Suitability of some wells water to the Human Usability at Diala Governorate (Baakoba City). Iraq

By Hussain A. Sheriff
College of basic education.
University of Al-Mustansirya.

ABSTRACT

An analytical study of 25 wells water had been achieved as a samples choosen by the authority of wells and ground water.
These wells were located at different sites scattered within Baakoba city at Diala governorate. These wells were numbered from 1 to 25 after the determination of their positions, ecology and topographic sites (The elevations above sea surface).

Samples of wells water were analyzed within the months (June, July, August and September) 2010 AB. There were 19 parameters including physiochemical factors and 5 heavy metals as the following:- 1. water temperature, 2. pH, 3. E.C, 4. Turbidity, 5. Bicarbonate, 6. Sulphate, 7. Nitrate, 8. Chloride ion, 9. Ca, 10. Mg, 11. Na, 12. K, 13. Hg, 14. Pb, 15. Cu, 16. Zn, 17. Cd, 18. TDS, 19. SAR.

The obtained results were introduced as a fined report to the authority of wells and ground water and after that it was discussed by a scientific meeting in front of many cadres came from many departments of wells and ground water from different governorators in Iraq, including the cadres from Baakoba city (The position of the present study), then some recommendations were considered to take care about the suitable wells and to treat the other bad wells in order to insure the water supply which is in a good quality for drinking, irrigation and other usages. Such consideration must pointing not only to these 25 wells but it is necessary to direct toward all other Iraqi wells, by achieving the comprehensive survey and doing the similar tests in order to stand on their water nature and their suitability or not.

Introduction

Man has been noticed since an old periods the relationship between water destruction and diseases prevalence, then he work to choice a good water resources to avoid it's harmfuls by testing the water from color, odor and taste. The new knowledge and technology yield the man to determine the water suitability that is used for drinking and other

purposes, it's natural, chemical and microbal ways in advance and new manners more that before. (Hallber. 1987).

It was very clear that the human been dispersal like other thinks of living organism always depend on water abundance. Water existence in the environment means that human and all living thinks are existing as well. Many countries have not enough freshwater resources, then they depend on underground water like wells, springs or by sea water distillation, so the water supplying problem still depending on development creation of all agricultural, industrial and civilization progressive. (Hynes. 1974).

Iraq among other developing countries needs a hard works of scientific and academic activities in order to control it's physical and chemical parameters, also in the containing of water minerals.

This fact is leading to draw a strategic plan in necessary to analyze the water of all used wells, such plan will be a good control to avoid any harmful coming from using the water of these wells.

Physiochemical pollutions are causing a disturbance in the environmental system, because it can not removed easily by natural operations like any organic pollutants. (Cousins et al., 2002).

The aquatic environment of domestic wells are the most concerned by human activities and their pollutants, includes domestic sewage, mining, organic and atmospheric distribution. (Tebbutt. 1977). Ingesting large amount of heavy metals and minerals can cause a serious toxic effects and health risks. (Akinola et al., 2002).

Ground water is one of the earth's widely distributed, renewable and most important resources. It is a generally considered least polluted compared to other inland water resources, but studies indicated that ground water is not absolutely free from pollution through it is likely to be free from suspended solids. The major problem with the ground water is that once contaminated, it is difficult to restore it's quality. Hence there is need and concern for the protection and management of ground water quality. (Keshavan and Parameswari 2005).

The presence of heavy metal in aquatic environment can lead to greater environmental problems when the metals are up taken by organisms, hence consumption of such kind of organisms may from a significant pathway to metals contamination in human beings and eventually poses greater health risk because of their stability. (Bieny et al., 1994).

Cautions like Calcium, Magnesium, Sodium, Potassium and anions like Chlorides are the most ions dispersed in all kinds of waters and ground waters, most of them in definite concentrations are very essential

to the organism's life. Physical parameters like temperature play on effective role on the water quality of all kinds of natural water sources, specifically on ground water wells, because it's interfering with a large list of other physiochemical parameters. (Masoud et al., 2004). Wells sites elevations are effecting on physiochemical parameters when it display on very high different localities. (Wilber 1969).

Description of the studied wells.

Twenty five wells from different sites had been chosen within Diala governorate (Baakoba city) north of Baghdad. These wells are distributed within different ecological areas (Table 1) and they were located between 20-56 meter above sea water level, their evaluations are shown in (Table 2).

Table 1. The ecological conditions of the 25 studied wells.

Number of wells	Location and ecology
1, 3.	Baakoba central water refinement.
5, 6, 8, 17, 20.	Inside a date palms forest.
4, 12.	Garden park.
9, 11, 13, 25.	Domestic house.
15.	Domestic house inside agricultural land.
24.	Domestic house, six meters away from evacuation place (W.C.).
21, 22.	Nursery land.
14.	Nursery land near Iron smithies.
23.	Bakery near a main street.
2.	Diala University near College of Medicine.
16.	Diala University, deserted well.
7.	Near Arts Institute, a place used as a carbage and now it is a nursery land.
18.	Inside a barber place and a surface domestic drainage passing near this well.
10.	Inside a restaurant and there was a domestic waste drainage passing near this well.
19.	Near a school and a surface domestic drainage passing near this well.

Table 2. The elevation of 25 studied wells (meter above the sea surface level) and geographic positions.

No	Well No	Geographic position						Elevation
		N			E			
1	W1	33	46	40	44	38	36	43m
2	W2	33	45	23	44	37	43	31m
3	W3	33	43	38	44	38	49	36m
4	W4	33	44	37	44	34	03	40m
5	W5	33	42	43	44	37	25	28m
6	W6	33	46	20	44	37	17	35m
7	W7	33	44	51	44	39	45	40m
8	W8	33	43	24	44	37	51	40m
9	W9	33	46	51	44	35	55	40m
10	W10	33	43	58	44	36	49	44m
11	W11	33	43	58	44	39	36	30m
12	W12	33	45	28	44	35	51	40m
13	W13	33	44	45	44	35	57	40m
14	W14	33	45	27	44	38	45	20m
15	W15	33	40	19	44	35	53	40m
16	W16	33	40	34	44	35	53	40m
17	W17	33	44	02	44	37	88	32m
18	W18	33	44	59	44	37	13	40m
19	W19	33	44	39	44	38	38	40m
20	W20	33	44	34	44	38	06	23m
21	W21	33	45	30	44	38	05	33m
22	W22	33	46	34	44	39	16	35m
23	W23	33	44	53	44	38	27	56m
24	W24	33	43	40	44	39	06	33m
25	W25	33	41	42	44	45	35	40m

Materials and Methods

Ground water samples were collected from 25 wells scattered at different locations within Baakoba city (Diala governorate) in a clean 3 liters capacity plastic polyethylene bottles. Sampling was carried out directly without adding any preservations in clean bottles to avoid any contamination and brought to the laboratory.

Ground water samples were collected and analyzed according to a regular schedule from may till August 2010.

Samples were taken every two weeks regularly among the four months study. Temperature, PH, EC, and TDS were measured in the field directly by using a kit instruments. Other chemical parameters like minerals and mineral salts by using the ways according to recommendations given by standard methods for water and waste water analysis as described by APHA 1998 and Parsons et al., 1984. Heavy metals in the studied ground

water wells were determined for their concentrations by using flame atomic absorption spectrophotometer (UK.) (Model-ALPHA 4) equipped with a microcomputer controlled air-acetylene flame at different suitable nanometers for each heavy metal.

The observed data during the whole results were analyzed statistically by using the available software programs (Statigraph version 4 and Microsoft Excel professional Edition 2007/ Data Analysis). All of the chemicals used were of analytical reagent grade or the highest purity available. Doubly distilled deionized water, which is non-absorbent under ultraviolet radiation, was used throughout.

Results and Discussion

Before starting the discussion of the results, it is so necessary to explain that all off 25 wells have been chosen from Baakoba city within different localities and ecological conditions. (Table 1). These wells were sharing each others on their geographical locations between 33 degree northly and 44 degree eastward and most of them were located at elevation between (30-40) meter above the sea surface level, except the well number (14) which was at (20) meter and the well number (20), at 23 meter, whereas the well number (23) was the unique one at (56) meter above the sea surface level. (Table 2).

It was very known that a variable elevation affecting on the wells located at the zones of seas, lakes and beaches, but most of the studied wells were coincided at least on atmospheric temperature and acidity and alkalinity of their waters.

The following explanation are attempting to discuss the nature of the 25 studied wells water from a physicochemical points of view, and the suitability of their water to the human usability like the drinking, cultural irrigation and other utilities.

1- The water temperature TC°:

Results of the presence investigation has showed that the water temperature reached to 32.4C^{o} as a maximum at the well numbered (18) and the minimum grade was at the wells waters as (19, 19.5, 19.6, 19.8, 20.4, 21.1, 23.2) at the wells numbered (9, 7, 20, 11, 19, 25, 5) respectively. The rest of the other 25 studied wells were mostly around 30C^{o} more or less. In conclusion the water of all 25 studied wells showed that they were a moderate warm waters and could be consider as a suitable for drinking, agriculture irrigation and for the other utilization from the temperature point of view. (Table 3).

Different studies and researches reported that any increasing in water temperature with a critical grades could be affecting in clear

situations on the diminution of dissolved oxygen, water viscosity, water surface tension, electrical conductivity, pH, water hardness and organic decay on the water (Rutter 1963), (Sokolov 1986).

2- Wells water pH:

Results obtained from the presence investigation showed that all 25 studied wells were in a moderate grades for the ground water pH. The minimum grades were (6.9, 6.9, 6.98, 6.89) at the wells numbered (21, 24, 12, 2) respectively, whereas the all others had a grades around pH7, more or less. The maximum grade was (8.19) on the ground water of the well numbered (4). In conclusion the water of all 25 studied wells showed that they were in a moderate suitable grades and could be consider in a good quality to use for drinking, agricultural irrigation and for other utilizations from the pH point of view. (Table 3).

It is well known that any variation on pH could be play an imported role to effect on the water quality and nature, when this water altered toward the acidity, alkalinity or when to be balanced on the pH, (7). The bicarbonate salts could be affected by pH and water temperature and then altered after that into a carbonate salts and then it will be play a role to increase the alkalinity in the water. (Maulood and Hinton 1978.).

3- Wells water E.C.:

The water electrical conductivity is depending generally on the concentration of dissolved ions in the water and on the water temperature at the time of measurement. Results obtained from the presence investigation showed a moderate warm of water temperature (as mainshened before) and a high grades of electrical conductivity, which was a maximum 22185 μ moos/cm^2 for the well numbered (16) and a minimum grade 1119μ moos/cm^2 for the well numbered (6). The ecological permissible EC for the drinking water is between 200-300 μ moos/cm^2 , so all obtained grades were higher than this permission which are pointed that all 25 studied wells are not a suitable to use for drinking and another natural life in the aquatic ecosystems since the ecological permissible EC for this is between 150-750 μ moos/cm^2 and it will be too bad when it is reaching to grade equal to 3000μ moos/cm^2. (table 3). (Sheriff and Dellool 1994). (Wilber 1969). (WHO 2003).

4- Wells water turbidity NTU:

The turbidity of the water was described as the water ability to disperse the sunlight penetration throw it's suspending matters, instead of it's way on a straight lines turbidity is causing a diminution on oxygen saturation of the water. Also the sedimentation of these matters will cause an inhibitions to the life of many water organisms at the bottom. The

turbidity of the water may introduce a protection to many kinds of microorganisms and viruses against the detergents powers, that is why there are a need to increase the chlorine in a consider ratio to complete the sterilization of the water. Generally it is well known that (5) units of NTU or more than this are not acceptable and it will be critical for drinking water and agricultural irrigation. (Abbawi, and Hassan, 1990).

Results obtained from the presence investigation showed that most of the 25 studied wells were at a higher grades of turbidly (more than 5 NTU) except the wells numbered (7) and (8), then it is easy to consider that the water of those ground water wells are not in a good quality for drinking, agricultural irrigation and other usages. (Table 3).

5- Wells water bicarbonate HCO_3^-:

Calcium and Magnesium bicarbonates have an important role on decreasing the grade of hardness for the water, especially the water of the wells and springs. The kinds of hardness considered as temporary hardness (because it could be easily removed by heating the water). Then carbon dioxide will be released and after that the bicarbonate changed into carbonate. (Sheriff. 1986).

It is well known that any elevating on the alkalinity (such as adding calcium hydroxide to the water)toward pH 10 will be changing the bicarbonate to a carbonate and it will be precipitate soon as created in the water.

Results obtained from the presence investigation showed that all 25 studied wells have a good water quality since the limiting grades of bicarbonate in grand water pointed 1.0-1000 mg/ℓ as a good for drinking and agriculture irrigation. (Deborah, Ch. 1996). (Table 4).

6- Wells water sulphate $SO_4^=$:

Sulphate ions are existed in the fresh water which are interfering with the other cationes. The source of sulphate generally came from sulpher compounds dissolving which is existing in the bottom sediments of drainage and rain water basins or underground water. Sulphates salts are playing in an important ecological role on body building of plants and specially an phytoplankton which are very important for the productivity. Sulpher salts also provide the sulpher element which is very important to the metabolism of protein.

The concentration which they altering the water taste according to different types of sulphate salts changed between 350-400 ppm, although it is depending on the type of the cations. (Odum and Odum 1971). Results obtained from the presence investigation showed that some of these wells were at a high concentrations like the wells numbered

(1,2,3,4,5,6,7,8,9,10, 11,12,13,14,15,16,17,18,24), whereas the rest of the 25 studied wells were in a good quality like what they numbered (6, 17, 19, 20, 21, 22, 23, 25) which they were suitable for drinking, agricultural irrigation and other usages. (Table 4).

7- Wells water Nitrate NO_3^-:

Nitrogen as a free ion may existed in the natural waters or may be like organic or inorganic nitrogenous compounds like ammonia, Nitrate or nitrete some times. The nitrate is one of the most important nutrients in the natural waters. Most of permissible concentration reported 45 mg/ℓ as a higher border, more than this concentration causes the disease called (syanosis), which have a symptoms as a blue spots near the lips skin specially on infants. (Abawi and Hussan 1990).

Results form the presence investigation showed that all 25 studied wells had a suitable concentrations of nitrates which were good for drinking, agricultural using and other usages from nitrate concentration point of view.

8- Wells water chloride CL^-:

Salinity as a sodium chloride salts are not affecting the water taste when it is exceeding 0.05% which is equal to 0.5PPT. Potassium or Magnesium chloride didn't give a salty taste. It is well known that most of non-polluted inland waters had a little grades of chloride, specially when these waters sources flow within natural sedimental lands. Waters with concentration of sodium chloride exceeding 500 ppm are not good for drinking of humans, but it could be used for some animals drinking and some kinds of plants agriculturing.

Results obtained from presence investigation showed that eleven wells were at high grades and not in a good quality for drinking and they numbered as (1,2,3,4,5,9,12,13,15,16,22), whereas the rest of the 25 wells were in a good quality from chloride point of view. (Table 4), (Sheriff 1986).

9- Wells water Calcium Ca^{++}:

Calcium concentrations plays an important role on it's natural grades for keeping the hardness levels and from another side it is affecting on the water quality for drinking and general health. The calcium ions plays a physiological role within it's natural grades on blood and bones. (Cole 1986), Most of scientific reports and researches pointed that a drinking water should be not exceeding (100 ppm). (Abawi and Hassan 1990).

Results obtained showed that only four wells were good quality as they numbered (6,17,23,25), whereas the rest of the 25 studied wells were not suitable for drinking and agricultural irrigation. (Table 5).

10- Wells water Magnesium Mg^{++}:

Although the Magnesium is a lesser than Calcium in it's dispersal within the earth crust, but it's more important because this mineral is an essential in composing the chlorophyll molecules of the plants. (Russell 1961).

Magnesium salts like the Calcium salts plays an important role for increasing the water hardness when it is dissolving by carbon dioxide effect or by some biological processing. Some of this carbon dioxide may be came by rain water into the soil and another amounts of this gas may alter by the microbial processes and all of the affecting on some parts of earth's stones layers which are composed from Calcium or Magnesium carbonate, then they altering into a bicarbonate and this will be dissolved in the water and after a while it will be change into a carbonate salts to increase the hardness of the water later on, when the water temperature increase. Drinking of such water may precipitate (Yang, et al. 1989). A urinary stones and also the water hardness may cause some heart and blood vessels diseases. (GEMS water program. 2006).

Results obtained from the presence investigation showed that ten wells within 25 were not in a good quality and they named as (1,2,3,4,5,9,12,13,16,22), because they had more than 50-150 mg/ℓ magnesium. (Abawi and Hussan. 1990). The other 15 wells were in a good quality for drinking and cultural irrigation usages. (Table 5).

11- Wells water Sodium Na^{+}:

Like potassium the sodium element belonged to the alkaline elements group because of their similar chemical characters. Sodium element considered as a high dispersed elements in the natural and underground waters. The salts of this element are always dissolving in the water and not giving any precipitations or any affections on the hardness of the water even when it was as carbonate or bicarbonate of sodium except when it work to increase the water alkalinity. (Al-Saidrizka and Al-Sharhan 2008). (Table 5).

Sodium element may occur in natural water as a form of borax (Sodium tetra borate) or as sodium sulphate and with a concentration mostly higher than Potasium concentrations although when Sodium concentration are not affecting by the seasonal changing. (Todd 1980).

Results obtained from the present study showed that the sodium concentrations were higher than the permissible limits for drinking water (20-200 ppm) at fourteen wells named (1, 2, 3, 4, 5, 7, 9, 10, 12, 13, 15,

16, 22, 24), whereas the other eleven wells were good for drinking and other usings. There are no harmfuls known about the sodium salts in drinking water except the unsuitability for the plants growth and some physiological disturbing in the body of human and animals especially what are related to the blood pressure and blood vessels. (Abdo and Ahmed 1990). (Table 5).

12- Wells water Potassium K^+:

Potassium are considered as a very important mineral for the essential nutrients which are used to build the protein and other amino acids inside the body of the living organisms. Its also important agriculturally for the plant crops that are storaging the starch materials, then it is concentration inside the plant body in a high grades than the natural and ever the mineral water (Sherif, and Kushik, 2013).

Results obtained from the presence study showed that potassium ions were in a good quality for all studied wells, so that was to confirm the suitability of their waters for drinking, irrigating and others usages. It was well known that the concentrations of potassium have not any dangerouses with a suitable limiting between 10-40 ppm, but if it exceeding this range it will cause the same harmful symptoms of sodium on blood pressure and blood vessels. (Abdo and Ahmed 1990). (Table 5).

13- Mercury concentrations Hg:

Mercury concentrations are considered as the most dangerous compounds on all water resources, that are affecting on human health and other living organisms. Mercury is existing in surface water bodies with a different concentration and more than it's concentrations in the underground waters and wells waters because most of this pollutants took place by pollutants drainage for the pesticides, paints and other industrial wastes, especially the wastes of electrical industries and the mercury mining. (Sheriff 1986). The most dangerous of organic mercurial pollutants what is called the Mercury Methyl. This compounds are precipitating on the bottom of the rivers, lacks and seases by the changing of the inorganic mercurial compounds in to organic mercurial compounds by certain microorganisms. The existing of mercury methyl in the water will cause a poisoning disease, which is affecting on the human nervous system and causing later the blindness, deafness and tongueless and another harmful symptoms (Warren and Mark 1985).

Results obtained from the present study showed that all wells waters were below the fumble of the measuring instrument for the mercury concentrations, because the all concentration of these 25 wells were below 0.025 ppm, while the permissible concentrations for the drinking water must exceed 0.002 ppm, so it's easy to say that the

mercury concentrations of all studied wells were in a doubtful case for the suitability or not suitability for drinking, irrigation and other usages. (Table 6).

14- Lead concentration Pb:

It is one of the most dangerous heavy metal which is existing in surface water more than it's identical of underground waters or wells. The most famous pollution with the lead that comes from the air pollution especially from automobiles exhausts and these are more than the exhausts of another transportation on media, since they are using the benzene which is mixed with the lead. The lead poisoning diseases were known by their dangerous on the embryos and children below three years. This poisoning symptoms appear clearly on blood, kidney and the central and peripheral nervous systems.

The American national academy for science had pointed a permissible limit for the lead in drinking water that not exceeding 0.05 ppm, while the most international limits pointing not more than 0.010 ppm. (Melanby, 1988).

Results obtained from the present study showed that thirteen wells were not in a good quality, which they named (4,9,11,12,14,15,16,18,19,21,22,23,24), whereas the other wells were in a good quality from the point of view for the lead concentrations. (Table 6).

15- Copper concentrations Cu:

This heavy metal is considered as the most abundant in the soil and some aquatic systems, and it is one of the secondary nutrients that is very important for the living organisms and this is what stand behind such abundance in water and sediments beside the bodies of many organisms. Copper compounds are also used as an agricultural pesticides and to control algae in lakes and reservoirs. The body may exposed to copper by skin contact with soil, water or other substances containing copper compounds. Copper found naturally in ground water and surface water is generally very low (about 4µg/ℓ or less. However, drinking water may contain higher levels of dissolved forms of copper. (Janos, et al, 2002).

There were very evidences pointing that 0.5 ppm/ℓ copper concentration will be high affecting to the some sensitive types of algae and a parts of 1 ppm/ℓ copper concentration will be a high killing to many kinds of fish. The mammals are very sensitive on their drinking water to the less than the 1-5 ppm/ℓ as a permissible limit for copper concentration, more than this concentration will cause a severe damage to the brain nerves (Farkas, et al. 2001).

Results obtained from the present study showed that all 25 studied wells were in good quality for drinking, irrigation and other using purposes. (Table 6).

16- Zinc concentration Zn:

Zinc compounds are composing approximately 0.004% from the eartherust and it is considered as one of the most secondary nutrients for the living organisms. This element has not a large poisoning especially when it is not mixing with lead or Arsenic. Zinc compounds can fined their ways towards the water bodies within the oxidation and analysis processing and then it will precipitate in the rivers, lakes sediments or may be going toward the underground waters as sulphide, oxide of zinc or as a zinc carbonate. (Sheriff 1986).

The permissible concentrations of zinc in drinking water could be reach between 1-5 ppm without any harmful cases. Results obtained from the present investigation showed that all 25 studied wells were in a good quality for drinking, irrigation and other usages from the point of view related to zinc pollution. (Table 6).

17- Cadmium concentration Cd:

Cadmium element classified as one of heavy metal which had a high poisoning and it is existing as a mixture with zinc pollutants that are produced from the minery places. Cadmium rarely existing with small amounts in ground waters naturally, except when there was a cadmium drainage toward surface or ground waters as it was happened in Japan and causing the illness which is called Itai Itai. The cadmium poisoning attacks the human kidney cortex on the limit of poisoning as 0.01 ppm concentration. (Sheriff. 1986).

Results obtained from the present investigation showed a safety cadmium concentration since all studied wells were at a good quality for drinking, irrigation and other usages from the point of view related to cadmium concentration. (Table 6).

18- Total Dissolved Solids T.D.S:

It is well know from sanitary point of view which is related to many scientific suggestions that total dissolved solids in drinking water must not be higher than 500 ppm. Such exceeding concentration will cause a severe harmfulls to the humans especially for the kidney and other internal membranes of the body. (WHO. 2003).

Results obtained from the present investigation showed that 24 studied wells were not good in their quality related to the concentrations of T.D.S. (Table 7).

According to this results, it is easy to consider that all of these wells were not in a good quality from the point of view related to

concentrations of T.D.S. The only one well was in a good quality for drinking, irritation and other usages named the well number 25. (Table 7).

19- Sodium Adsorption Ratio S.A.R.:

S.A.R. was considered as an expression about the sodium activity in ratio to calcium and magnesium ions, and it is measured by mEq/ℓ with the following equation:

$$S.A.R = \frac{Na \times 100}{\sqrt{\frac{Ca + Mg}{2}}}$$

This ratio is expressing about the activity and classification of the water resources from it's content of sodium. The waters containing (S.A.R 0-10) considered as a low in sodium content. Such a results may be looks in a contrary with the sodium analysis that was measured and determined before especially at the wells numbered (1,2,3,4,5,6,7,9,10, 12,13,15, 16,22,24) as they mentioned before, but such a results although they showing a high sodium concentrations whereas the S.A.R reading could be proof the high ratio of the sodium adsorption which is making the water of all studied wells in a good quality for drinking, irrigation and other usages. (Borcherding and Volpers 1994) (Table 5) and (Table 7).

General conclusions:

Although all results obtained from the present study were fixed and discussed but some general conclusions may be important to mention as a gained observations. This observations had introduced previously to the general committee of wells and ground water in Baghdad, then they invited many staffs of local departments from many governorates including Baakoba staff (The studied area), to discuss the observations of the present study, then hopefully they will be take the obtained results on their duty about the 25 wells choosed and numbered by them their selves. It is too necessary for them to take care about safety, clean and ecology of those wells as a patterns for the large number of wells located in Bakkoba city, after the consideration of the following observations:

1. There are no affects form the different forms of pollution at the surrounding areas of all studied wells and their ground waters because there was no any drainage toward the ground waters of those wells.
2. There are no affects from the different elevations on the 25 studied wells because of the topography similarly on the areas of all 25 studied wells and their faraway from any sea or salty lakes.
3. There are no affects from ground water temperature because their heat similarity except the wells numbered (7,9,11,20,25) which were less than others in temperature.

4. The pH grades were close to each other for the all studied wells.
5. The electrical conductivity were in a high grades for the all studied wells and it is considering with the turbidity grades, except the wells numbered 7 and 8.
6. The turbidity was in a good situations for the all studied wells except the wells numbered 7 and 8.
7. Bicarbonate and nitrate concentrations were in a good quality for the all studied wells.
8. Sulphate concentrations were at a high grades in most of studied wells, except the wells numbered (6,17,19,20,21,22,23,25).
9. Cloride concentrations were at a high grades almost in more than the half of studied wells, except the wells numbered (1,2,3,4,5,9,12,13,15,16,22).
10. Calcium concentrations were at a high grades in twenty wells, except the wells numbered (6,17,22,23,25).
11. Magnesium concentrations were in a good quality for 15 wells except the wells numbered (1,2,3,4,5,9,12,13,16, 22).
12. Sodium concentrations were in a bad quality for 14 wells except the wells numbered (6,8,11,14,17,18,19,20,21,22, 25).
13. Potassium concentrations were in a good quality for all the studied wells.
14. There was no any heavy metals pollution for all the studied wells.
15. Total dissolved solids were in a high grades except the well numbered 25.
16. Sodium adsobtion ratio were in a good situation for all the studied wells although the high concentration on 14 wells while the power and activity of the sodium adsorbtion was adapting the sodium concentrations which is making the water as in a good salinity to be used in drinking, irrigation and other usabilities.

Table 3. The physical parameters of 25 studied ground water wells

Well No	Water temperature C° range and mean S.D		pH range and mean S.D		E.C µmoss/cm² range and mean S.D		Turbidity NTU range and mean S.D	
W1	29.5-31 0.052	30	7-7.3 0.5	75	6200-6800 27	6600*	36-41 3.2	39.2*
W2	29.2-3.2 1.3	29.9	6.6-7 0.6	6.98	7050-7800 62	7290*	122-146 6.1	134*
W3	31.8-31 2.1	31.3	7.1-7.92 0.5	7.75	6250-6640 50	6460*	30-37 1.4	34.6*
W4	31.6-30 2.2	31.2	8-8.30 0.15	8.19	5320-5830 72	5560*	123-141 4.2	130*
W5	26.2-22.6 1.4	23.2	7-7.60 0.10	7.52	9220-9512 44	9340*	76-91 4.2	82*
W6	28.5-31.2 0.06	30.0	6.80-7.92 0.66	7.33	1020-1312 82	1119*	62-83 3-4	7.8*
W7	18.1-21.5 0.022	19.5	6.94-7.95 0.80	7.58	2116-2660 45	2570*	1.5-2.6 0.12	2.0
W8	28.4-32.6 2.04	31.9	7-7.92 0.8	7.61	1120-1616 28	1453*	4.2-6.3 0.54	5.0
W9	16.8-22.2 0.036	19.0	7-7.62 0.20	7.38	1280-1396 27	1309*	9.4-13.2 0.83	11.0*
W10	28.4-33.2 0.066	31.2	6.80-7.82 0.4	7.65	2140-2680 36	2450*	7.8-11.2 0.85	9.0*
W11	16.6-22.1 0.013	19.8	7-7.6 0.2	7.37	1862-2120 64	1935*	7-12.1 2.1	8.0*
W12	26.4-33.2 1.06	31.4	6.91-7.1 0.15	6.98	5360-5940 36	5760*	10.6-13.1 0.42	11.6*
W13	30.6-33.0 0.016	31.2	7-7.6 0.4	7.3	5060-5820 37	5410*	5.2-7.2 0.22	6.0*
W14	28.6-32.2 0.65	31.5	7-7.4 0.2	7.2	1312-1868 24	1695*	19.1-22.3 0.62	20.8*
W15	30.6-32.8 1.02	31.4	6.9-7.4 0.6	7.1	2216-2730 33	2690*	16.2-18.6 0.92	17.3*
W16	30.0-32.6 1.08	30.5	7-7.8 0.6	7.5	2060-2412 86	22185*	142-163 1.5	155.0*
W17	30.2-33.1 0.04	31.0	7-7.6 0.1	7.3	1066-1317 10	1173*	10.2-13.6 0.19	12.3*
W18	30.6-34.1 1.14	32.4	6.8-7.4 0.8	7.0	1080-1316 20	1182*	15.8-21.3 0.76	18.0*
W19	18.6-22.0 1.54	20.4	7-8.1 1.1	7.8	2100-2348 57	2220*	9.6-11.6 0.42	10.0*
W20	16.8-23.1 1.44	19.6	7-7.8 0.5	7.5	2012-2306 25	2180*	10.2-15.7 0.44	13.0*
W21	28.8-36.2 2.13	30.1	6.5-7 0.5	6.9	1062-1616 20	1315*	8.1-12.3 0.32	9.0*
W22	30.6-33.5 1.08	31.5	7-8.1 0.2	7.6	7930-8260 37	8150*	13-16.6 0.54	15.8*
W23	30.7-33.5 0.86	31.7	7-7.8 0.7	7.5	1260-1516 80	1356*	10.4-16.3 0.92	12.0*
W24	30.6-33.1 1.8	31.7	6.5-7.2 0.8	6.9	2012-2316 26	2240*	32-37.3 0.53	35.0*
W25	18.6-23.1 1.12	21.1	7.6-7.8 0.6	7.4	514-722 13	692*	10.6-16.2 0.58	14.8*

Notes. *= unsuitable. The others = suitable.
The mean is for eight values (readings).
P-values for all readings were (0.05). confidence level 95%.

Table 4. The chemical parameters of 25 studied ground water wells

Well No	Bicarbonate mg/L⁻ range and mean S.D		Sulphate mg/L⁻ range and mean S.D		Nitrate mg/L⁻ range and mean S.D		Chloride mg/L⁻ range and mean S.D	
W1	802-1014 26	976	712-802 64	776.5*	3.5-5 0.12	4.5	488-521 34	505*
W2	306-366 18	340	996-1085 26	1043*	3-5.2 0.62	4.0	820-900 41	889*
W3	310-387 15	350	926-1096	1039*	6.6-7.4 0.17	7.0	864-902 36	886*
W4	485-604 22	590	810-893 38	879*	5.2-6.8 0.22	6.0	812-886 28	861*
W5	678-786 16	731	2005-2203 72	2156*	0.2-0.8 0.04	0.6	1022-1201 61	1171*
W6	142-194 20	158	112-164 16	149	4.2-5.6 0.36	5.1	210-276 16	239
W7	312-388 26	353	587-677 31	621*	1.2-2 0.52	1.8	300-328 10	311
W8	46-67 12	51	420-495 18	489*	1.0-1.8 0.03	1.4	120-192 26	145
W9	1396-1504 33	1457.9	1694-1785 67	1732*	3.2-5.6 0.12	4.3	2212-2469 52	2332.2*
W10	149-192 22	168	499-573 60	567*	5.5-6.4 0.18	6.1	184-202 22	192
W11	80-106 26	94	484-536 42	513*	1.8-2.9 0.24	2.2	300-347 17	321
W12	504-627 17	591	812-900 55	880*	4.1-5.8 0.45	5.0	510-583 24	565*
W13	724-802 42	789	614-705 35	671*	5.2-6.8 0.30	6.1	796-852 36	849*
W14	58-74 14	68.1	398-420 22	409*	6.2-9.3 0.11	8.1	240-312 16	292
W15	403-380 36	450	510-534 10	518*	1.2-3 0.4	2.1	496-536 27	519*
W16	212-293 52	2449	3642-4022 43	3830*	5.6-8.1 0.26	7.2	3760-4010 63	3910*
W17	120-202 46	159	146-172 35	150	4.2-6.4 0.17	5.1	216-302 37	260
W18	46-72	62	520-616 26	599*	5.4-7.3 0.18	6.3	145-183 33	156
W19	272-312 25	305	300-394 33	343	0.3-1.1 0.02	0.9	220-266 18	248
W20	263-326 18	300	312-406 57	339	1-2.6 0.14	1.9	200-255 21	239
W21	202-276 16	245	302-344 20	330	3.2-5.6 0.17	4.0	294-332 16	321
W22	116-135 8	125	316-392 37	351	2.4-3.8 0.16	3.5	2212-2354 14	2337*
W23	139-203 31	155	150-186 12	166	3.3-5.2 0.20	4.0	220-284 11	258
W24	310-384 14	323	390-450 26	423*	1-1.8 0.16	1.3	260-304 24	284
W25	106-142 18	120	78-90 16	81	2.6-4.6 0.12	4.3	94-117 9	101

Notes. *= unsuitable. The others = suitable.
The mean is for eight values (readings).
P-values for all readings were (0.05). confidence level 95%.

Table 5. The mineral ions of 25 studied ground water wells

Well No	Ca^{+2} ppm range and mean S.D		Mg^{+} ppm range and mean S.D		Na^{+} ppm range and mean S.D		K^{+} ppm range and mean S.D	
W1	360-412 36	395*	220-265 15	224*	380-442 14	430*	10-12.4 0.6	10.5
W2	382-410 25	390*	194-232 11	210*	282-342 11	322*	6-12.2 0.8	9.0
W3	338-418 12	393*	188-246 14	215*	288-346 16	335*	8.2-9.8 0.2	9.2
W4	210-274 18	261*	140-180 16	155*	910-994 20	970*	4.6-6.2 0.4	5.0
W5	512-580 27	563*	220-302 28	265.4*	900-972.4 6.3	948.1*	15-22 0.3	19.1
W6	81-93 6	89	30-54 6	41	101-128 8	118	1.8-2.6 0.2	2.4
W7	152-180 22	160*	75-96 7	83	240-286 16	261*	1.6-2.8 0.4	2.3
W8	94-118 8	102*	72-94 6	80	75-92 13	76	6.5-10.2 0.3	8.5
W9	793-846 26	825.6*	290-322 12	301.9*	1280-1392 11	1375.5*	8-13.6 0.4	11.7
W10	102-116 10	110*	35-44 4	41	211-284 12	255*	6.8-14.6 0.8	11.0
W11	135-162 17	149*	76-101 12	89	150-192 16	167	8.5-16.2 0.5	10.8
W12	250-274 14	265*	140-172 9	156*	896-994 14	974*	8.6-11.6 0.4	9.0
W13	3628-40.10 26	3810*	180-226 10	207*	302-338 18	321*	6.5-12.4 0.3	8.0
W14	130-158 8	144.2*	60-86 6	74	110-126 6	116	5-9.2 0.5	7.8
W15	196-220 12	209*	86-122 9	105	305-362 13	340*	1.5-3.4 0.7	2.1
W16	695-718 12	709*	286-355 14	310*	3600-3912 3	3901*	3-5.5 0.6	4.0
W17	86-104 6	91	36-54 4	41	100-166 10	120	2.6-5.2 0.4	3.5
W18	100-132 12	120*	75-106 8	90	96-120 6	109	4-4.6 0.2	4.3
W19	110-142 11	126*	36-62 16	49.2	176-204 11	196.1	0.1-0.6 0.02	0.3
W20	118-136 16	122*	45-66 7	50	186-206 10	191	0.2-0.8 0.04	0.4
W21	120-148 10	131*	74-96 9	80	150-180 5	160	1.5-2.8 0.6	2.0
W22	800-854 15	830	280-315 5	309*	1294-1400 8	1380*	10.5-18.6 2.2	15.1
W23	90-130 12	100	35-54 11	42	102-136 6	117	2.6-6.4 0.3	4.0
W24	144-171 16	150.3*	52-80 10	61	200-230 5	210*	1.2-1.42 0.8	1.17
W25	30-48 8	39	23-34 6	28	40-67 8	55	0.02-0.4 0.06	0.1

Notes. *= unsuitable. The others = suitable.
The mean is for eight values (readings).
P-values for all readings were (0.05). confidence level 95%.

Table 6. The heavy metals concentration of 25 studied ground water wells

Well No	Hg ppm range and mean S.D	Pb ppm range and mean S.D		Cu ppm range and mean S.D		Zn ppm range and mean S.D		Cd ppm range and mean S.D	
W1	L0.025	0.012-0.020 0.006	0.018	0.102-0.154 0.02	0.117	0.0001-0.0006 0.00001	0.0002	0.0001-0.0008 0.00003	0.0005
W2	L0.025	0.08-0.12 0.005	0.10	0.001-0.009 0.005	0.004	0.0001-0.0008 0.00003	0.0003	0.010-0.022 0.004	0.014
W3	L0.025	0.002-0.009 0.001	0.006	0.012-0.024 0.006	0.017	0.0003-0.008 0.00005	0.0009	0.001-0.008 0.0002	0.003
W4	L0.025	0.010-0.026 0.004	0.018*	0.024-0.062 0.003	0.030	0.0002-0.0009 0.00004	0.0006	0.0001-0.0005 0.00003	0.0002
W5	L0.025	0.002-0.0011 0.0002	0.008	0.023-0.072 0.002	0.048	0.0002-0.0009 0.00003	0.0007	0.006-0.016 0.0002	0.010
W6	L0.025	0.002-0.009 0.0003	0.006	0.09-0.016 0.002	0.011	0.0011-0.0028 0.0005	0.0016	0.0001-0.0008 0.00005	0.0004
W7	L0.025	0.004-0.0016 0.0005	0.008	0.0012-0.0029 0.0005	0.0078	0.001-0.007 0.0008	0.002	0.0010-0.0035 0.0006	0.0014
W8	L0.025	0.003-0.02 0.001	0.009	0.010-0.037 0.009	0.016	0.0010-0.0016 0.0004	0.0012	0.0016-0.0048 0.0005	0.0022
W9	L0.025	0.015-0.032 0.006	0.024*	0.0008-0.006 0.00003	0.001	0.0006-0.004 0.00002	0.002	0.006-0.016 0.0006	0.010
W10	L0.025	0.002-0.01 0.0006	0.008	0.0046-0.0073 0.0005	0.0058	0.0011-0.0025 0.0003	0.0018	0.0015-0.0074 0.0007	0.0035
W11	L0.025	0.011-0.017 0.004	0.014*	0.0008-0.006 0.00002	0.001	0.0016-0.0022 0.0008	0.0018	0.0001-0.0009 0.00002	0.0007
W12	L0.025	0.010-0.015 0.007	0.012*	0.0016-0.0083 0.0004	0.0045	0.001-0.006 0.0002	0.002	0.0020-0.0062 0.0004	0.0054
W13	L0.025	0.002-0.01 0.0006	0.008	0.012-0.037 0.002	0.023	0.001-0.008 0.0004	0.002	0.0025-0.0092 0.0005	0.0056
W14	L0.025	0.009-0.016 0.0002	0.011*	0.013-0.042 0.003	0.028	0.0010-0.0017 0.0001	0.0014	0.0012-0.0023 0.0001	0.0017
W15	L0.025	0.008-0.018 0.0005	0.012*	0.0008-0.009 0.00006	0.007	0.001-0.009 0.0005	0.002	0.0011-0.0028 0.0005	0.0018
W16	L0.025	0.012-0.019 0.008	0.016*	0.001-0.03 0.0006	0.009	0.0010-0.0026 0.0004	0.0012	0.0010-0.0032 0.0004	0.0020
W17	L0.025	0.0006-0.02 0.0004	0.008	0.0010-0.0036 0.0004	0.0018	0.001-0.006 0.0003	0.002	0.0001-0.006 0.00003	0.0008
W18	L0.025	0.009-0.016 0.0008	0.012*	0.0006-0.008 0.00003	0.001	0.0010-0.0017 0.0005	0.0015	0.0013-0.0061 0.0005	0.0019
W19	L0.025	0.004-0.016 0.0005	0.010*	0.02-0.5 0.001	0.09	0.0002-0.008 0.00006	0.0009	0.0011-0.0084 0.0007	0.0031
W20	L0.025	0.002-0.02 0.0001	0.008	0.022-0.3 0.006	0.095	0.00045-0.006 0.00002	0.00098	0.0010-0.0029 0.0006	0.0014
W21	L0.025	0.012-0.036 0.007	0.024*	0.010-0.025 0.001	0.014	0.0012-0.0044 0.0004	0.0026	0.008-0.0016 0.0004	0.0011
W22	L0.025	0.011-0.035 0.003	0.023*	0.013-0.055 0.004	0.020	0.0015-0.0063 0.0007	0.0036	0.0015-0.0045 0.0001	0.0026
W23	L0.025	0.012-0.016 0.001	0.014*	0.0007-0.003 0.0005	0.001	0.0010-0.0022 0.0002	0.0016	0.0006-0.0022 0.00002	0.0011
W24	L0.025	0.015-0.042 0.006	0.020*	0.001-0.008 0.0007	0.003	0.0012-0.0026 0.0001	0.0015	0.0013-0.0074 0.0005	0.0036
W25	L0.025	0.001-0.009 0.0008	0.006	0.001-0.009 0.0008	0.005	0.0011-0.0027 0.0006	0.0019	0.0008-0.0026 0.00008	0.0010

Notes. *= unsuitable. The others = suitable.
The mean is for eight values (readings).
P-values for all readings were (0.05). confidence level 95%.

Table 7. The chemo physical parameters of 25 studied ground water wells

Well No	TDS ppm range and mean S.D		SAR mEq/ℓ range and mean S.D	
W1	4135-4462 236	4320*	0.012-0.062 0.02	0.031
W2	4542-4986 22	4925*	0.812-0.922 0.60	0.866
W3	4300-4370 16	4354*	0.533-0.802 0.46	0.648
W4	3632-4002 25	3808*	0.515-0.683 0.12	0.620
W5	6212-6437 27	6346*	1.1-1.75 0.14	1.11
W6	750-682 42	761*	0.02-0.12 0.004	0.07
W7	1705-1911 30	1821*	0.3-0.51 0.008	0.144
W8	950-992 11	983*	0.112-0.362 0.5	0.241
W9	9050-9226 14	9127*	1.050-1.262 0.54	1.102
W10	1600-1685 17	1633*	0.10-0.63 0.04	0.22
W11	1331-1412 27	1393*	0.08-0.73 0.007	0.16
W12	3626-4006 45	3887*	0.442-0.612 0.16	0.537
W13	3050-3222 82	3186*	0.12-0.76 0.04	0.37
W14	1032-1215 38	1177*	0.80-0.242 0.6	0.139
W15	2110-2420 15	2221*	0.202-0.284 0.12	0.243
W16	17652-18012 36	17820*	0.120-0.186 0.16	0.155
W17	750-8012 14	772*	0.022-0.164 0.06	0.051
W18	1105-1217 42	1185*	0.024-0.106 0.02	0.095
W19	1463-1562 19	1509*	0.2-0.34 0.08	0.13
W20	1123-1483 12	1418*	0.92-0.146 0.20	0.117
W21	1126-1347 45	1295*	0.064-0.182 0.08	0.098
W22	9312-9647 46	9424*	0.12-0.38 0.3	0.22
W23	826-986 25	945*	2.6-6.2 0.60	4.0
W24	1345-1600 47	1533*	1.1-2.5 0.62	1.3
W25	4002-486 16	447	2.4-5.8 0.6	4.1

Notes. *= unsuitable. The others = suitable.
The mean is for eight values (readings).
P-values for all readings were (0.05). confidence level 95%.

References

1- Abbawi, S.A and Hassan, M.S., (1990). Practical environmental engineering water analysis. Ministry of Education and Scientific research. Al-Hikma publishing house. University of Musil, Iraq. 160pp.

2- Abdo, R.F. and Ahmed, S.A.(1990) Developmental and cytological effects of herbicides preometryne, Trifluration and EPTC in lentil. LENS. Newsletter. The international Center for Agriculture Research in dry area (ICARDA), 17(1): 17-20.

3- Akinola, M.O.; Njoku, K.L and Ekeifo, B.E. 2008. Determination of Lead, Cadmium and Chromium in the tissue of an economically important plant grown around a textile industry at Ibcsh, Ikorodu area of Lagos state, Nigeria. Advances in Environmental Biology, 2(1): 25-30.

4- Al-Saidrizk, Z. and Al-Sharhan. A.S. (2008). Water resources in United Arab Emirate. University book shop and Ithraa publishing and distribution (In Arabic). 623p.

5- APHA (American Public Health Association), (1988). Standard methods for examination of water and wastewater. 20th edu., Washington.

6- Bieny, C.D; Calam, D. and Morlea, P. 1994. Review of heavy metals. Review of pollution in African Aquatic Environment, 25: 37-43.

7- Borcherding, J., Volpers, M., (1994). The Dreissena Monitor. First results on the application of the biological early warning system in the continuous monitoring of water quality. Wat. Sci. Technol. 29, 199-201.

8- Cole, G.A. (1983), Text book of limnology. 3rd. E.d. The C.V, Mosby Co. London. 401 pp.

9- Cousins, T.M.; Mulquin, D.B. and Pickering, J.L. (2002) Survey of heavy metal in sediments of the Manly Lagoon Catchment in Freshwater. Ecology report 2002, Department of Environment Sciences, University of Technology, Sydney. 32 p.

10- Deborah, Chapman 1996. Water quality assessment. Agide to use of biota sediment and water in environmental. Monitoring. Second edition. 1996 INESCO/WHO/UNEP. Chapter 9 ground water by J. Chilton.

11- Farkas, A., Salanki, J., Speciar, A. (2001). Seasonal and spatial variations of heavy metals in organs of Abramis brama L. Populating Lake Balton. In : proceedings of the 9th international conference on the conservation and management of Lakes. Otsu, Japan, pp 83-86.

12- (GEMS) water programme. United Nations Environment Programme Global Environment Monitoring System. Water Guality for Ecosystem and Human Health. ISBN; 92-95039-10-6.

13- Hallberg.G.R.(1987), Agriculture chemicals in ground water. Extant and implications, Amer.J. Alter. Agric 2(1): 3-15pp.

14- Hynes, H.B.N, (1974), The biology of polluted water, Liverpool University Press. 212 p.

15- Janos. S; Anna. F; Tamara. K and Katalin. S.R. (2002). Molluscs in biological monitoring of water quality. Toxicology letters. 403-410.

16- Keshavan, K.G. and Parameswari, R., 2005. Evaluation of ground water quality in Kancheepuram. India. J. Environmental protection, 25(3): 235-239.
17- Masoud, S; Mamdouh, Z.M and Abdou, M.A. (2004). Study of ground water quality in kom Hamada Area, Beheira Goverorate, Egypt. Bulletin of the Chemists and Technologists of Macedonia, Vol. 22, No.2, pp. 143-154.
18- Massoud, A.D and Nejati, Y.S. (2006). Spectrophotometric determination of trace Cu(II) ion based on complication with Anthroquinine derivative. Anual Sci. Vol. 22(3).pp. 617-619.
19- Maulood, B.K. and Hinton, C.F, (1978), Anecological study on serchinar water, Chemical and physical aspects. J. Zanco, 93-117 p.
20- Melanby, K. (1988). Air pollution, acid rain and the environment). Elsevier Science pub, 120p.
21- Odum, E.P and Odum, H.T. (1971). Fundamental of ecology. 3rd. ed. Philadelphia. WB Saunders and Co. 574p.
22- Parsons, T.R., Youshiaki, M., and Carol, M.L., (1984). A manual of Chemical and Biological Methods for seawater analysis. Pergamon. International Library. Robert Maxwell, Publishers, M.C. Oxford, UK. 171pp.
23- Russell, E.J., (1961). Soil conditions and plant growth. Longmans, 365p.
24- Rutter, F. (1963). Fundamental of limnology. 3rd edition. (Canada UN Toronto press). 295. p.
25- Sheriff, H.A (1986). Effects of heavy metals upon certain fresh water insects. PhD thesis, University of Wales. 159, pp.
26- Sheriff, M.A and Kushik, M.A. 2013. Laboratrical analysis for soil, water and plant materials. Publishing house of Universities 637. P (In Arabic).
27- Sheriff. H.A and Delool, R.A., (1994)., A comparative study of ecological and genetical adaptation of three Iraqi. Freshwater snails in respect to heavymetals pollution. Iraq natural history museum journal. No 65: 28-36.
28- Sokolove, A.A, (1986), Forest types and the quentitave composition of surface and ground water, Forestry Abst. 220 p.
29- Tepputt, T.H.Y, (1977), Principles of water quality control, 2nd Ed, Persimmon Press, Oxford, 201 pp.
30- Todd, D.K., (1980). Ground water Hydrology. John Wiely and Sons, Inc., N.Y. 336p.
31- Warren,V. JR and Mark, J. H. (1985). Water supply and Pollution control. Harpper and Row publishers. New York. 460 p.
32- WHO. (2003). Total dissolved solids. Background document for preparation of WHO Gidelines for drinking-water quality. Geneva, World Health Organization (WHO/ SDE/ WSH/ 03.04/16). PP 30-31.
33- Wilber, C.G. (1969). The biological Aspects of water pollution. Thomas Springfield , C.C. 296 pp. Illinois.
34- Yang.Ch.Y., Cheng, M.F., Tsai, S.S. and Hsieh Y.L., (1998). Calcium, Magnisium and nitrate in drinking water and gastric cancer mortality. Japanese Journal Cancer Resources 89, 124-130.

ملائمة مياه بعض الابار للاستخدامات البشرية في محافظة ديالى مدينة بعقوبة (العراق . بغداد)

حسين احمد شريف

قسم العلوم – كلية التربية الاساسية – الجامعة المستنصرية

المستخلص

تمت دراسة وتحليل مياه خمس وعشرين بئراً كعينة مختارة من قبل الهيئة العامة للابار والمياه الجوفية، والتي تنتشر في مواقع متباينة ضمن مدينة بعقوبة في محافظة ديالى. وقد تم ترقيم الآبار بالاعداد من 1–25 بعد تثبيت مواقعها البيئية والطوبوغرافية (الارتفاعات عن سطح البحر) وقد جرى تحليل عينات المياه لهذه الابار في الاشهر (حزيران، تموز، آب وايلول)، 2010م ، وكانت للعوامل الفيزيوكيمياوية والمعادن الثقيلة وبعدد تسعة عشر عاملاً، وهي الاتي:– 1. درجة حرارة الماء، 2. الأس الهايدروجيني، 3. التوصيلية الكهربائية، 4. الكدرة للماء، 5. البايكربونات، 6. الكبريتات، 7. النترات، 8. أيون الكلورايد، 9. عنصر الكالسيوم، 10. المغنيسيوم، 11. الصوديوم، 12. البوتاسيوم، 13. الزئبق، 14. الرصاص، 15. النحاس، 16. الزنك، 17. الكادميوم، 18. الاملاح الصلبة الذائبة، 19. نسبة إمتزاز الصوديوم.

وبعد تحليل النتائج ثم تقديم التقرير النهائي الى الهيئة العامة للمياه الجوفية، وقد جرى تدارسها ومناقشتها في اللقاء العلمي الذي حضره عدد من كوادر أقسام المياه الجوفية والابار في عدد من المحافظات، ومن بينها محافظة ديالى (موقع الدراسة الحالية). وتم التوصل الى التوصيات اللازمة للمحافظة على سلامة ونظافة وبيئة مياه الأبار ذات المواصفات الجيدة، ومعالجة مياه الأبار غير الجيدة منها وذلك لضمان الحصول على مياه للشرب والري وللاستخدامات الاخرى، وليس فقط للخمس وعشرين بئراً بل ولبقية الأبار المنتشرة الاخرى سواء ماكان منها في بعقوبة أو في مدن أخرى، والتي تتطلب مسحاً شاملاً وفحوصات مماثلة للوقوف على طبيعة مياهها وصلاحيتها من عدمها.