Determining the quality of water wells in the southern part of the city of Basrah

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□ ABSTRACT □

This study aims to examine some physicochemical parameters (pH, electrical conductivity, turbidity, Total Dissolved Solids, total suspended solids, alkalinity, total hardness, hardness, temperature, chloride, sulfate, nitrate, nitrite, sodium, potassium, calcium, magnesium, carbonate) of some groundwater samples (well water) collected from four sites in the southern part of Basrah from four stations (Safwan, Barjesia, Zubair and Khor Zubair) to determine quality and quality of water. .

The results showed the highest values for the main variables studied in Safwan, where the results were as follows: pH values (7.9), sulfate value (2975.9 mg/l), nitrite (mg/l 6.4), sodium (mg/l 1921.9), potassium (mg/l 150.3) carbonate (280.6 mg/l) and electrical conductivity (14.3).

The results of the analysis showed water for chloride in Barjesia (mg/l 3727.5), for calcium (mg/l 1080), for total alkalinity (mg/l 119560) and total hardness (mg/l 34020) as well as CaCO3 hardness (13600 mg/l), Total Dissolved Solids (mg/l 11480), total suspended solids (mg/l 61), nitrates (mg/l 72.0) and carbonates (mg/l 280.6) were recorded in Zubair .

It was noted that the average temperature of all stations (24.2C°), and that the turbidity is obvious for the water samples of the four wells with high percentages of pollutants recorded, so it is not preferable to use water for human purposes, especially for drinking

Key words: Ground water, Well water, Water quality, physicochemical parameters

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تحديد جودة مياه الأبار في الجزء الجنوبي من مدينة البصرة

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□ ملخّص □

تهدف هذه الدراسة إلى فحص بعض المعايير الفيزيوكيميائية (pH، الناقلية الكهربائية، العكورة، المواد الصلبة الذائبة الكلية، المواد الصلبة العالقة الكلية، القلوية، العسرة الكلية، العسرة، درجة الحرارة، كلورايد، كبريتات، نترات، نتريت، صوديوم، بوتاسيوم، كالسيوم، مغنيزيوم، كاربونات) لبعض عينات المياه الجوفية (مياه الآبار) التي تم جمعها من أربعة مواقع في الجزء الجنوبي من مدينة البصرة من اربع محطات (صفوان، برجيسيه، الزبير وخور الزبير) لتحديد نوعية وجودة المياه .

أظهرت النتائج اعلى قيم للمتغيرات الرئيسة المدروسة في صفوان، حيث كانت النتائج على الشكل التالي: لقيم الـ pH (7.9)، وقيمة الكبريتات (2975.9mg/l)، وللنتريت (6.4 mg/l) والصوديوم (1921.9 mg/l) والبوتاسيوم (150.3 mg/l) كربونات (280.6mg/l) والناقلية الكهربائية (14.3).

بينت نتائج التحليل المياه للكلورايد في البرجيسيه (3727.5 mg/l)، وللكالسيوم (1080 mg/l)، وللقلوية الكلية (119560 mg/l) والعسرة الكلية (34020 mg/l) وكذلك العسرة CaCO3 (13600 mg/l)، وإجمالي المواد الصلبة الذائبة (11480 mg/l)، وإجمالي المواد الصلبة العالقة (61 mg/l) ، أما في الزبير فسجلت النترات (72.0 mg/l) والكربونات (280.6 mg/l) .

لوحظ أن متوسط درجة الحرارة لجميع المحطات (24.2°C) ، وأن التعكر واضحا لعينات مياه الآبار الأربعة مع تسجيل نسب عالية من الملوثات لذلك لا يفضل استخدام المياه للإغراض البشرية وخاصة للشرب

الكلمات المفتاحية : مياه جوفية، مياه ابار، نوعية المياه، المتغيرات الفيزوكيميائية

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Introduction:

Well water is ground water found within the pore spaces of geologic material beneath the surface of the earth. It exists in standard layers of sands and gravels in certain types of clay materials in cracks within crystalline rock [1]

Ground water can be define as the water contained beneath the surface in rocks and soil, it is the water that accumulates underground in aquifers, ground water constitutes 97per cent of global fresh water and an important source of drinking water in many countries especially in rural areas [2].

The available sources from water for use and for other domestic purposes must be high degree of purity [3], many locations in Southern Basrah city are facing water quality problem ,especially during Summer season [4], because of the hot weather in this part of Iraq. Consumption of polluted water caused health problems to adults and children in these areas. Natural ground water is usually of good quality and its preferred source of drinking water [5], but uncontrolled rapid growth of urbanization especially its debris discharging and the industrial and agriculture waste discharging [6]caused many damaged to these sources. Contamination of ground water has very implications for public health and has been responsible for water born diseases including gastroenteritis, hepatitis, giardiasis, cardiovascular and mutagenic-carcinogenic effects [5]

Because the highly demand for drinking water and for many other domestic purposes, and increased of anthropogenic activities [6] that caused pollution for water sources, that will caused many health effects so we need to educate the general populace proper disposal of wastes and control human activates to prevent sewage from water sites to avoiding water contamination [7] . For maintaining the human health and health of the ecosystem its importance to us to focused on water quality [8] researches. This paper study the quality of ground water of some selected wells at Basrah city, southern Iraq

Materials and Methods:

1- Study area and sampling procedure

Most of ground water locations in Basrah city are in the Southern part in the desert zone .The samples were collected from four selected locations they are Safwan, Al-Barjesia , Al-Zubair & Khor Al-Zubair ,as shown in Fig.1.

The water samples were collected in clean plastic bottles and bring to the laboratory for further analysis

2- Laboratory Analysis :

water quality physicochemical parameters PH, electric conductivity, turbidity, total dissolved solids, suspended solids, alkalinity, total hardness, hardness, temperature, chloride, sulphate, nitrate, nitrite, sodium, potassium, calcium, magnesium, carbonate were examined by using the procedures as in [9] ,the turbidity measured by (Lovibond) meter , made in Germany ,and the electric conductivity with the temperature by using (WTW Cond 315i) meter made in Germany .

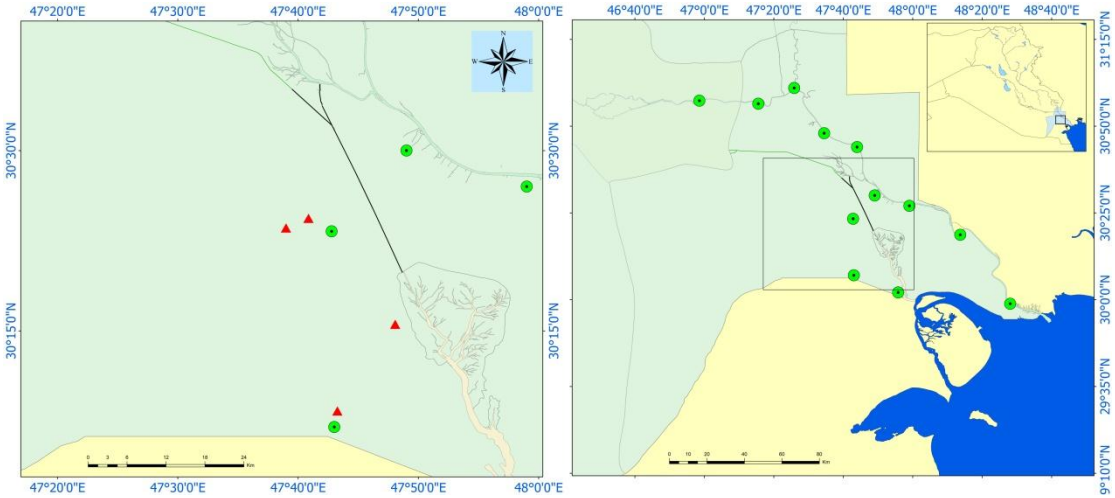

Fig. 1 . Sampling locations

As we can see the chemical physical parameters recorded and showed in table 1and 2, somehow high concentrations, the southern region of Iraq is one of the areas that depend on groundwater, but the expansion of agriculture and the increase in consumption of this type of water has led to a change in water quality, this may also be due to the geological composition of the area [14]

In the charts from 1-12 shoes the physicochemical parameters the reason for the high levels of some variables may be due to the quality of the soil as the study area is characterized by a mature soil with a medium-depth water layer, which is why there are high concentrations of some physico-chemical variables [15]

The reason for the disparity in concentrations is due to the fact that the lands where the well water is spread are agricultural lands where chemical pesticides and organic fertilizers are used, while the surrounding lands are used for grazing, and also due to the presence of petrochemical plant, south gas plant and fertilizer plant spread in that area[18]

The ground water in Basrah southern Iraq polluted by many different sources, oil refineries, rural runoff, sewage discharge and urban runoff [19]

The same reasons shows by [16] that the high concentrations are due to the nature of geological formation of the area where the presence of well water and groundwater is concentrated as well as contamination via the uncontrolled using of fertilizers and pesticides

Result and Discussion:

Below two tables (1&2) shows the recorded values of some chemical and physical parameters for the four selected stations that the well water samples collected from

Table 1. Chemical parameters, in mg/L

Parameters	Safwan	Barjesia	Al-Zubair	Khor Al-Zubair
pH	7.9	6.9	7.2	7.4
Chloride	3443.5	3727.5	35.5	1739.5
Sulphate	2975.9	1910.1	657.8	2658.4
Nitrate	11.5	0.7	72.0	17.3
Nitrite	6.4	3.3	0	0.4
Sodium	1921.9	262.4	887.0	1572.4
Potassium	150.3	7.4	8.5	54.6

Calcium	880	1080	144	768
Magnesium	267.3	170.1	106.9	238.1
Carbonate	280.6	268.4	280.6	244
Total Alkalinity	460	119560	460	400
Total Hardness	3300	34020	800	2900
Hardness as CaCo3	2200	13600	360	1920

Table 2. Physical Parameters, in mg/L

Parameters	Safwan	Barjesia	Al-Zubair	Khor Al-Zubair
Tep. °C	25	26	20.8	25
Turbidity	Clr	Clr	Clr	Clr
Conductivity (E.C ms/cm)	14.3	12.3	4.3	10.3
Total Dissolved Solids(TDS)	5740	11480	463	3824
Total Suspended Solids (TSS)	51	61	13	29

Also the charts (1-12) below shows the values of each physicochemical parameters that the study recorded

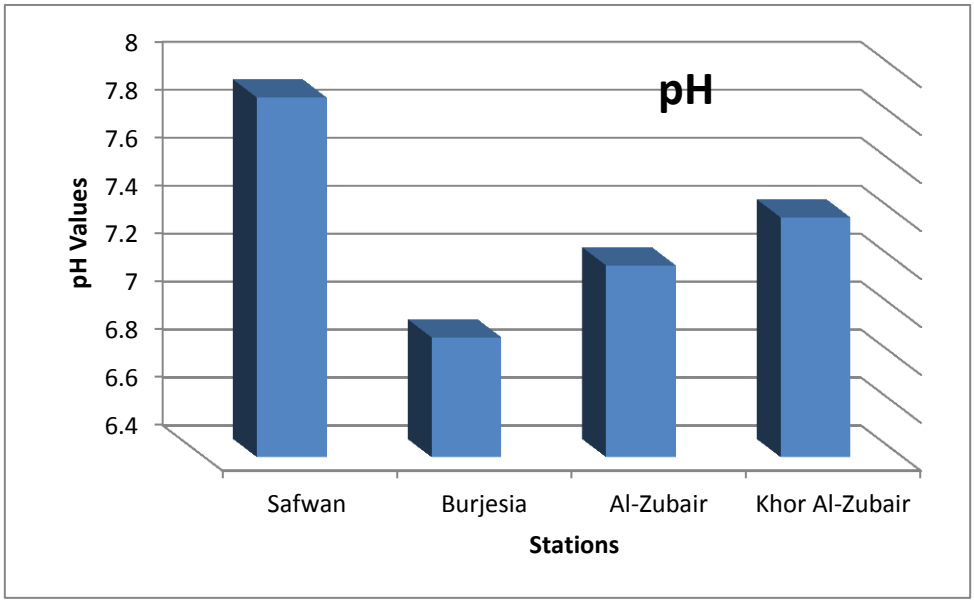

Chart .1. pH values

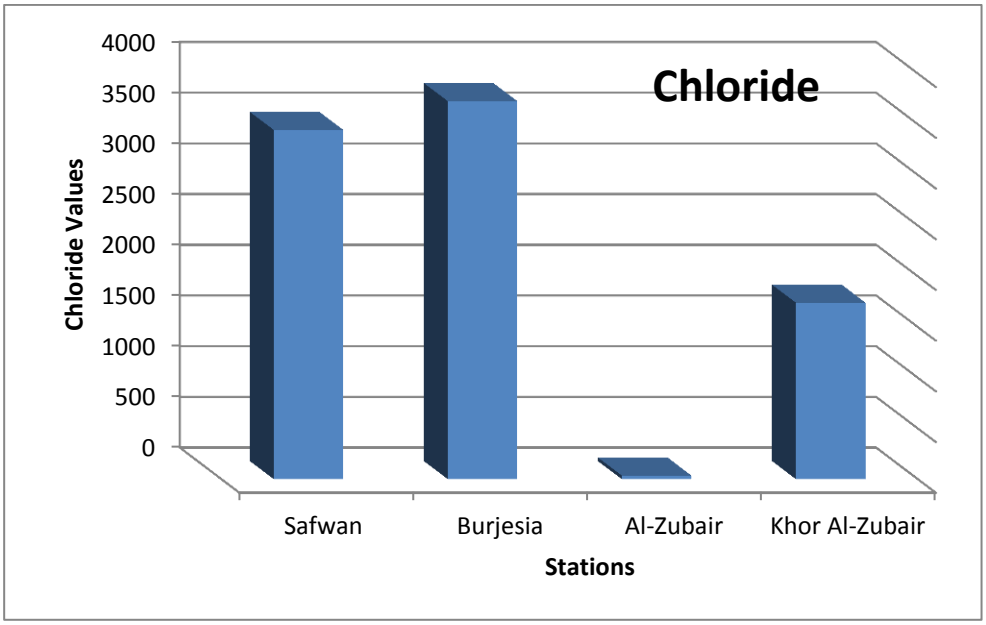

Chart .2. Chloride values

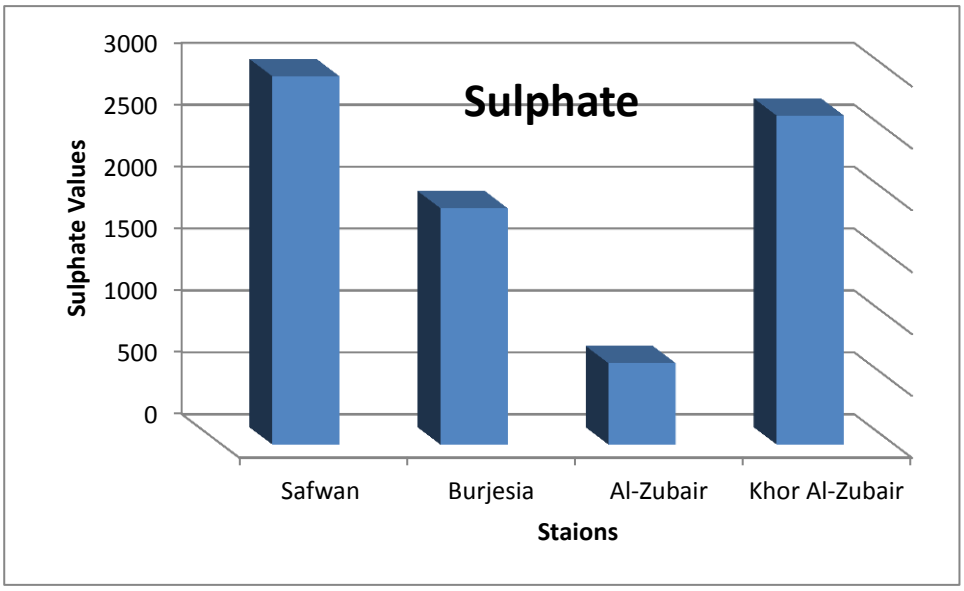

Chart .3. Sulphate values

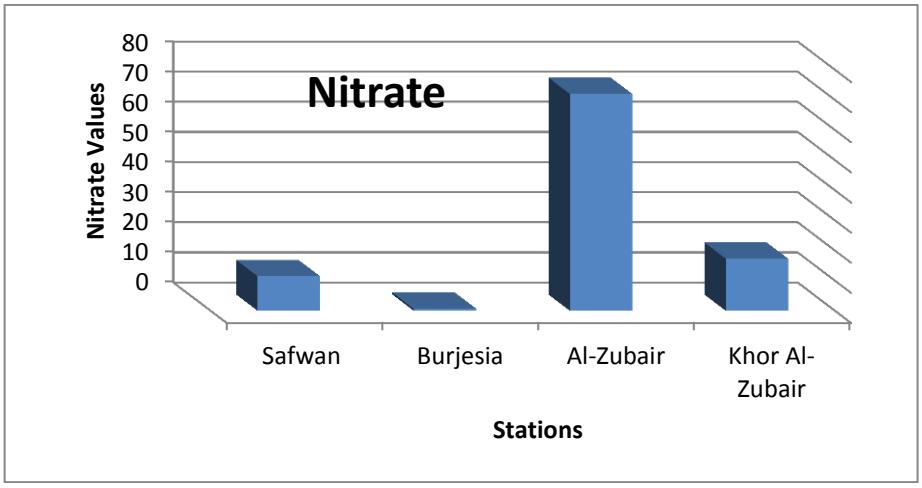

Chart .4. Nitrate values

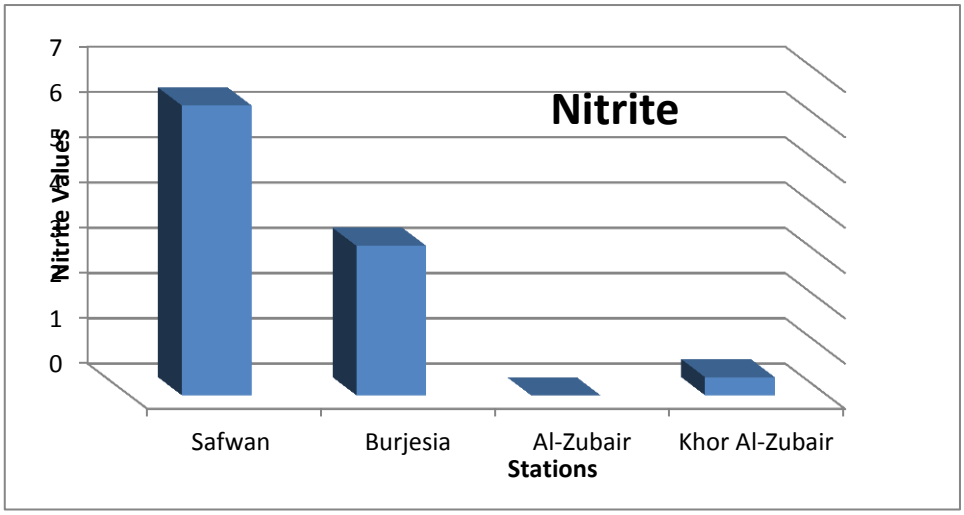

Chart . 5. Nitrite values

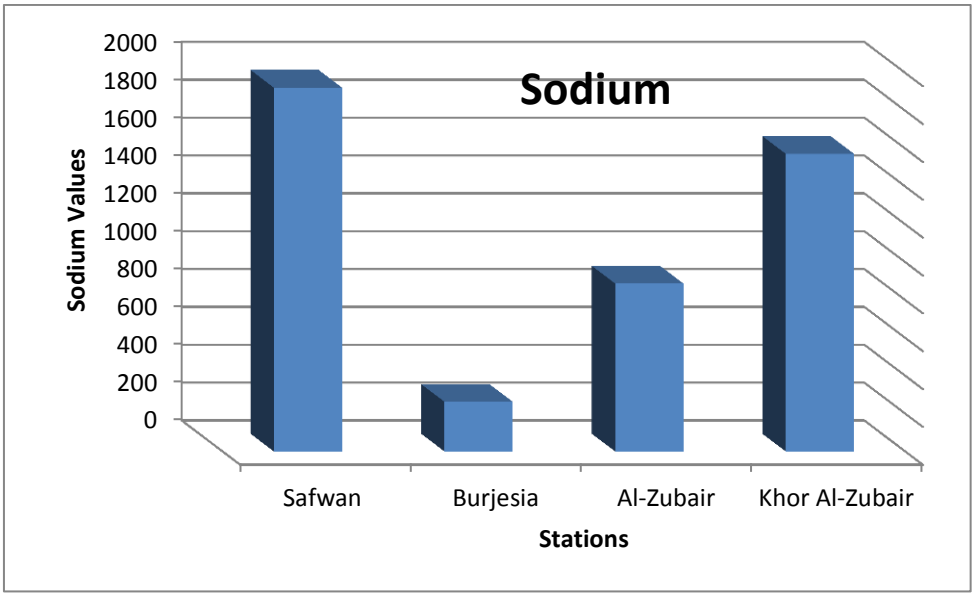

Chart .6. Sodium values

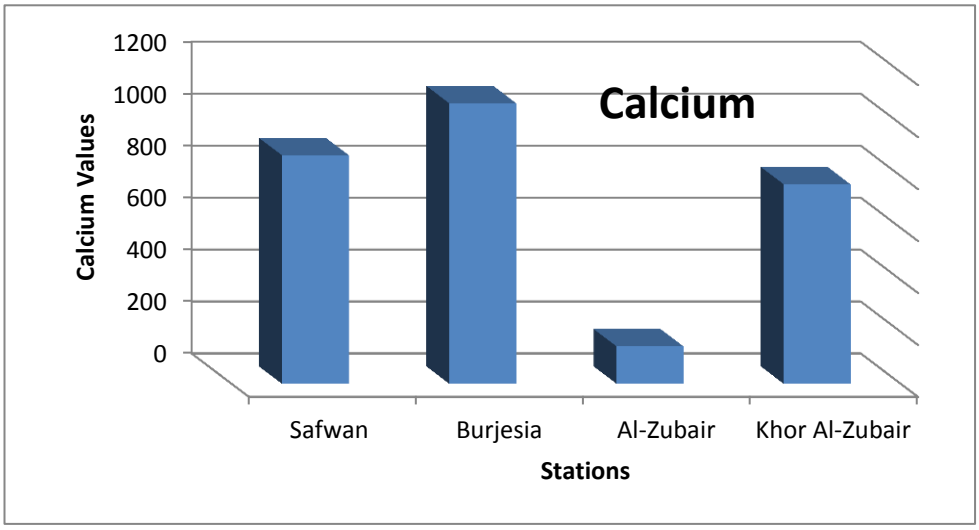

Chart. 7. Calcium values

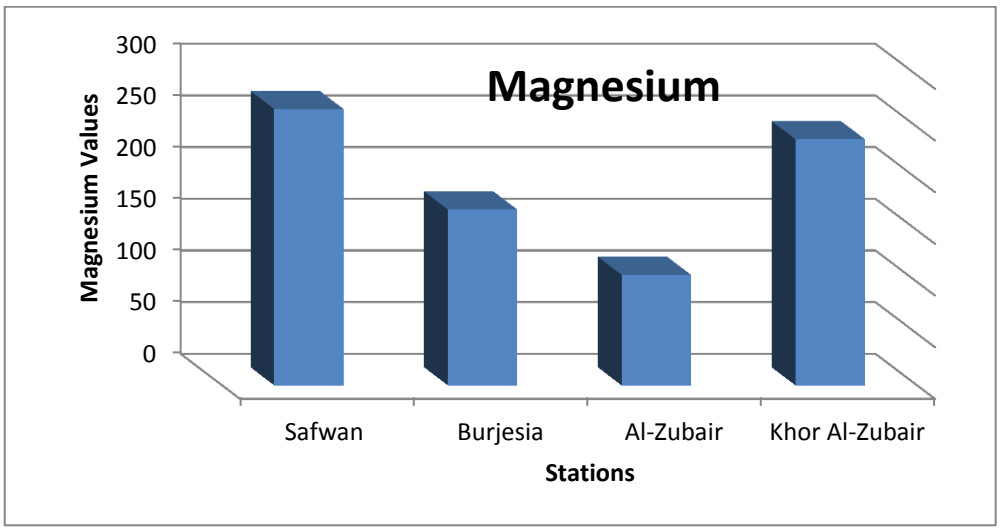

Chart .8. Magnesium values

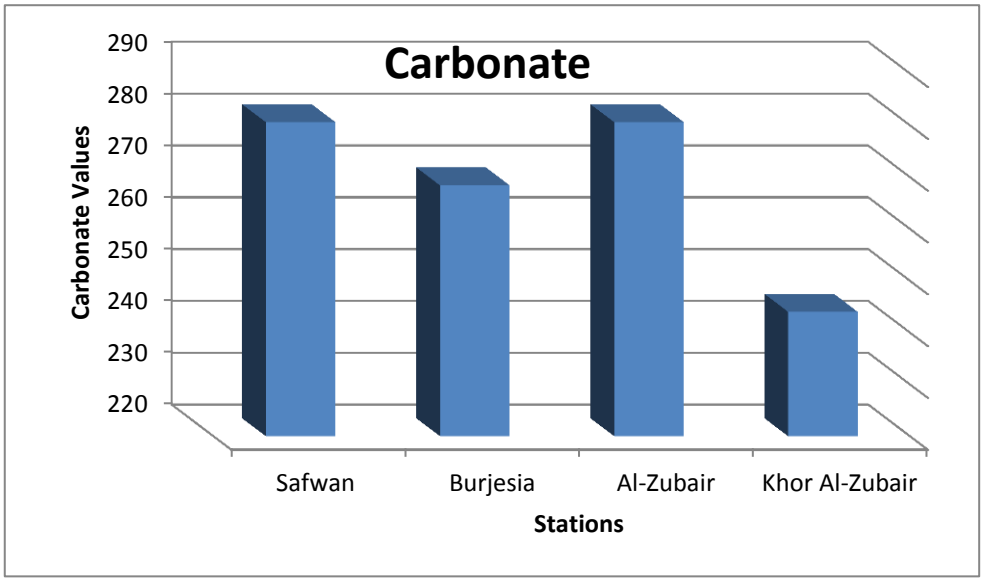

Chart .9. Carbonate values

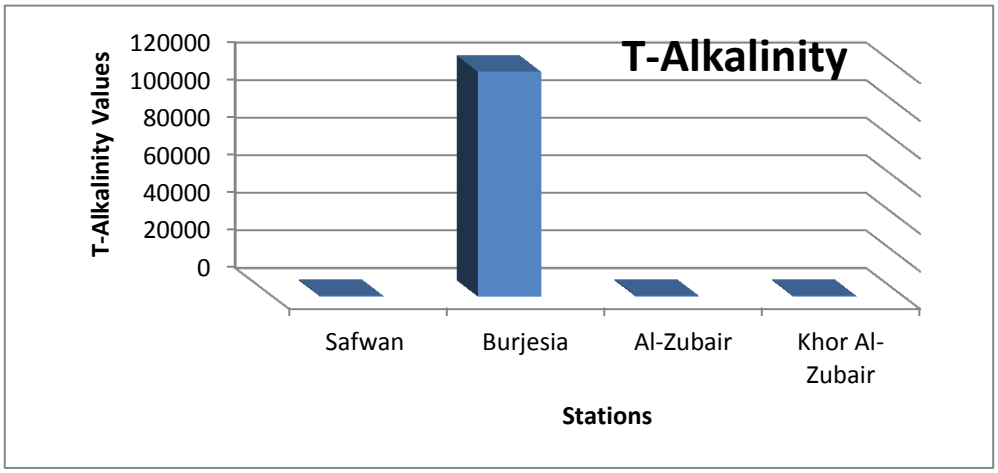

Chart. 10. T-Alkalinity values

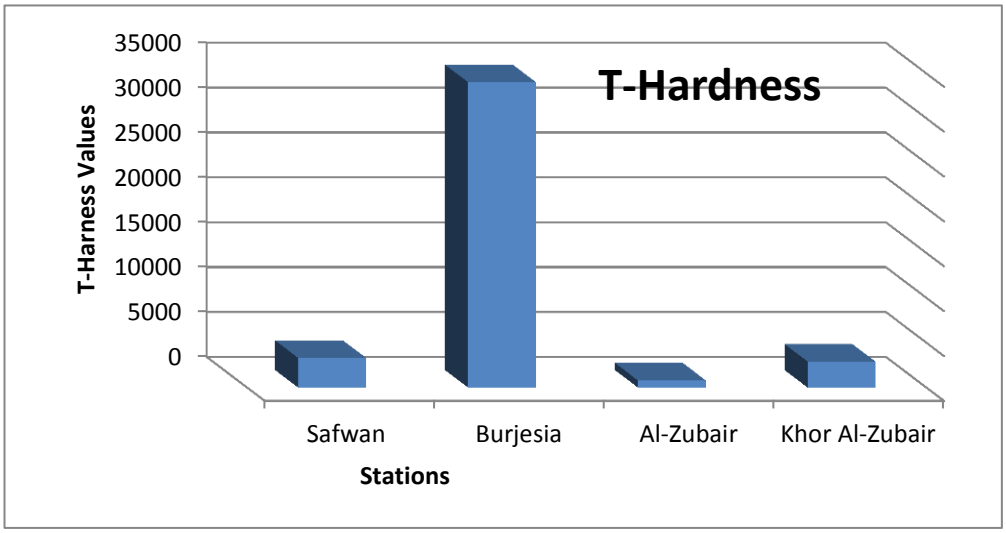

Chart . 11. T-Hardness

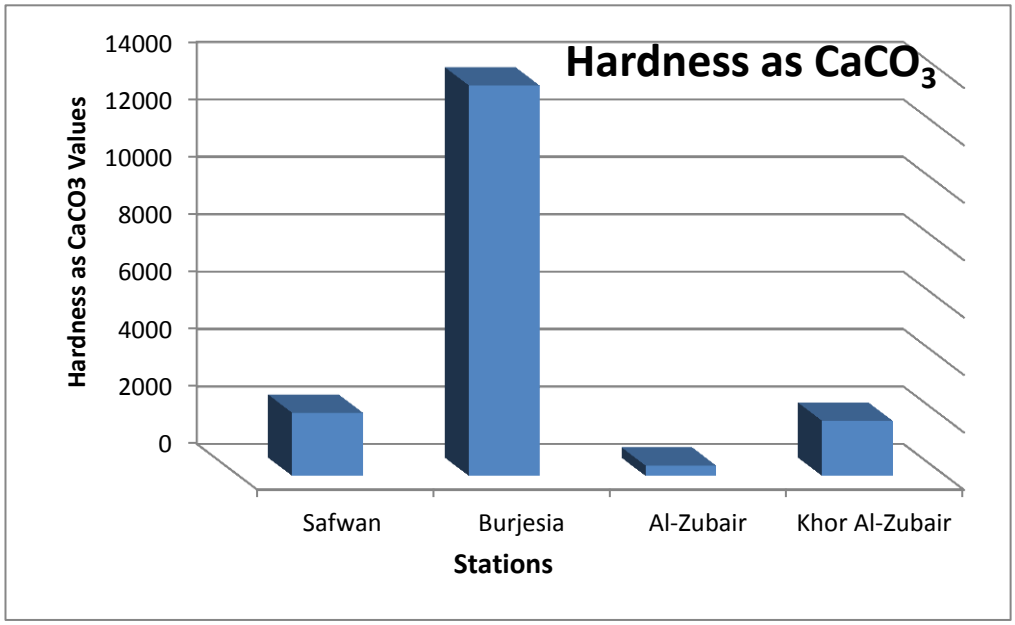

Chart .12. Hardness as CaCO3

Table 3. Summary results for the physicochemical parameters analyses

Parameters	Std. Error Mean	Std. Deviation	Mean	t. Test Value	Sig. (2-tailed)
PH	0.25	0.5	7.25	29	0
Chloride	854.953	1709.906	2237	2.617	0.079
Sulphate	515.138	1030.276	2050.5	3.98	0.028
Nitrate	15.856	31.712	25.5	1.608	0.206
Nitrite	1.436	2.872	2.25	1.567	0.215
Sodium	368.705	737.41	1160.75	3.148	0.051
Potassium	33.588	67.176	55	1.637	0.2
Calcium	201.921	403.842	718	3.556	0.038
Magnesium	35.825	71.65	195.5	5.457	0.012
Carbonate	8.723	17.445	268.5	30.782	0
Alkalinity	29780	59560.01	30220	1.015	0.385
Hardness	7940.614	15881.23	10255	1.291	0.287
Hardness as CaCo3	3053.61	6107.22	4520	1.48	0.235
Temp. C°	1.109	2.217	24.25	21.873	0
Conductivity	2.16	4.32	10	4.629	0.019
(TDS)	2308.275	4616.549	5376.75	2.329	0.102
(TSS)	10.813	21.626	38.5	3.561	0.038

Comparing the study results with many other local studies in the same field shows that most of the results recorded in this study have high rates, and this is in agreement with others in this field, the study of [10] confirms that there are rates of pollutants as a result of hydrocarbon sources.

One of the reasons for increasing levels of substances in these waters is also confirmed by the studies of [11] and also [12] that these areas are polluted as a result of military operations during the war.

[13] Also confirmed the possibility of water pollution as a result of military operations and the explosion of munitions of war.

The study of [14] and [15] confirmed the high percentages of materials due to the expansion of agricultural activities. Therefore, more studies must be conducted in this area

[16] also shows that this type of ground water is not suitable for drinking and are limited for certain agricultural purposes. Thus, this study may agree with the other studies that this type of ground water is not suitable for various human domestic uses and for human consumption, especially for drinking [17] and also for fish ponds and aquaculture

References:

[1]Cech, T.V., Principles of water resources, 3d edition, copyright 2010, 2005, 2003, John Wileg and sond, INC. USA. 2009.

[2]Howard, G., Bartram, J., Pedley, S., Schmoll, O., Chorus, I., Berger, P. Ground water and public health, World Health Organization ,IWA Publishing, London, Uk. 2006.

[3]Raja, G. and Ven katesan P. Assessment of ground water pollution and its impact in and around Punnam Area of Karur District, Tamilandu , India. *E- Journal of Chemistry*, 7(2), 473-478, 2010

[4]Mishra, D., Mudgal, M., Khan, M. A., Padmakran, P. and Chakradhar, B. Assesment of ground water quality of Bhavnagar region (Gujarat), *Journal of Scientific & Industrial Research* ,Vol.68. Pp. 964-966, November 2010

[5]Ramirez, E., Robles, E., Gonzalez, Maria E., and Martinez, M. E., Microbiological and physicochemical quality of well water used as sources of public supply, *Air, Soil and Water Research*, 3pp.105-112, 2010

[6]R.Reza and G. Singh, Phisico-Chemical Analysis of Ground Water in Angul-Talcher Region of Orissa India, *Journal of American Science*, vol.5, no. 5, Pp.53-58, 2009.

[7]Shittu, O.B., Olaitan, J.O. and Amusa, T. S., Physico-Chemical and Bacteriological Analyses of water used for Drinking and Swimming Purposes in Abeokuta, Nigeria, *African Journal of Biomedical Research*, Vol.11, Pp. 585 – 290, 2008

[8]Mahanand, M. R., Mohanty, B. P. and Behera, N. R. Physico-Chemical analysis of surface and ground water of Bargarah District , Orissa, India, *International Journal of Research and Reviews in Applied Sciences* 2(3),Pp. 284- 295, March 2010

[9] Standard Methods, for the examination of water and waste water. 21st Edition, American public health association 800 I Street, NW, Washington, DC 20001-3710

[10] Jawad,A.H.M. levels of petroleum residues in ground water of wells at Basrah city, *Marina Mesopotamica* ,14(2), Pp.291-298, 1999

[11] Al-Gharabi, S.J., Hardan, A., Ahmid, B.A. and Nafaa, m. H. Pollution resulting from the aggression's use of depleted uranium in southern Iraq after ten years, The scientific conference on the effects of the use of uranium weapons on humans and the environment in Iraq, Pp. 61-81,2002 in Arabic

[12] Boutros, S.M., Wartan, Kh. F. and Boutros, L.M. Evaluation of the level of radioactive contamination in Basra Governorate, The scientific conference on the effects of the use of uranium weapons on humans and the environment in Iraq,Pp.125-141, 2002 in Arabic

[13] Al-Imarah, F. J.M., Jawad, A. H., Kyork, S. A. Levels of Mercury in ground water at Basrah, south of Iraq, *Uruk for Scientific Researches* , No.2, 97-104, May 2008

[14] Hassan, W.F. and Mahmood, A.A. Ground water in southern Iraq, *Basra Research Journal of Science*, No.31, part one 17-22, 2005 in Arabic

[15] Mohammed, M. H., Mizhir, A. A. and Al-Baaj, A. K., 2010. Determination of Nitrate and Nitrite and Chloride in ground water of some wells/Basrah, south of Iraq, *Basra Research Journal of Science* No.(36), Part (1), (64-59)

[16] Al-Imarah, F. J.M., Jawad, A. H., Al-Hello, AZ. AR. Chemical evaluation of ground water and its suitability for agricultural uses, southern Iraq, *Marina Mesopotamica*, 16(1):79-87, 2001

[17] Venkateswarlu, P., Suman M. and Narasimha, Rao C. Evalation of physicochemical parameters of ground water Renigunta, Andhra Pradesh, India, *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, Vol.2 (2), Pp. 464-469, April-June 2011

[18] Mahmood, A.A. Specify some heavy metals in select wells water at Basrah, Iraq, *Journal of Dhi Qar Sciences*, Vol.5 (2), 1-14, 2015 in Arabic

[19] Al-Mudlak, S. M. and Jabur, H. S. Utilization of ground water in Iraq and pollution, Al-Khaley Al-Arabi, 13(3):73-84