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STUDY AND EVALUATION OF GROUND WATER IN AL- DIWANIYAH PROVINCE, IRAQ

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Abstract:

This study was conducted on well water for 6 sites in Al-Diwaniyah Province, Iraq (Al-Shamiya, Al-Amin, Al-Sudair, Al-Shafiya, Al-Daghara and Al-Shinafiya). For the two seasons, summer and winter, The parameters were measured which are (pH, turbidity, electrical conductivity, total dissolved salts, total hardness, chlorides, calcium, alkalinity, copper and zinc concentration). The results showed an increase in most of the studied indicators compared to the international and Iraqi determinants, The highest values were (33.6 , 5987, 2313, 1986, 988, 911 , 360, 31.4) for turbidity , EC, TDS, TH, CL, Ca , Alk and Cu . The rest of the indicators were within the permissible international and Iraqi limits. The suitability of the water of these wells for irrigation was determined using WQI. The wells of Al-Shamiya and Al-Daghara were poor water, while the water from the Al-Shinafiya and Al-Shafi'i wells was unsuitable for irrigation, while the Al-Sudair and Al-Amin wells were in the very poor category.

Keywords: Ground water, WQI, Unsuitable water, well.

Introduction

Groundwater ecosystem is considered an important aspect in the ecosystem interns of its versatility in cycling of water globally, supporting different kinds of species and in turn provides service for humanity (1). Importance of groundwater usually comes from its connection with water bodies of lakes, rivers, coastal waters, estuaries, oceans and along with atmosphere contributes to support biodiversity and water cycle in glob (2).

Activities such as agriculture and industry have widely been supported by groundwater (3,4) and most of which is due to several reasons such as it is far away from being polluted, its quality and quantity are more stable over the years and cannot be influenced by extreme environmental conditions (5). When it comes to surface water, pure groundwater is frequently the sole source that can supply people with high-quality drinking water (6). In contrast, the urgent need to use groundwater has appeared recently (7), and this is due to extreme environmental conditions such as drought events globally as a result of climate change, as well as overuse, and population growth (8).

Concern and knowledge regarding water contamination have increased recently on a global scale. As a result, new strategies have been developed internationally to achieve sustainable management of water resources. To evaluate the quality of water for different applications, it is important to conduct routine monitoring of water resources (9). Parameters related to water quality are the most important part of any WQI. When pollutant concentrations are below water quality criteria. WQIs assist specialists in separating monitoring data into a larger framework, enabling administrative decision-makers to evaluate the efficacy of regulatory programs and provide water quality data to the public in a readily understood manner (10). The majority of monitoring program objectives, including water quality, evaluation, treatment, use, public communication, research and development, and environmental planning, were met by indices (11).

The aim of this research is to study some physical and chemical characteristics, and from these characteristics we evaluate the water of these wells and determine their suitability for irrigation using the Iraqi guide WQI.

Materials and Methods:

Six wells were selected from different areas of Diwaniyah Governorate, which are (Al-Shamiya, Al-Amin, and Al-Sudair Al-Shafiya, Al-Daghara and Al-Shinafiyah). These stations are districts in Al-Diwaniyah Governorate and depend on the water of these wells for irrigation purposes. Samples were taken in three replicates for each location, and samples were collected for the summer and winter seasons.

Physical and chemical parameters were conducted: pH, electrical conductivity EC, total dissolved salts TDS , total hardness TH, chlorides CL, calcium Ca , Alkalinity Alk , and heavy metals copper Cu and zinc Zn .pH , EC and TDS The test was carried out using laboratory equipment in the laboratories of the Environmental Research and Pollution Prevention Unit, College of Science / Al-Qadisiyah University, after calibrating the equipment (pH meter , EC ,TDS meter) . While the rest of the results were measured according to (12).

The well water quality was evaluated using the water quality index QWQI and according to the equations below:

$qi=si/ci *100$

$wi=1/si$

$WQI= \Sigma wi * qi$

$Overall\ WQI = \Sigma wi*qi / \Sigma wi$

Results & Dissection:

Stations (wells)	Parameters									
	pH	Turb	EC	TDS	TH	CL	Ca	Alk.	Cu	Zn
Al-Shamiya	7.81	4.76	3867	2240	2023	973	911	360	5.5	138
Al-Amin	7.43	11.6	5143	2986	2006	989	818	382	9.3	183

Al-Sadair	7.75	23.1	1975	1140	1009	580	430	280	8.8	243
Al-Shafiya	7.53	12.4	3763	1844	1098	579	563	292	5.11	178
Al-Daghara	7.70	15.4	1981	871	1121	316	329	190	4.3	142
Al-Shinafiya	7.86	4.22	3765	1920	2276	630	713	225	11.6	118

Table (1) physical and chemical parameters in study station in Summer

Stations (wells)	Parameters									
	pH	Turb	EC	TDS	TH	CL	Ca	Alk.	Cu	Zn
Al-Shamiya	7.88	5.94	3414	1986	1986	856	822	356	7.7	184
Al-Amin	7.46	33.6	5987	2313	1740	988	781	312	11.6	189
Al-Sadair	7.6	21.3	1959	1081	985	477	411	266	11	321
Al-Shafiya	7.67	24.4	3977	2214	2200	678	662	310	8.31	383
Al-Daghara	7.75	17.1	2098	1281	1394	515	434	200	12.7	434
Al-Shinafiya	7.88	5.8	3458	1932	2232	612	730	220	31.4	241

Table (2) physical and chemical parameters in study station in Winter

From the results of Table (1,2), The pH values ranged between (7.43 - 7.98) in the wells of the Al-Amin area and the Al-Shinafiya wells, respectively. The extent of change in this property is due to the buffer capacity of water due to the presence of carbonates and bicarbonates , the pH values were slightly higher in the winter than in the summer. This is due to the increase in the amount of surface water resulting from rainfall, which consequently washes away part of the soil components containing carbonates and bicarbonates(13) . This increases the pH values, but The increase was slight and all values were within permissible limits locally and globally.(12). As for electrical conductivity (µs/cm3) and total dissolved salts (mg/l), the highest values were in wells. In the current study, the highest value for electrical conductivity and total dissolved salts was observed in the Al-Amin area of the Sunniyah district (5987, 2313) respectively in winter, and the lowest values were in one of the villages of Al-Sudair district (1930, 1081) respectively. Through the results of this study, it is noted that all conductivity values and total dissolved salts are high and are classified as being between very salinity to very high salinity (14). However, the reason for the decrease and increase in values between seasons was due to rainfall and the geology of the area (15).

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As for the total hardness, the highest value in Al- Shinafiya wells in both of seasons (2276, 2232) ppm,and all value was high excced the international and Iraq limits , the quality of water in Iraqi wells is hard, especially in the southern regions due to the geological nature of the soil of the region within which water is stored and the rocks that contain salts that dissolve in the water due to continuous contact with it, so these salts dissolve, which increases the overall hardness of the water (16) . As for the chlorides, magnesium, and basic ions, it is noted from the tables above that the values are very high, exceeding the international and Iraqi permissible limits. The reason for this is mainly the nature of the Iraqi lands, and then the pollutants coming from surface water (17) . Therefore, the values of these indicators were very high, as the increase was recorded in all the wells studied, where The highest values recorded (989, 911, 382) . As for the elements copper and zinc, it is noted that the concentration of the element copper was higher than the globally and locally permissible values in all wells studied and in both seasons. The reason is due to external pollutants that reach the well water from fertilizers sprayed on agricultural lands in large quantities (18). The conscious value was (31.4). As for the element zinc It was within the internationally permissible limits in all the wells studied .

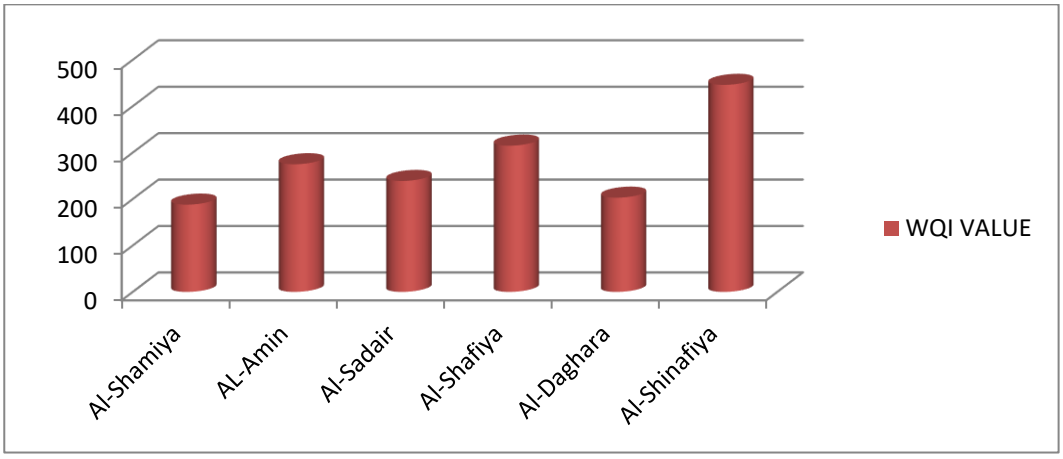

Fig (1) WQI in the study stations

In Figure (1), WQI indicates numerical values that clearly give the state of the water body (19). It is noted that the highest value for wqi was in the Al Shamiya and AL Shafiya Wells, where the value reached (446,319) and according to classification (20), this water is not suitable for irrigation. This is due to the increased concentration of hardness and salts, as well as the increased concentration of copper, which comes from fertilizers and that seep into the groundwater. After being added to surface agricultural lands and as a result of incorrect irrigation and watering operations, this water laden with pollutants seeps into groundwater This is consistent with the results (20). The lowest values were according to the values of (19) poor water in Al Shamiya and Al Daghara wells reached 188 and 203 respectively, it is noted that this water has a high percentage of salts, hardness, and conductivity, but much less than the previous one. It is noted that there are determinants that were within the permissible limits of pH values, turbidity, and zinc values. As for the rest of the wells, they were in a very poor category due to the high values of conductivity, dissolved salts, hardness, chlorides, and copper.

Therefore, the WQI value increased, as the values were recorded (239 and 275) in the Al-Sudair and Al-Amin wells, respectively. Due to the geological nature of the soil of the southern regions of Iraq, as well as pollution factors in surface water, most well water is either poor, very poor, or unsuitable(21).

Conclusion

The study concludes that an increase in most of the studied indicators compared to the international and Iraqi determinants, The highest values were (33.6, 5987, 2313, 1986, 988, 911, 360, 31.4) for turbidity, EC, TDS, TH, CL, Ca , Alk and Cu. The suitability of the water of these wells for irrigation was determined using WQI. The wells of Al-Shamiya and Al-Daghara were poor water, while the water from the Al-Shinafiya and Al-Shafi'i wells was unsuitable for irrigation, while the Al-Sudair and Al-Amin wells were in the very poor category.

References

1. Saccò, M., Mammola, S., Altermatt, F., Alther, R., Bolpagni, R., Brancelj, A., Brankovits, D., Fišer, C., Gerovasileiou, V., Griebler, C., Guareschi, S., Hose, G. C., Korbel, K., Lictevout, E., Malard, F., Martínez, A., Niemiller, M. L., Robertson, A., Tanalgo, K. C. ... Reinecke, R. (2023). Groundwater is a hidden global keystone ecosystem. Global Change Biology, 30, e17066.
2. Scanlon, B. R., Fakhreddine, S., Rateb, A., de Graaf, I., Famiglietti, J., Gleeson, T., Grafton, R. Q., Jobbagy, E., Kebede, S., Kolusu, S. R., Konikow, L. F., Long, D., Mekonnen, M., Müller Schmied, H., Mukherjee, A., MacDonald, A., Reedy, R. C., Shamsudduha, M., Simmons, C. T., & Zheng, C. (2023). Global water resources and the role of groundwater in a resilient water future. Nature Reviews Earth and Environment, 4(2), 87–101.
3. Foster, S.; Eichholz, M.; Nlend, B.; Gathu, J. Securing the critical role of groundwater for the resilient water-supply of urban Africa. Water Policy 2020, 22, 121–132.
4. Zhang, J.; Tang, D.; Wang, M.; Ahamd, I.; Hu, J.; Meng, Z.; Liu, D.; Pan, S. A Regional Water Resource Allocation Model Based on the Human–Water Harmony Theory in the Yellow River Basin. Water 2023, 15, 1388.
5. Martirosyan, A.V.; Ilyushin, Y.V. Modeling of the Natural Objects' Temperature Field Distribution Using a Supercomputer. Informatics 2022, 9, 62. [CrossRef].
6. Tomakov, M.V.; Tomakov, V.I.; Bokinov, D.V.; Andrienko, V.V.; Pashkova, M.E. (2018). Tasks of rational use and protection of groundwater in the territory of the Russian Federation—The main environmental problems of the country. Proc. Southwest State Univ. Ser. Eng. Technol. 8, 118–128.
7. Vaccarelli, I., Colado, R., Pallarés, S., Galassi, D. M., Sánchez-Fernández, D., Di Cicco, M., Meierhofer, M. B., Piano, E., Di Lorenzo, T., & Mammola, S. (2023). A global meta-analysis reveals multilevel and context-dependent effects of climate change on subterranean eco- systems. One Earth, 6, 1510–1522.

8. Sabale, R., Venkatesh, B. and Jose, M., (2023). Sustainable water resource management through conjunctive use of groundwater and surface water: A review. Innovative Infrastructure Solutions, 8(1), p.17.
9. Ewaid, S.H.; Abed, S.A.; Al-Ansari, N. Crop water requirements and irrigation schedules for some major crops in Southern Iraq. Water 2019, 11, 756.
10. Sutadian A.D., Muttil, N., Yilmaz, A.G. and Perera, B.J.C., (2016). Development of River Water Quality Indices - A Review. Environmental Monitoring and Assessment, 188:58, pp. 1–33.
11. Li, P., (2014). Abbasi T and Abbasi SA: Water Quality Indices. Environmental Earth Sciences, 71 (10): 4625–4628.
12. APHA American Public Health Association. (2003). Standard methods for examination of water and wastwater, 20th, Ed. Washington DC,USA.
13. Al-Sudani, H.I.Z. 2017. Groundwater Investigation in Iraqi Marshland Area. Diyala Journal for Pure Sciences. 13 (3):12-29.
14. Al-Sudani, H.I.Z. 2018. Hydrochemical Evaluation and Utilization of Groundwater in Khanaqin Area, Diyala Governorate- East of Iraq. Iraqi Journal of Science, 59 (4C): 2279-2288.
15. W.G.AL-Kaisi H.M.Shukri Azam H. AL-Hadithy (2012). Evaulation the quality of the wells water in AL-Jadria district / Baghdad. Kufa Journal for Agricultural Sciences, 4(1) : 127-146.
16. Hashim, Z.E.; Al-Madhhachi, A.T.; Alzubaidi, L.A (2020). Behavior of soil erodibility parameters due to biological soil crusts using jet erosion tests. Ecol. Eng. 153, 105903.
17. Abdullah Abdul Jalil Ayad Khairullah Hardan Alkfagi (2016). Ecological and biological study of groundwater in Al-falluja city- West Iraq . AJAS .14, (2). 133 – 146.
18. Jerzy J. Małecki, Monika Kadzikiewicz-Schoeneich, and Marzena Szostakiewicz-Hołownia (2016). Concentration and mobility of copper and zinc in the hypergenic zone of a highly urbanized area . Environ Earth Sci (2016) 75:24 , 2- 14.
19. Lateef, Zahraa Q., Abdul-Sahib T. Al-Madhhachi, and Dawood E. Sachit. 2020. "Evaluation of Water Quality Parameters in Shatt AL-Arab, Southern Iraq, Using Spatial Analysis" Hydrology 7, no. 4: 79.
20. M. A. House (1989). Water quality indices as indicators change Environmental Monitoring & Assessment, 15(3), 255.
21. Sadeq AlJawad, Nadhir Al-Ansari, Nasrat Adamo, Varoujan K. Sissakian , Jan Laue and Sven Knutsson. (2018). Groundwater Quality and Their Uses in Iraq . Journal of Earth Sciences and Geotechnical Engineering, vol . 8, no. 3, , 123-144.