2100N Turbidimeter) is of German origin and is expressed in units (Nephelometric Turbidity Unit) (NTU) naphthalene turbidity unit. Immediately upon arrival at the laboratory, the water samples were shaken well to ensure their homogeneity and an average of two readings were taken for each sample after calibrating the device with standard solutions.

4- MaterialsTotal Dissolved Solid

The total dissolved solids of the samples were measured according to the method presented in[22], where a volume of 50 ml of water samples is evaporated and then dried in an electric oven at a temperature of 105 °C, after which the concentrations of total dissolved solids are calculated through the following equation, and the results are expressed in mg. L-1.

Total dissolved solid = (AB) × 1000 / sample volume (ml)

SinceA: Represents the weight of the plate with the remainder.

B: represents the empty weight of the plate.

3. Results and discussionResults and Discussion

1- Water temperature (°C): Temperature of water

The results of the current study, as shown in Table (1) and Figure (1), showed that the average temperatures of the water samples studied ranged between (20.8 - 23) C, with the highest value (26) C recorded in September at Well 6, and the lowest value (17). °C in January at Well 8, and the results of the current study were close to the results of (Hassan, 2021) in her study estimating the water quality factor of a number of wells and their suitability for using them for various purposes in Kirkuk, as the average water temperatures ranged between (21 - 23) °C, The same is true with the study [23]evaluating the water of some wells in the Yaji district in Kirkuk Governorate, as its rates ranged between (21.3 - 23) C. The reason for the slight variation in the temperatures of the wells' water is due to the fact that the temperature of the wells' water changes little.Sterothermal throughout the year, as a result of its distance from the surface of the Earth and thus its distance from the effects of climatic factors[24].

2- The turbidityTurbidity

The results of the current study, as shown in Table (2) and Figure (2), indicated that the turbidity rates of the studied well water ranged between (0.47 - 47.62).NTU, as the highest value (78) NTU was recorded in Well 5 in the month of February, and the lowest value (0.2) NTU in Well 1 in September. The results of the current study were close to the results of [25] in her study of a number of water wells on the left side of the city. Mosul, as the turbidity rates ranged between (0.10 - 42.12) NTU, and higher than the results of in her study of applying water quality indicators to evaluate the water quality of a number of wells on the left coast of the city of Mosul, as the turbidity rates ranged between (0.26 - 20.23). NTU, the reason for the high turbidity values in the water of some wells may be due to the high concentration of suspended materials such as clay and silt particles or due to the process of pumping water from the well and the occurrence of a relative stream of groundwater-carrying components to the opening of the lower well, leading to the movement of clay and silt particles with the water current, causing Turbidity[26], and it may be due to the penetration of soil particles into the well water from unstable sides, which increases the turbidity of the water[27][28]. As for the reason for the low turbidity values of the water of some wells, it may be due to the filtration of groundwater through the geological layers of the earth, and it may be due to the slow or relatively stagnant movement of groundwater at times.

3- Electrical conductivityElectrical Conductivity

The results of the current study, as shown in Table (3) and Figure (3), indicated that the electrical conductivity rates ranged between (1598 - 8699.2) microsiemens.cm-1, and the highest value (8971) microsiemens.cm-1 was recorded in well 6 in the month of February. The lowest value (1552) microsiemens.cm-1 was recorded in well 3 in December, and these results were close to the results in his hydrogeochemical study of groundwater and determining its fate in the areas surrounding the city of Ramadi, as electrical conductivity values ranged between (815 - 8470) microsiemens.cm-1, and also similar to the results of in his study evaluating water quality Some wells in the north of Salah al-Din Governorate[29], as their rates ranged between (1920 - 7675) microsiemens.cm-1, as well as an approach to the results in his study evaluating the water of some wells in the Yaji district in Kirkuk, as their rates ranged between (1801 - 7371) Microsiemens.cm-1, and higher than the results of in his study evaluating groundwater and treating its salinity in Tikrit, as their rates ranged between (1742 - 3002) microsiemens.cm-1, and also higher than the results of in her study. Applying water quality indicators to evaluate the water quality of a number of wells on the left coast of the city of Mosul, as their rates ranged between (473 - 1968) microsiemens.cm-1, and also higher than the results of in her study estimating the water quality factor of a number of wells and their suitability. It was used for multiple purposes in the city of Kirkuk, as its rates ranged between (566.3 - 2707) microsiemens.cm-1. The reason for the variation in the electrical conductivity values of the water of the wells studied is attributed to the nature of the geological formations through which the water passes. The groundwater that passes through the layers containing salts Gypsum (CaSO4.2H2O) and anhydrite rocks (CaSO4) are characterized by high electrical conductivity values[30], and the increase may be due to the amounts of salts that reach the well water as a result of watering agricultural lands, as well as the processes of washing agricultural lands with rainwater, which washes away the salts of neighboring lands (Abdul Jalil and Al-Khafaji, 2016). In general, all of the well water samples studied are not suitable for drinking because they exceed permissible Iraqi and international limits.

4- Total dissolved solidsTotal Dissolved Solids (TDS)

The results of the current study, as shown in Table (4) and Figure (4), indicated that the concentrations of dissolved solid salts ranged between (1140 - 6509.5) mg.L-1, with the highest value (7086) mg.L-1 recorded in well 6. In January, the lowest value was (1004) mg.l-1 in well 3 in November. These results were similar to the results of [31]in their study of the suitability of well water in the city of Fallujah, as its rates ranged between (2100 - 7900) mg.L-1, and also close to the results of [32] in his study of the development potential for investing in groundwater. In Najaf Governorate, their rates ranged between (937 - 5913) mg.l-1. It is higher than the results of [33] in his study of some of the physical and chemical properties of the water of a number of wells in the city of Kirkuk, as the values ranged between (387-819) mg.L-1, and also higher than the results of [34] in her study of the validity of the water of a number From wells in Kirkuk Governorate, the values ranged between (253-1170) mg.l-1. The reason for the high concentrations of dissolved solid salt values in the water of the studied wells, especially well 6, is due to the nature of the geological structures of the study area, as geological and topographical conditions play a major role in changing salinity values, and groundwater passing through rocks is rich in evaporite salts, gypsum (CaSO4.2H2O) and anhydrite (CaSO4).

Anhydrite is characterized by high concentrations of dissolved solid salts. High concentrations of dissolved solid salts in groundwater cause severe intestinal disorders and heart and kidney problems.

Tables 1-4 show the values of water temperature, turbidity, electrical conductivity, and total dissolved solid salts of well water during the study period.

the average	2024		2023				the date / Wells
	2	1	12	11	10	9	
22.5	20	19	23	23	24	25	W1
21.7	19	18	22	24	23	24	W2
22.8	21	20	23	24	24	25	W3
22.3	20	19	21	23	24	25	W4
22.2	21	20	23	22	23	24	W5
23	22	19	22	24	25	**26**	W6
22	21	20	21	23	23	24	W7
20.8	19	**17**	20	22	23	24	W8

Table (1) Well water temperature values during the study period (°C)

the average	2024		2023				the date / Wells
	2	1	12	11	10	9	
0.85	1.8	0.7	1.4	0.6	0.4	**0.2**	W1
0.97	1.4	1.3	0.5	1.2	0.8	0.6	W2
8.42	8.8	8.5	7.6	7.9	8.1	9.6	W3
0.47	0.3	0.6	0.3	0.7	0.5	0.4	W4
47.62	**78**	45.7	28.5	24.9	31.6	77	W5
10.15	15	7.4	6.7	13.6	5.8	12.4	W6
15.62	22.8	18.5	9.3	7.9	11.2	24	W7
23.63	13	11.8	10.4	15.6	26	65	W8

Table (2) Turbidity values of well water during the study period (NTU).

the average	2024		2023				the date / Wells
	2	1	12	11	10	9	
2768	2854	2943	2972	2830	2670	2339	W1
2454.5	2468	2332	2680	2540	2317	2390	W2
1598	1628	1570	**1552**	1618	1640	1580	W3
2615	2386	2227	2750	2860	2920	2547	W4
4420.5	4357	4552	4463	4390	4540	4221	W5
8699.2	**8971**	8447	8540	8825	8632	8780	W6
3250	3194	3463	3280	3431	3100	3032	W7
3610	3558	3317	3890	3822	3750	3323	W8

Table (3) Electrical conductivity values of well water during the study period (microsiemens.cm-1).

the average	2024		2023				the date / Wells
	2	1	12	11	10	9	
1765	1862	1986	1810	1746	1652	1534	W1
1635	1480	1542	1630	1854	1748	1556	W2
1140	1290	1095	1143	**1004**	1276	1032	W3
1675	1578	1496	1688	1754	1858	1676	W4
2054.5	1983	1884	2332	1936	2064	2128	W5
6509.5	6724	**7086**	6571	6380	6422	5874	W6
2213	2136	2352	2246	2370	2130	2044	W7
2449	2475	2256	2624	2591	2486	2262	W8

Table (4) values of total dissolved solidsTDS of the studied well water (mg.L-1).

Figures 1-4 show the average values of water temperature, turbidity, electrical conductivity, and total dissolved solid salts of well water during the study period.

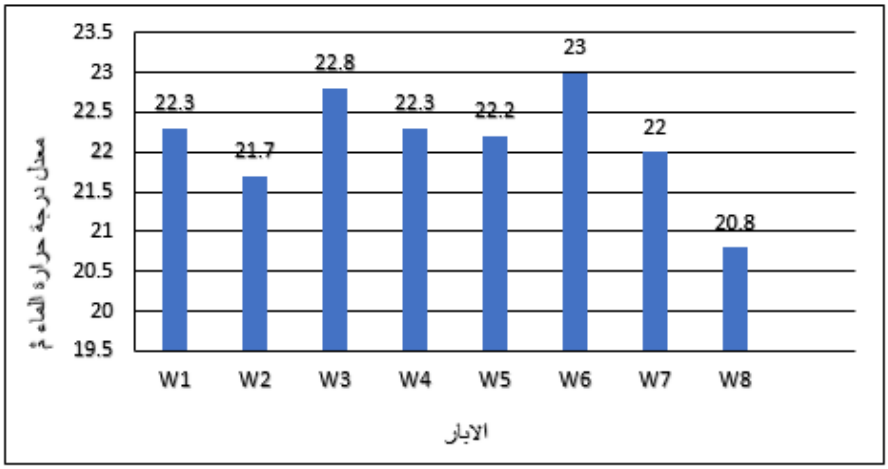

Figure (1) Average well water temperature values during the study period.

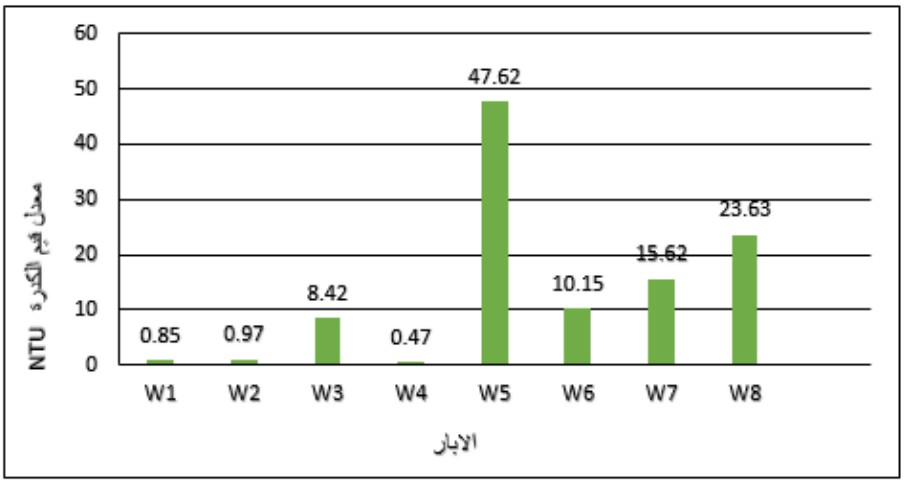

Figure (2) Average turbidity values of well water during the study period.

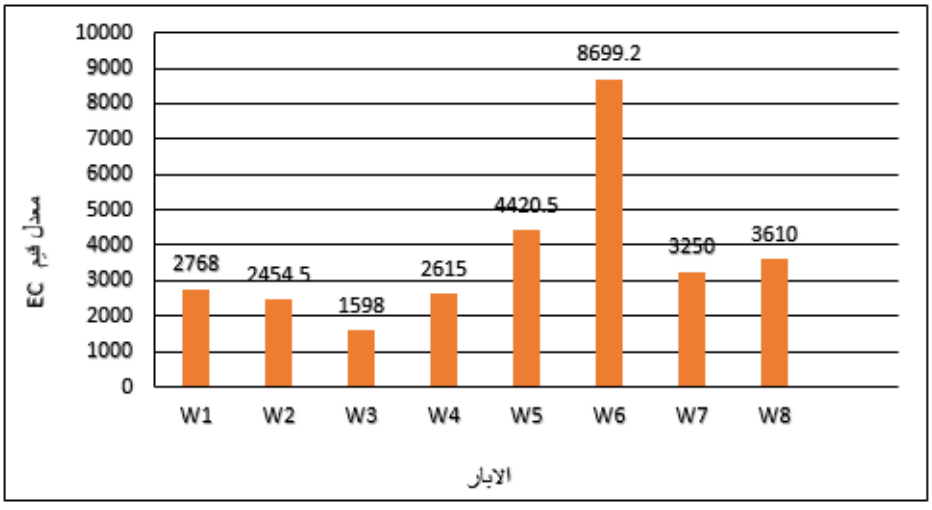

Figure (3) Average electrical conductivity values of well water during the study period.

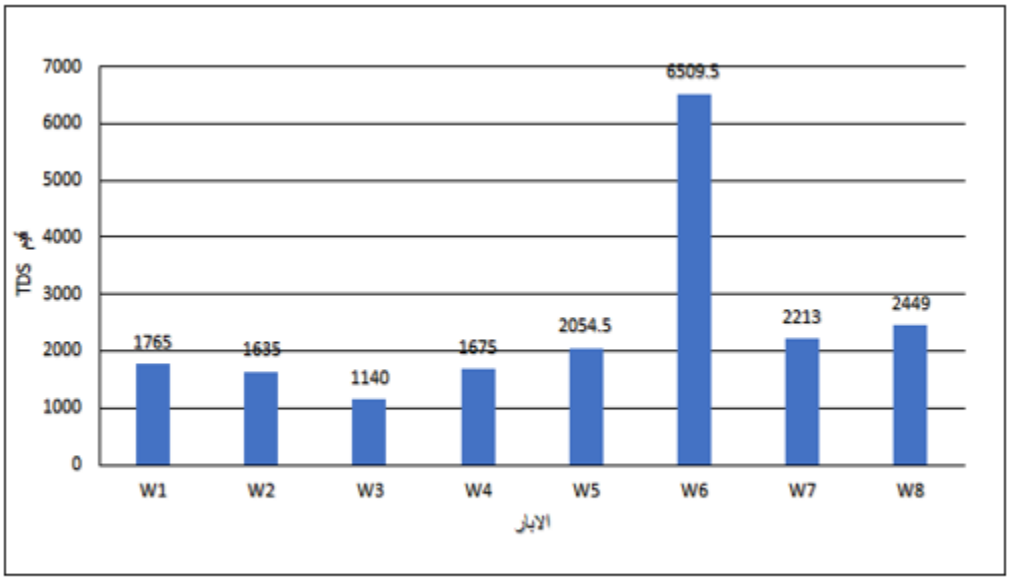

Figure (4) Average concentrations of total dissolved solids in well water during the study period.

4. Conclusions

The results indicated that turbidity concentrations increased by 50% of the studied well water, and 50% were within the permissible limits for drinking, with high concentrations of both electrical conductivity and total dissolved solid salts for all well water, and that it was unfit for drinking because it exceeded the standard limits permitted internationally.

References

[1] S. Wheeler, A. Loch, A. Zuo, and H. Bjornlund, "Reviewing the adoption and impact of water markets in the Murray–Darling Basin, Australia," *J. Hydrol.*, vol. 518, pp. 28–41, 2014.

[2] F. H. Abbas, "Hydrogeochemical study of groundwater in the island near Samarra-Iraq," *Iraqi Natl. J. Chem.*, vol. 10, no. 40, pp. 624–631, 2010.

[3] R. A. Salih, I. I. Ghdhban, and A. K. A. Wahid, "Evaluation of a number of water treatment plants in Kirkuk governorate using the water quality index," *Tikrit J. Eng. Sci.*, vol. 25, no. 1, pp. 49–59, 2018.

[4] A.-A. Y Al-Saffawi and R. A Talaat, "Sewage Water Purification Through direct exposure to solar radiation," *Rafidain J. Sci.*, vol. 27, no. 1, pp. 64–75, 2018.

[5] A. Ehab Mohammad, A. Ektifa Taha, S. Fatma Adnan, and S. Rania Haithem, "Study of qualitative properties of groundwater and its suitability for different uses in the Eastern of the Al-Dour city/Salahaldin/Iraq," *Tikrit J. Pure Sci.*, vol. 25, no. 2, pp. 47–53, 2020.

[6] S. S. Alazzawi and Y. K. Alasadi, "Synthesis and study of the biological activity and molecular Docking of 2-hydrazinobenzothiazole derivatives.," *Multi-Knowledge Electron. Compr. J. Educ. Sci. Publ.*, no. 62, 2023.

[7] R. A. Ali, L. S. Ahamed, and S. I. C. AL-Khazraji, "Synthesis, Characterization, and Study of Anticancer Activities of New Schiff Bases and 1, 3-Oxazepine Containing Drug," *Russ. J. Bioorganic Chem.*, vol. 50, no. 1, pp. 28–33, 2024.

[8] A.-A. Y. T. Al-Saffawi, "Water quality of Nimrud district wells southeast of Mosul city for drinking and civil purpose using the Canadian model of water quality," *Pakistan J. Anal. Environ. Chem.*, vol. 20, no. 1, pp. 75–81, 2019.

[9] E. D. Ebong, A. E. Akpan, C. N. Emeka, and J. G. Urang, "Groundwater quality assessment using geoelectrical and geochemical approaches: case study of Abi area, southeastern Nigeria," *Appl. Water Sci.*, vol. 7, pp. 2463–2478, 2017.

[10] Z. F. Altahaan and D. Dobslaw, "Assessment of post-war groundwater quality in urban areas of Mosul city/Iraq and surrounding areas for drinking and irrigation purposes by using the Canadian Environment Water Quality Index CCME-WQI and Heavy Metal Pollution Index HPI," *World J. Adv. Res. Rev.*, vol. 21, no. 3, pp. 2461–2481, 2024.

[11] A. F. Rusydi, "Correlation between conductivity and total dissolved solid in various type of water: A review," in *IOP conference series: earth and environmental science*, IOP publishing, 2018, p. 12019.

[12] A. A. MARIF and A. O. ESMAIL, "QUALITY EVALUATION OF WATER RESOURCES FOR IRRIGATION IN SULAIMANI GOVERNORATE, IRAQ.," *Appl. Ecol. Environ. Res.*, vol. 21, no. 3, 2023.

[13] J. A. Prieto-Amparán, B. A. Rocha-Gutiérrez, M. de L. Ballinas-Casarrubias, M. C. Valles-Aragón, M. del R. Peralta-Pérez, and A. Pinedo-Alvarez, "Multivariate and spatial analysis of physicochemical parameters in an irrigation district, Chihuahua, Mexico," *Water*, vol. 10, no. 8, p. 1037, 2018.

[14] A. Kur, A. T. Alaanyi, and S. T. Awuhe, "Determination of quality of water used by students of College of Education, Katsina-Ala through physical and electro-chemical parameters," *Sci. World J.*, vol. 14, no. 1, pp. 78–83, 2019.

[15] A. M. Mahdi and S. A. Salman, "Assessment of some heavy metals and study some physical and chemical characteristics of drinking water in the central water purification station, Samarra city, Iraq," in *AIP Conference Proceedings*, AIP Publishing, 2022.

[16] P. Aravinthasamy, D. Karunanidhi, T. Subramani, K. Srinivasamoorthy, and B. Anand, "Geochemical evaluation of fluoride contamination in groundwater from Shanmuganadhi River basin, South India: implication on human health," *Environ. Geochem. Health*, vol. 42, pp. 1937–1963, 2020.

[17] R. A. Talat, A. Y. R. Al-Assaf, and A. Y. T. Al-Saffawi, "Valuation of water quality for drinking and domestic purposes using WQI: Acase study for groundwater of Al-Gameaa and Al-Zeraee qaurters in Mosul city/Iraq.," in *Journal of Physics: Conference Series*, IOP Publishing, 2019, p. 72011.

[18] P. Alexander, I. B. Bwatanglang, and J. Daniel, "Assessment of physicochemical and bacteriological parameters of borehole and hand dug well water in Michika and Environs, Adamawa State, Nigeria," *Microbiol. Res. J. Int.*, vol. 28, no. 6, pp. 1–11, 2019.

[19] A. Ameloko, E. A. Ayolabi, E. Enaworu, and E. O. Bolujo, "Assessment of leachate contamination of groundwater around Ighenre Ekotedo dumpsite, Ota, Southwest Nigeria," 2018.

[20] N. A. S. Al-Hamdani, "Application of water quality indicators to assess the water quality of a number of wells on the left coast of the city of Mosul/Iraq," *A Master's thesis, Coll. Environ. Sci. Technol. Mosul, Iraq)*, 2020.

[21] B. A. Mahdii, A. J. Mohammed, S. A. Mahdii, and A. N. Ajaweed, "Investigation of the drinking water quality of some residential areas in Baghdad city-Karkh District," *Iraqi J. Sci.*, vol. 57, no. 1A, pp. 78–

97, 2016.

[22] A. N. Amadi *et al.*, "Investigating the Quality of Groundwater from Hand-dug Wells in Lapai, Niger State, North-central Nigeria using Physico-chemical and Bacteriological Parameters," *Minna J. Geosci.*, vol. 1, no. 1, pp. 77–92, 2017.

[23] K. Hamilton *et al.*, "A global review of the microbiological quality and potential health risks associated with roof-harvested rainwater tanks," *NPJ Clean Water*, vol. 2, no. 1, p. 7, 2019.

[24] R. E. Daffi, M. I. Alfa, and E. S. Ibrahim, "Gis-based analysis of water quality parameters of Groundwater with proximity to onsite wastes pits in vom community of Jos South, Nigeria," *parameters*, vol. 11, no. 15, p. 4, 2020.

[25] H. F. A. Al-Mamouri and F. M. Alkam, "Physical and chemical properties of some Babylon province wells water and conformity to standard drinking water of Iraq.," *Plant Arch.*, vol. 19, no. 2, 2019.

[26] O. E. Odipe, H. O. Sawyerr, and S. O. Adewoye, "Filling stations and their effects on groundwater quality in Ilorin metropolis," *Int. J. Environ. Prot. Policy*, vol. 8, no. 1, p. 11, 2020.

[27] M. Ayoub, "Modelling of the Fabrics Filtration to Remove the Turbidity from the Extracted Groundwater," *Am. Sci. Res. J. Eng. Technol. Sci.*, vol. 49, no. 1, pp. 76–85, 2018.

[28] B. N. Shuhaibar, "Development of a process for harmful algal bloom location prediction using GIS and trend analysis for the terrestrial waters of Kuwait." The George Washington University, 2009.

[29] H. I. Z. Al-Sudani, "Groundwater system of Dibdibba sandstone aquifer in south of Iraq," *Appl. Water Sci.*, vol. 9, no. 4, p. 72, 2019.

[30] A. A. S. Al-Allaf and T. M. K. Al-Shwany, "Health Effects of Nitrate Concentrations in the Groundwater of Kirkuk Governorate, Iraq," *NeuroQuantology*, vol. 20, no. 6, p. 2711, 2022.

[31] M. S. A.- Khafaji, I. A. Alwan, A. G. Khalaf, S. A. Bhat, and A. Kuriqi, "Potential use of groundwater for irrigation purposes in the Middle Euphrates region, Iraq," *Sustain. Water Resour. Manag.*, vol. 8, no. 5, p. 157, 2022.

[32] E. W. Rice, L. Bridgewater, and A. P. H. Association, *Standard methods for the examination of water and wastewater*, vol. 10. American public health association Washington, DC, 2012.

[33] S. Bouslah, L. Djemili, and L. Houichi, "Water quality index assessment of Koudiat Medouar Reservoir, northeast Algeria using weighted arithmetic index method," *J. water L. Dev.*, vol. 35, no. 1, p. 221, 2017.

[34] R. Nayar, "Assessment of water quality index and monitoring of pollutants by physico-chemical analysis in water bodies: a review," *Int. J. Eng. Res. Technol.*, vol. 9, no. 01, 2020.

[35] M. J. Saleh and K. A. Al-Badrany, "Preparation, Characterization of New 2-Oxo Pyran Derivatives by AL2O3-OK Solid Base Catalyst and Biological Activity Evaluation," *Cent. Asian J. Med. Nat. Sci.*, vol. 4, no. 4, pp. 222–230, 2023.

[36] A. W. A. S. Talluh, "Preparation, Characterization, Evaluation of Biological Activity, and Study of Molecular Docking of Azetidine Derivatives," *Cent. Asian J. Med. Nat. Sci.*, vol. 5, no. 1, pp. 608–616, 2024.

[37] A. Talluh, J. N. Saleh, and M. J. Saleh, "Preparation, Characterization and Evaluation of Biological

Activity and Study of Molecular Docking of Some New Thiazoli-dine Derivatives," 2024.

[38] A. W. A. S. Talluh, M. J. Saleh, J. N. Saleh, K. Al-Badrany, and H. mohammed saleh Al-Jubori, "Preparation, characterization, and evaluation of the biological activity of new 2, 3-dihydroquinazoline-4-one derivatives," *Eur. J. Mod. Med. Pract.*, vol. 4, no. 4, pp. 326–332, 2024.

[39] J. N. Saleh and A. Khalid, "Synthesis, Characterization and Biological Activity Evaluation of Some New Pyrimidine Derivatives by Solid Base Catalyst AL2O3-OBa," *Cent. Asian J. Med. Nat. Sci.*, vol. 4, no. 4, pp. 231–239, 2023.