Analytical Evaluation Study of Some Characterization of Potable water for an Old Well in Baghdad City

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Abstract

This study involved measuring seventieth tests five of its physically ,temperature, color, turbidity, electrical conductivity and pH and remaining tests were chemical ten of them for heavy metals ,the chlorine and fluorine were also investigated for water of old well in Baghdad city close to tiger river weekly for six months ,this study showed validity of this well to drink and domestic use within the limit of the properties and elements studied only ,through the tests ,all the samples were found to be transparent and non-colored ,there was nothing left after her leaving ,and the pH ranged from (7.655-7.920) , conductivity (821-908µsemens/cm) and temperature (19.68-23.36ºC) ,the concentrations of elements were (0.031-0.044), (0.038-0,053), (0.009-0.015), (0.019-0.025), (0.004-0.006), (0.009-0.011), (0.029-0.035), (0.108-0.112) ,(0.003-0.005), (95-111), and (0.424-0.571) µg/ml for lead ,cadmium, iron, copper, antimony, cobalt, chromium, zinc, manganese, chlorine and fluorine respectively ,as for nickel, it is not registered, all the tests have been subject to the local and international standards except lead and cadmium, according to international standard only.

Key wards: *potable water, quality, heavy metals, Toxicity; polution.*

Introduction

Drinking water, define a water that is safe to drink and using in food preparation ,also known as potable water. Drinking water amount required varies, and depends on some parameters physical activity, environmental conditions, age, and health issues[(1)] . In developed countries ,typically tap water meets drink water quality standard properties, even though only a small proportion is actually used in food or preparation consumed. Other typical useing include irrigation, toilets, and washing . Grey water may also be used for irrigation or toilets. The uses to irigation however may be asociated with risks[(2)]. Water may also be unaceptable due to levels of suspended solids or toxins. Globally, 89% of peoples had access to water from a source that is suitable for drinking called improved water source. Nearly 2.4 billion had access to public taps or wells ,while another 4.2 billion peoples world wide had access to tap water. The World Health Organization WHO considers access to safe drinking water a basic human rights [(3)].

Typically drinking water quality parameters fall within three categories: chemical, physical, and microbiological, chemical and physical parameters include turbidity, trace organic compound, heavy metals, and total suspended solids, microbiological parameter includes E. coli, Coliform bacteria, specific pathogenic species of bacteria such as cholera causing Vibrio cholera, protozoan parasites, and viruses[(4)] .

Chemical and Physical Properties of studied well water

Temperature

The density, viscosity, the vapor pressure and surface tension of water more or less depending upon the temperature. Continuous process of sinking and heating keeps the water body from freezing entirely. Temperature of water changes gradually in response

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to changes in seasonal. Seasonal variations in water temperature may be caused by changing meteorological events ,solar angle, air temperature and a several of physical aspects related to the watershed and stream[3.4] .

pH

Beacause the efficacy of disinfection with chlorine is highly pH dependent ,the measure of pH at the same time as chlorine residual is important since: disinfection is less effective where the pH exceeds 8.0, simple tests may be conducted in the field using comparators such as that used for chlorine residual. It is possible to measure pH and chlorine residual simultaneously with some chlorine comparators. Alternatively, portable pH electrodes and meters are available. If the water has a low buffering capacity ,results may be inaccurate [2] .

Electrical Conductivity

Electrical Conductivity define as a concentration of number dissolved minerals or ions in water. Its a material fundamental property that quantifies how strongly that material opposes the flow of electrical current. The highest and lowest concentration was observed starts 0.1 value Electrical conductivity to 4.5 value were observed[7].

Chlorine

In most countries ,Chlorine in one form or another is the principal disinfecting agent employed in small communities. A number of advantages of Chlorine as a disinfectant, including its relative efficacy, ease of measurement, and cheapness. Chlorine leaves a disinfectant residual that assists in preventing recontamination during transport, distribution, and household storage of water is an important additional advantage over some other disinfectants [5] .

Fluorine

Although fluoride is helpful for dental health at low concentrations, sustained consumption of large amounts of soluble fluoride salts is dangerous. Fluoride toxicity is a condition in which there are in elevated level of the fluoride ion in the body. Referring to a common salt of fluoride, sodium fluoride ,the lethal dose for most human adults is estimated at 5 - 10 g which is equivalents to 32 - 64 mg per kg fluoride per kg body weight [7] .

Heavy metals

Natural occures elements that having a highly atomic weight and at least 5 times greater than that of water density are called heavy metals. Their multiple domestic, industrial, agricultural, technological and medical aplications have leds to their wide distribution in the environment. Toxicity of heavy metals depends on number of factors includes the dose, chemical species, and route of exposure, as well as the gender, genetics, age, and nutrtional status of exposed indviduals. Classifing of heavy metals as human toxicity known or probable according to the U.S. [6] .

Table (1): Classification of metals according to its type of toxicity.

non-critical			Toxic but rare		Very toxic		
H	Sr	F	Ti	Ba	Cu	Ag	Au
Li	AI	Cl	Hf	Ga	Ni	Pd	Pt
Na	Fe	Br	Zr	La	Zn	Cd	Hg
K	C	O	W	Ta	Be	Se	Te
Rb	Si	S	Nb	Re	Sn	As	Cr
Ca		N	Os	Ru	Pb	Sb	Co
Mg		P	Ir	Rh	TI		Br

a. Cadmium

Cadmium is used in some industrial paints and may represented a hazard when sprayed, it extensively used in electroplating. Cadmium is also present in the manufacturing of some types of batteries. Cadmium is an extremelly toxic metal commonlly found in industrial workplace. Due to its low permisible exposure limits, over exposures may occurs even in situations where trace quantities of cadmium are found [7].

b. Copper

Copper Cu is an essential element in mammalian nutrition as a component of metalloenzymes in which it acts as an electron acceptor or donor. Copper excessive human intake may leads to severe corrosion and mucosal irritation, wide spread capillary damage, hepatic and renal damage and central nervous system irritation followed by depression [8] .

c. Iron

The iron source in surface water is anthropgenic and is relates to mining activities. Due to its ferric - ferrous inter conversion between ions Iron consider an attractive transition metal for various biological redox processes. Iron is one of the vital components of organisms like enzymes and algae of such as catalase and cytochromes, as well as of oxygen transporting proteins, such as myoglobin and hemoglobin [9].

d. Lead

Lead interferes with a variety of body processes and is toxic to many organs and tissues including the intestines , bones , heart , kidneys , and nervous systems and reproductive. Lead toxicity is a medical condition in humans and other vertebrates caused by increased lead levels in the body. It interferes with the development of the nervous system [9] .

e. Manganese

Manganese is used as a purifying agent in the production of several metals. Manganese poisoning may be caused by chronic ingestion and inhalation of manganese particles. Symptoms associated with over exposure to manganese may caused damage to the central nervous system and pneumonia [9] .

f. Zinc

Zinc though is an essential requirement for a healthy body, while excess zinc can be harmful, and cause zinc toxicity. The free zinc ion in solution is highly toxic to plants, bacteria, even vertebrate and invertebrates fish .Excessive zinc absorption can suppress iron and copper absorption. Zinc over exposure may cause the flu like symptoms of metal fume fever, intestinal and stomach disturbances, and or liver dysfunction.

g. Chromium

Exposure to too much chromium metal or ion may cause respiratory tract and lung cancer as well as kidney diseases. The over exposure may also cause gastro intestinal symptoms, such as vomiting and diarrhea, often with blood. Symptoms may lead to severe electrolyte water disorders, increased mild acidity of body tissues ,blood acidosis, and /or inadequate blood flow to it is tissues resulting in shock.

h. Cobalt

Cobalt in minute amounts conseder an essential element for animal healths as a component of vitamin B_{12}. Three basic ways that cobalt can cause poisoning. You can swalow too much of it, have it comes in constant contact with your skin or ,breathe too much into your lungs. Some times, cobalt particles are release as the metal ball grinds against the metal cup when you walk and can get release into the hip sockets and some times the blood stream, forming cobalt toxicity[10].

Experimental Part

The tests were carried out on the water components in the chemistry department - Faculty of Science / University of Mustansiriya and Chemistry Department / Faculty of Science / University of Baghdad and Ibn Sina Public Company and Ministry of Science and Technology / Department of Research and Technology of Environment and Water and on the following device:-

*Flame Atomic Absorption Spectophotometry FAAS:GBC 933 plus, used for estimation of iron, lead, nickel, copper, zinc, antimony, cobalt, cadmium, chromium and manganese via air-acetylene gas.

*Conductivitimeter EC 214 used for estimation of well water conductivity in (µSiemens) unit, after

adjusting with three standard solutions of potassium chloride.

*Ion selective membrane electrode WTW used for estimation of florin and chlorine via florin and chlorine ion selective electrode with reference calomel electrode.

*pH meter HANNA pH 211 used for estimation acidity or basicity degree of well water medium, after adjusting with two buffer solutions (4, 10).

The water samples in the well under study were examined and analyzed. The samples were collected, transported and stored in glass bottles, examined weekly, and for three readings per sample for a period of six months starting from the beginning of October until the end of March.

Results and Discussion

In this chapter, the study of the validity of using the well water under study for drinking purposes for humans by comparing the obtained results of this water with the maximum allowable value according to the standard of the local standard for quality standardization [(4)] . and quality control for World Health Organization WHO [(4)] .The following forms show the average of four measurements for each month of the six months studied from the beginning of October until the end of March, as well as comparison to the maximum limit of the values allowed locally and globally, and Table (2) summarizes all those specifications and contents studied .

Table (2): Comparison of the results of the examination of the components of the well water with the permissible values according to the Iraqi Ministries and the World Health Organization WHO.

Water Property	or Part Per Million (ppm)(ml/µg)Concentration										
	October	November	December	January	February	March	Average	Standard Deviation SD	Coefficient of Variation	Local Iraqi Quality	International WHO Quality
Temperature ℃	23.25	23.65	21.19	19.68	20.87	23.36	22.00	1.6400	0.0745	unlimited	unlimited
Conductivity (µSiemens)	821	836	895	875	888	908	864.5000	32.5254	0.0376	1000	1000
pH	7.673	7.655	7.661	7.687	7.712	7.920	7.7180	0.1010	0.0130	6.5-8.5	6.5-8.5
Chlorine	111	108	106	105	98	95	103.8330	6.1120	0.0588	200	250
Fluorine	0.571	0.556	0.511	0.489	0.457	0.424	0.4847	0.0566	0.1167	1	1.5
Lead	0.031	0.034	0.036	0.039	0.042	0.044	0.0377	0.0049	0.1299	0.01	0.05
Cadmium	0.038	0.039	0.044	0.048	0.050	0.053	0.0453	0.0060	0.01337	0.03	0.05
Chromium	0.029	0.030	0.032	0.033	0.035	0.035	0.0323	0.0025	0.0773	0.05	0.05
Iron	0.009	0.011	0.011	0.012	0.014	0.015	0.0120	0.0022	0.1825	0.3	0.3
Cobalt	0.009	0.008	0.008	0.009	0.011	0.011	0.0093	0.0014	0.1473	0.1	0.1
Copper	0.019	0.020	0.020	0.021	0.023	0.025	0.0213	0.0023	0.1056	1	1
Zinc	0.108	0.108	0.109	0.109	0.109	0.112	0.1092	0.0051	0.0134	3	5
Manganese	0.004	0.003	0.003	0.003	0.004	0.005	0.0037	0.00082	0.02216	0.1	0.1

The results of this study showed that all the properties examined for the samples of the well water, which is fixed in the table above, which is the rate of four measurements, are chemically and "chemically" valid during the study period, because the concentration of ions in the studied samples was within the permissible limits and for the period The study, except lead and cadmium, did not comply with the local standard, but according to the highest international standard, the thickness and antimony levels were not compared to the non-quantified quantity allowed by the markers, in addition to the nickel which was not detected and exposed to it under the detection limits of flame atomic absorption apparatus , noting that the characteristics of color and color were not tested automatically "but depending" on the naked eye, taking into account that the water of this well is drawn continuously and is used for drinking and domestic use is located near a populated area and away from the Tigris River 475 meters deep 11.5 meters.

Conclusions

Specific number of elements were measured and monitored in this research in addition to the physical properties that can be measured and coupled with the maximum allowed locally and globally for one well and is located near the course of the Tigris River and for a specific period of six months, ie for two seasons of the year and we recommend extending the study to include more elements Any four seasons and more than one well located medium and far away from the riverbed to observe and record the differences in the content of the elements and physical properties to know the suitability of human use such as drinking, washing and irrigation plantings.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

Conflict of Interest: Non

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