

## **Chemical and biological evaluation of water well as effected by some heavy metals at Al- Taji North of Baghdad City –Iraq**

**تقييم نوعية مياه الابار في منطقة التاجي شمال مدينة بغداد من الناحية الكيميائية والبايولوجية**

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### **Abstract**

This investigation was conducted to study chemical and biological properties (Al , Zn, NO<sub>3</sub>, K, , Ag , Cr and Cd ppm C% , PH , Salt g/l and the biological properties such as COD and BOD) ppm of water 8 water well during winter and summer seasons , 2012 at Al- Taji North of Baghdad City –Iraq.

The result indicated that the Chemical and biological properties of water at 8 water wells values of July , 2012 were higher ( more polluted ) than the values of January 2012. The salt had a significant different relation at 0.05 level with PH ( r = -0.655 ) , C% ( r = 0.649 ) , Al( r = 0.592 ) , COD( r = 0.721 ) and BOD( r = 0.728 ) between the above properties in January, and July well water of 2012.

It was noted that the surrounding environment and climate affected water quality.

Key words water well , contamination , biological properties Baghdad city- Iraq.

### **المخلص**

أجري البحث لدراسة الخصائص الكيميائية ( Ag , Cr ,Al , Zn , NO<sub>3</sub>, K, C% , pH , Cd ) و جزء بالمليون جزء Salt, غم/لتر) والخصائص البيولوجية مثل و BOD و COD جزء بالمليون جزء لمياه 8 ابار في فترة الشتاء(كانون الثاني) والصيف (تموز) لسنة 2012 في منطقة التاجي شمال مدينة بغداد - العراق. أن الخصائص المدروسة لمياه 8 ابار في فترة الشتاء والصيف لسنة 2012 في المنطقة المدروسة كانت عالية في الصيف (تموز) عنه في فترة الشتاء(كانون الثاني) وكانت العلاقة ذات دلالة إحصائية عند مستوى 0.05 بين الملوحة Salt و pH ( r = -0.655 ) و C% ( r = 0.649 ) و ( r = 0.592 ) Al و ( r = 0.721 ) COD و BOD ( r = 0.728 ) بين فترة كانون الثاني وتموز في عام 2012 . ولوحظ ان للبيئة المحيطة والمناخ تأثير على نوعية المياه.

### **Introduction**

At the present time deterioration of both quality and quantity of ground water has become a global issue , which will further intensify the demand for ground water (1) . severe cases of groundwater contamination was found (2,3,4,5) .

Years ago , the distinguished states of its resources and the diversity of large water sources where the annual income for water between 60-80 billion m<sup>3</sup>, and all are in areas along the Tigris and Euphrates rivers and their tributaries as well as natural depressions, reservoirs and marshes (6) .The impact of the continuing riparian States in the upper river to the implementation of irrigation work, dams in addition to the drought in recent years has recorded that water resources contained significant decrease amounted to up to 22 billion m<sup>3</sup> of the Tigris river and 9 billion m<sup>3</sup> of the Euphrates river which constitute all together 1 \ 3 the rates( 7 ).Therefore this natural essential resources should be protected.Seepage of pollutants from septic tanks and cesspools are responsible for the chemical and biological contamination of well water (8 , 9). Agriculture such as irrigation water , pesticide and inorganic fertilizers are related to this issue( 10) .The dangers of polluted water to human health drove what become known as the “sanitary revolution” in Europe and United States, emphasizing clean water supplies and sewer systems in cities (11). Today, despite of the progress in cleaning up waterways in some areas, water pollution remains as a serious global

problem, with impacts on the health of freshwater ecosystems and the human communities that rely on them for water supply (12 ).

So , it is important to study the chemical and biological status of the ground water in order to protect water resources.

**Materials and method**

1 - Samples were taken from 8 wells during two time periods in January and July, 2012 from cultivated land from Al- Taji North of Baghdad City (figure 1).

2 – Chemical contained 8 wells water were analysed for Al , Zn , NO<sub>3</sub> , K , C , pH , Salt , Ag , Cr and Cd ppm using standard methods ( 13 ).

3 – The Biological properties such as COD value were analysed according to (13). However BOD values were estimated using the equation described by (14) .

BOD (biological oxygen demand):

4 – The weather conditions such as mean rainfall and air temperature .

In January and July, 2012 were taken from Iraqi Meteorological Organization / Climatological Section Reports , 2012 Baghdad , Iraq(15).

5- Statistical analyses :Analysis of quantitative data was done using t-test and ANOVA( analysis of variance). Acceptable level of significance was considered to be below 0.05.

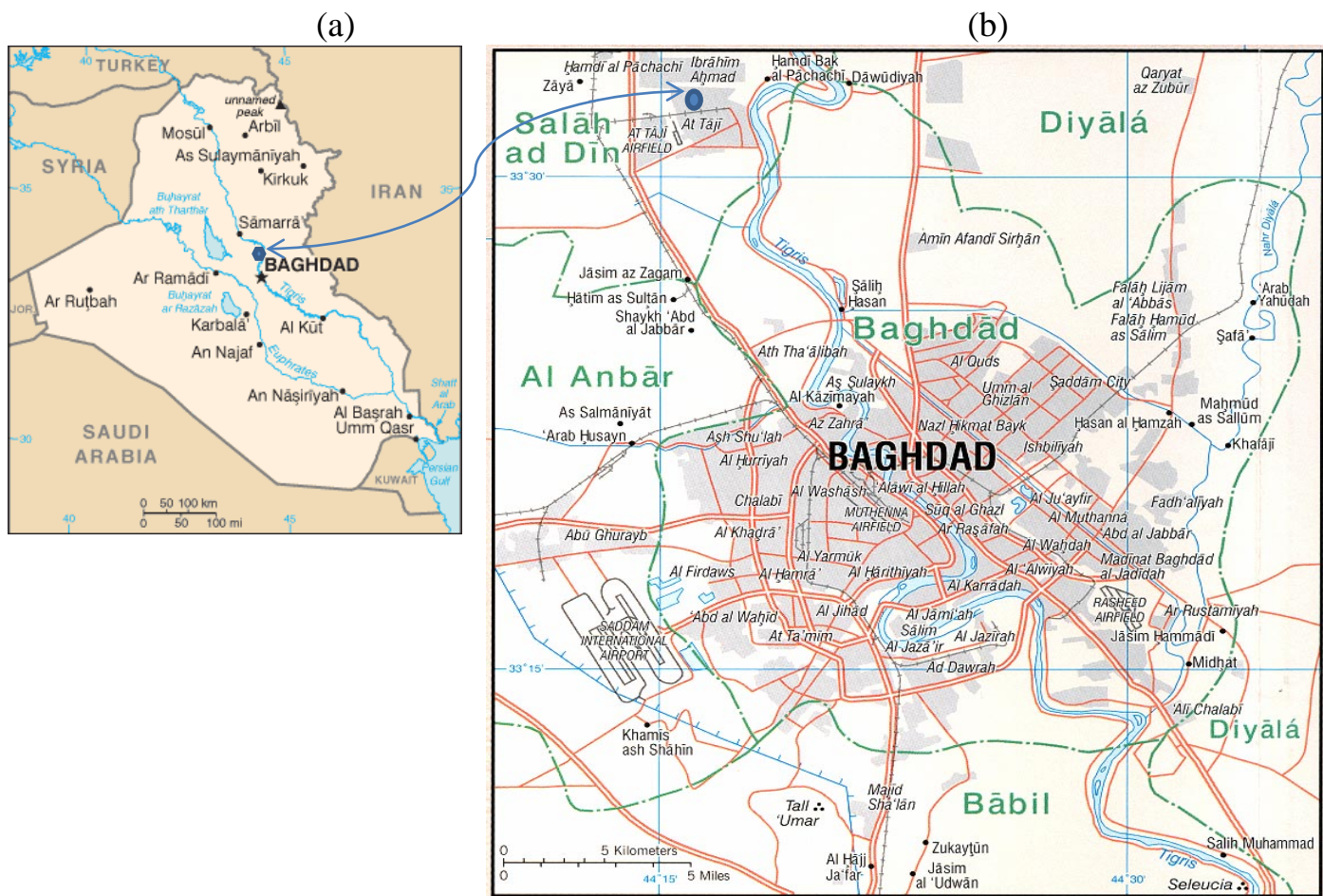


Figure (1) Map of Iraq(a) shows the investigated area ( ) north Baghdad city (b)

## **Result and Discussion**

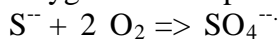
Table (2) showed the chemical content of 8 wells water have been shown such as Al , Zn , NO<sub>3</sub>, K , C , pH , salt , Ag , Cr and Cd ppm . Also , it showed results of biological properties such as COD and BOD values.

It can be seen that nitrate , salt , COD and BOD values were significantly different in well water of January month .However Al , C , pH , K and Zn did not show any difference . In July time values were higher than those in January .The overall difference between the properties of wells water in the two times(January and July ) showed that Al , Zn , NO<sub>3</sub>, K , C , pH , salt ,COD and BOD values were significantly different. Agricultural praetues such as irrigation water , pesticide and inorganic fertilizers are probably caused this issue ( 10) .

BOD values in the table showed that, well water was poor (somewhat polluted) usually indicated that organic matter was present and bacteria were decomposing this waste.

Any oxidizable material present in a natural waterway or in an industrial wastewater will be oxidized by both biochemical (bacterial) or chemical processes. The oxygen content of the water will be decreased. Basically, the reaction for biochemical oxidation may be written as: Oxidizable material + bacteria + nutrient + O<sub>2</sub> => CO<sub>2</sub> + H<sub>2</sub>O + oxidized inorganics such as NO<sub>3</sub>, SO<sub>4</sub>, etc.

Oxygen consumption by reducing chemicals such as sulfides and nitrites is typified as follows:



Since all natural waterways or well water contain bacteria and nutrient, almost any waste compounds introduced into such water will initiate biochemical reactions (as shown above). Those biochemical reactions create what is measured in the laboratory as the Biochemical or Biological Oxygen Demand (BOD).(16)

Oxidizable chemicals (such as reducing chemicals) introduced into a natural water will similarly initiate chemical reactions (as shown above). Those chemical reactions create what is measured in the laboratory as the Chemical Oxygen Demand (COD).

Figure (2).The Ag , Cr , Cd mg/l (ppm) of samples taken in January and those of July 2012.It can be seen that the values of Ag were higher in July than in January .However ,the values of Cr were higher in January than in July.

Figure (3). Showed that, difference between nitrate values (17) , ppm of samples taken in January and those of July , 2012 . It indicated that, the values of July , 2012 were higher than the values of January 2012 .

Table (3) showed the P-Values of the studied chemical and biological properties of well water in January, 2012 and in July,2012 at Al- TajiNorth of Baghdad City.The result indicated that, pH values were highly significantly different at 0.01 level ( p- value = 0.002) and the nitrate also significant different at 0.05 level.

The Correlations ( r ) of the studied properties , the average values of January, 2012 and July,2012 at Al- Taji North of Baghdad City have been shown in table ( 4 ) .

The salt had significantly different relation at 0.05 level with pH( r = -0.655 ) , C% ( r = 0.649 )

Al( r = 0.592 ) , COD( r = 0.721 ) and BOD( r = 0.728 ) between the above properties in January and July well water 2012 see table (3).

## **Conclusion**

Based on the results of the present investigation , the following conclusions may be drawn :

- chemical and biological properties of 8 well water at Al- Taji North of Baghdad city have been contaminated due to agriculture practice such as irrigation water , pesticide and inorganic fertilizers .
- The contamination of well water was more in summer ( July,2012) than in winter(January) time .

- Further study is needed concerning this subject to cover more areas to and get more information .Because of the circumstances experienced by the country the author could not expand in this investigation.

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Table ( 1 )The investigated area average weather by month.

Month	Temperature °F *				Average rainfall (mm)		Average Fog days
	Average		Absolute		Daily	Monthly	
	Max	Min	Max	Min			
January	58.8	38.1	75.2	23.0	0.7	21	10
July	111.6	77.7	122.0	68.0	0	0	0

$$*C^{\circ} = (F^{\circ} - 32) \times \frac{5}{9}$$

Table( 2 ) Mean± S.Dof the studied Chemical and biological properties of water well in January, 2012 and July,2012Al- TajiNorth of Baghdad City.

BOD* ppm	COD Ppm	Al ppm	Zn ppm	NO3 Ppm	K%	C%	pH	Salt g / L	Well	Date
24.20	51.00	.90	.05	10.00	.01	.06	7.10	.35	1	
20.70	42.00	.80	.05	6.00	.01	.04	7.20	.24	2	
22.70	47.00	.80	.05	10.00	.01	.04	7.10	.26	3	
23.40	49.00	1.00	.05	11.00	.01	.04	7.20	.31	4	January 2012
25.00	53.00	.90	.05	10.00	.01	.06	7.10	.32	5	
21.90	45.00	.70	.05	7.00	.01	.04	7.20	.26	6	
21.10	43.00	.70	.05	8.00	.01	.03	7.10	.26	7	
23.10	48.00	1.00	.05	7.00	.01	.04	7.20	.29	8	
22.76	47.25	.85	.05	8.62	.01	.04	7.15	.28	Mean	
1.48	3.80	.12	.000	1.84	.00	.01	.05	.04	S. D.	
27.50	59.00	1.00	.05	10.00	.01	.06	7.10	.50	1	
23.10	48.00	.90	.05	15.00	.01	.04	7.50	.20	2	
23.80	50.00	.80	.05	20.00	.01	.04	7.50	.25	3	
25.80	55.00	1.00	.05	30.00	.01	.09	7.30	.41	4	July 2012
24.60	52.00	.90	.05	14.00	.01	.06	7.50	.30	5	
21.90	45.00	.70	.05	13.00	.01	.05	7.20	.29	6	
23.40	49.00	.70	.05	10.00	.01	.03	7.40	.26	7	
21.90	45.00	1.00	.05	11.00	.01	.04	7.50	.35	8	
24.00	50.37	.87	.05	15.37	.01	.05	7.37	.32	Mean	
1.92	4.83	.13	.00	6.76	.00	.02	.16	.09	S. D	
23.38	48.81	0.86	0.05	12.00	0.01	0.04	7.26	0.30	Mean Total	Total
1.77	4.51	0.12	0.00	5.92	0.00	0.02	0.16	0.07	S. D Total	

\* BOD values have been estimated using the equation described by Abdulla ,2012 . (Abdulla , H . J. et. al .2012 ) .The equation: BOD = 6.1242+0.3142(COD)+0.0008(COD )<sup>2</sup>

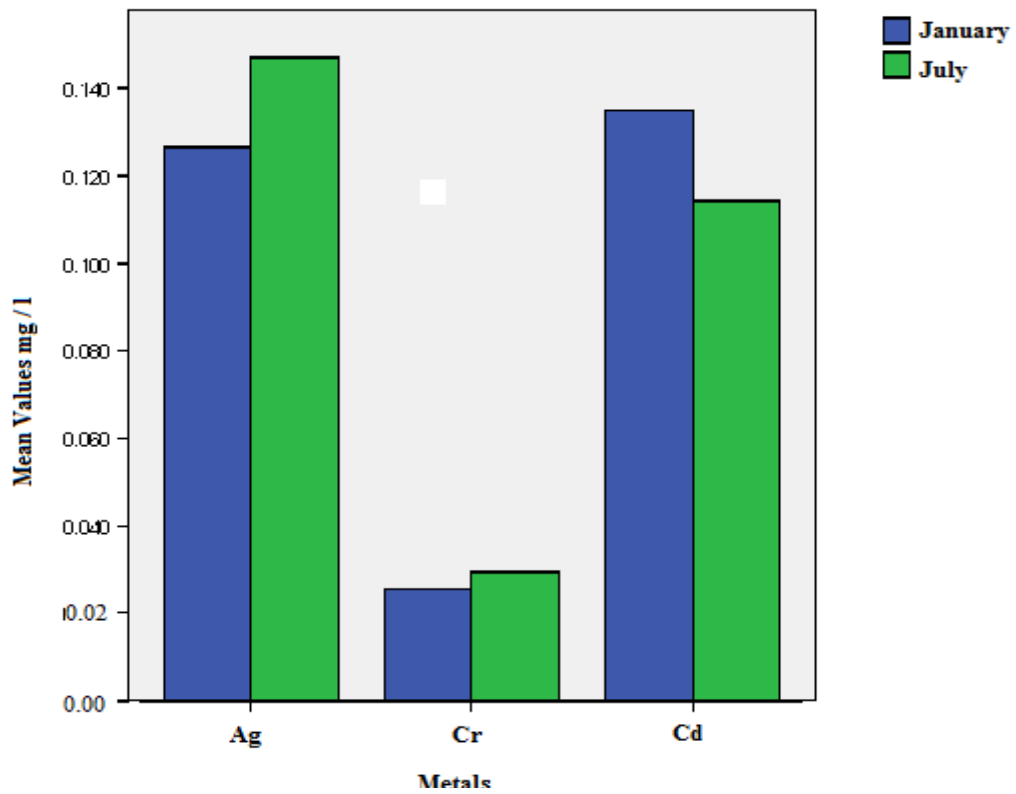


Figure (2).The Ag , Cr , Cd (ppm) of samples taken in January and those of July 2012 .

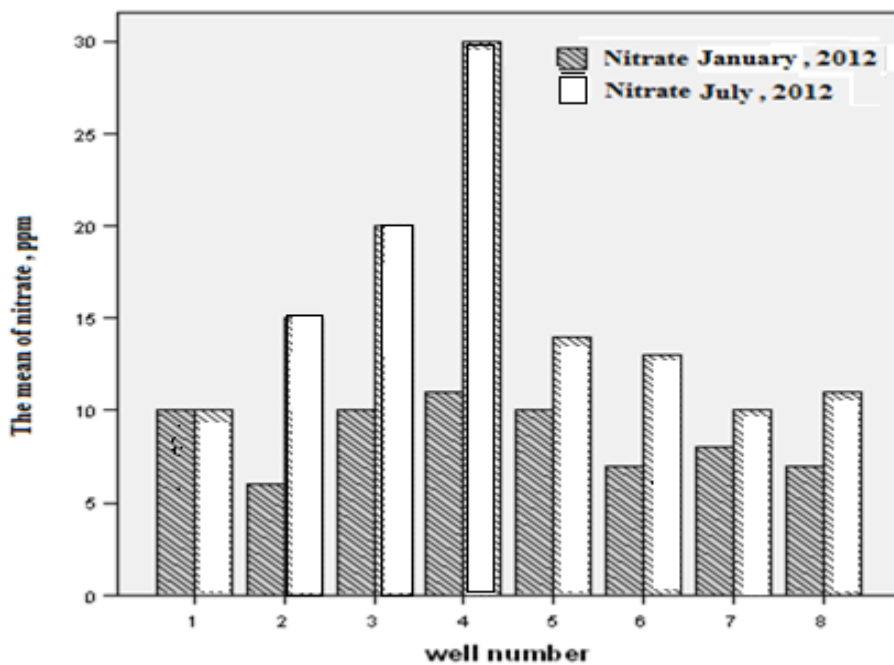


Figure (3).The nitrate values , ppm of samples taken in January and those of July 2012 .

Table (3) the P-Values of the studied Chemical and biological properties of January, 2012 and in July, 2012 at Al- Taji North of Baghdad City.

The properties	P – Value	
Salt	0.374	NS
pH	0.002	**
C%	0.343	NS
K%	1.000	NS
NO <sub>3</sub>	0.016	*
Zn	1.000	NS
Al	0.693	NS
COD	0.173	NS
BOD*	0.171	NS

\* significant at 0.05 level \*\* significant at 0.01 level NS not significant

Table (4) The Correlations ( r ) of the studied properties the average values of January, 2012 and July, 2012 at Al- Taji North of Baghdad City.

	Salt	pH	C%	K%	NO <sub>3</sub>	Zn	Al	COD	BOD
Salt	1.000**	-0.655*	0.649*	0.000 NS	0.135 NS	0.000 NS	0.592 *	0.721*	0.728*
pH	0.728*	1.000**	-0.406 NS	0.000 NS	0.015 NS	0.000 NS	0.024 NS	-0.434 NS	0.446 NS
C%	0.649*	-0.406 NS	1.000 **	0.000 NS	0.648 *	0.000 NS	0.480 NS	0.674*	0.672*
K%	0.000 NS	0.000 NS	0.000 NS	1.000 **	0.000 NS	0.000 NS	0.000 NS	0.000 NS	0.000 NS
NO <sub>3</sub>	0.135 NS	0.015 NS	0.648*	0.000 NS	1.000 **	0.000 NS	0.259 NS	0.323 NS	0.313 NS
Zn	0.000 NS	0.000 NS	0.000 NS	0.000 NS	0.000 NS	1.000 **	0.000 NS	0.000 NS	0.000 NS
Al	0.592*	0.024 NS	0.480 NS	0.000 NS	0.259 NS	0.000 NS	1.000 **	0.566*	0.569*
COD	0.721*	-0.434 NS	0.674*	0.000 NS	0.323 NS	0.000 NS	0.566 NS	1.000**	1.000**
BOD	0.728*	-0.446 NS	0.672*	0.000 NS	0.313 NS	0.000 NS	0.569 *	1.000**	1.000**

\* Correlations ( r ) is significant at 0.05 level

\*\* Correlations ( r ) is significant at 0.01 level

NS Correlations ( r ) is not significant

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