Evaluation of Some Minerals Content of Drinking and River Water in Iraq by AAS Method

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Abstract

The experiment was conducted during 2018 to evaluate to the presence of certain elements (Lead, Copper, Chromium, Zinc, Nickel, Cadmium, Arsine and mercury) in Tab and Bottled water in addition to riverbed and cliff water. The obtained data were compared with the corresponding international and national guideline values. The concentration of Tap and Bottled water samples for Cr and As were higher than the permitted concentration established by FAO/WHO scoring (0.0623, 0.3120)and (0.0680, 0.448) respectively. Whilst Zn, Ni, Pb, Hg, Cd, and Cu were lower than the permitted concentration established by FAO/WHO for both samples Tab and Bottled water which scored (0.0608, 0.0550, 0.0075, 0.00589, 0.0013 and nil) and (0.0420, 0.0152, 0.0105, 0.00581, 0.0003 and nil) respectively. Thus, the concentrations of As in both River bed and cliff water samples were higher than the permitted concentration established by the Iraqi (C.O.S.Q.C) Central Organization for Standardization and Quality Control which scored (0.754 and 0.245) respectively. Regarding the rest of the element which Seem to be lower than the permitted concentration established by Central Organization for Standardization and Quality Control in Iraq for Riverbed and cliff.

Keywords : *AAS, heavy metals, trace minerals*

Introduction

Water can be defined as a substance composed of hydrogen and oxygen. Water can be exist in three states gaseous, liquid and solid. Depends upon temperature, tasteless and odourless [1]. it has the important ability to dissolve many other substances such as salts and gases [20] . Water covers greater than twothirds of the earth's surface. however most of it salty and undrinkable. only 2.7% fresh water from the sum of the whole water on planet earth is fresh, but 1% of the fresh water can be used and accessible presented in lakes, rivers and groundwater. The inaccessible freshwater portion presented in deep aquifers and frozen in the polar ice. In our life Water considered to be an essential component. Water is an important source of elements more over pollutants which affect humans health. Therefore, water quality and quantity is of major importance for the human health [15]. There is no clear and uniform definition for SDW "safe drinking water." Safe drinking water can be defined as the water that does not represent any significant risk to health (chemical and microbial) during consumption over a long period of time [11]. Trace elements are carried in water as either dissolved. Majority of the harmful effects potentially comes from dissolved materials in the rivers or streams. Therefore , they may settles at the bottom of the riverbed sludge or penetrate into the underground water thereby it considered to be a source of ground water contaminations [10,12,16] . Trace elements at a low concentration considered to be essential nutrients, but may became toxic at a high concentration, also because of its formula. Yet, in the aquatic ecosystem elements (macro and micro) are considered to be one of the most substantial and main pollutants [22,23]. Toxic intakes and optimal intakes levels may vary from elements to other. Elements can be classified based on their biological activity in to essential trace elements which the human body needs it in very small amounts, and play a major role in good wellbeing. The second group are not considered as essential elements because of their toxicity and human nutrition. WHO (2004). Lead is a chemical element with the symbol Pb,it is a heavy metal that is considered to be widespread and environmentaltoxicant.

Lead is exist in the environments in three forms: Metallic lead, lead salts, and organic lead containing carbon [1,2]. Lead is a normally and naturally exist in the forms of toxic metal found in the Earth's crust, also Lead used widespread in may industry around the global has led to extensive environmental contamination.(WHO 2019). Lead is considered to be major harmful elements, can be accumulate in the environment thus causing pollutantion that affect all biological systems through exposure to air, water, and food sources [1,2]. Lead inside the human body is distributed in different organs such as brain, liver, kidney and bones. Also its stored in the teeth and bones. The main sources of environmental contamination include mining, smelting, manufacturing, recycling activities, leaded paint, leaded gasoline, and leaded aviation fuel. (WHO 2019). Copper is a chemical element with the symbol Cu. It is a reddish elements that occurs normally and naturally in rocks, soils, water, earth sediment, and air at relatively low level. Copper can also occurs in the crusts of the earth, plants and animals. It is considered to be an essential element for many living organisms including humans and other animals at relatively low levels. At much higher levels of Copper toxic effects can occur. Cu can enter to our body when we drink water or eating food, soil, or other substances that contain Copper [3,4]. Chromium is a chemical element with the symbol Cr. It is a steelygrey, specular, hard and brittle transition metal [27]. Cr is a part in lipid and protein metabolism inside human body. at low concentrations. For the normal human function very small amounts of Cr are needed. Chromium also exist at a relatively higher concentrations in industrial processes that can release potential pollutants to air and drinking water. Bielicka (2005). Chromium ions can also be detected in bone marrow, lungs, lymph nodes, spleen, kidneys, and liver, with the highest observed concentration in the lung cells.(ATSDR 2012) Zinc is a chemical element with the symbol Zn a famous element. Inside the human body Zinc considered to be the most important trace elements. It's important to life due to fundamental role in gene expression, cell development and replication Hambridge (2000). Zinc is the only metal that is a cofactor to more than 300 enzymes. (Rink and Gabriel 2000). Zinc major role is in the stabilization of the protein structure. Beyersmann (2002). Nickel is a chemical element with the symbol Ni. widely distributed in the world. Nickel can be found in air, water, and soil. Drinking water and food are major sources of exposure for the general population. (Barceloux 1999, Sutherland, Costa 2002). It is a silver-white elements found in several oxidation forms. Ni II is the most widespread in biological systems. Nickel easily forms nickel containing alloys, which have found an ever increasing use in modern technologies for over a hundred years now. Arsenic is a chemical element with the symbol As. Arsenic normally and naturally existed at relatively high levels in the groundwater of some countries. Arsenic is highly toxic in its inorganic formula. Polluted water which used used for drinking and some time in food preparation also in irrigation of food crops poses the greatest threat to public health. Arsenic is a natural component of the earth's crust and is widely distributed throughout the environment in the air, water and land.(WHO 2018). Mercury is a chemical element with the symbol. Hg is famous and widly distributed in the environment. Mercury is nonessential and toxic to the human body. It is considered to be one of the main environmental pollutants. Exposure to mercury even small amounts may cause serious health problems. Mercury is widely used in industry, agriculture, and medicine, and circulates in ecosystems, but is never destroyed. Mercury may have toxic effects on the nervous, digestive and immune systems, and on lungs, kidneys, skin and eyes. (ATSDR 1999)(WHO 2017) The main objective of the present study was to evaluate the presence of certain elements in tab water, bottled water, riverbed water and Rivercliff water to compare the obtained levels of the studied with the corresponding international and national guideline values. Selected trace elements was measured (Pb, Cu, Cr, ZN, Ni, Cd, As and Hg).

Materials and Method

The experiment was conducted during 2018, to evaluate the concentration of selected metals in tab water, bottled water, riverbed water and Rivercliff water to compare the obtained levels of the studied with the corresponding international and national guideline values. The selected metals of the study were (Pb, Cu, Cr, ZN, Ni, Cd, As and Hg).

Materials and equipment used

1. Atomic Absorption Spectroscopy (AAS) (AA-7000) Of Shimadzu Company.

2. Glass tube and volumetric flask.

3. H2SO4, HNO3 and distilled deionized water.

Sample Collection

A total of 36 water sample were obtained from Djilas river and the tab and bottled water present in Baghdad city. He water samples were obtained from local markets located in Baghdad. The samples were stored until the chemical analysis.

Chemical Analyses

The analysis was done in a chemical laboratory belongs to the ministry of Industry and minerals – republic of Iraq. Atomic Absorption Spectroscopy (AAS) used to analyze the samples.

Results and Discussion

Mean concentration of Lead (Pb), Copper (Cu), Chromium (Cr), Zinc (Zn), Nickel (Ni), Cadmium (Cd), Arsenic (As) and Mercury (Hg) obtained from the water samples were measured using Atomic Absorption Spectroscopy (AAS) method.

Our results indicated the following findings:

Tab water

The data in table 1, shows that the highest concentration for tab water samples were in As (0.3120) followed by Cr, Zn, Ni, Cd, Hg, Pb, and Cu which were (0.0623, 0.0608, 0.0550, 0.0075, 0.00589, 0.0013 and nil) respectively. The concentrations of Cr(0.0623) and As(0.3120) in tab water samples were higher than the permitted concentration established by FAO/WHO which were (0.05 and 0.01) respectively. On the other hands the concentrations of Zn, Ni, Pb, Hg, Cd, and Cu which were (0.0608, 0.0550, 0.0075, 0.00589, 0.0013 and nil) respectively Seemingly lower than the permitted concentration established by FAO/WHO.

Table 1: The mean concentration of the tested elements for Tab water with standards levels of FAO/WHO.

No.	Elements	Tab water (p.p.m.)	FAO/WHO standards (p.p.m.)
1	Cr	0.0623	0.05
2	Cu	Nil	2
3	Ni	0.0550	0.07
4	Zn	0.0608	3
5	Pb	0.0075	0.01
6	As	0.3120	0.01
7	Hg	0.00589	0.006
8	Cd	0.0013	0.003

Nil= no concentration detected

Bottled water

The data in table 2, shows that the highest concentration for bottled water samples were in As (0.4480) followed by Cr, Ni, Pb, Zn, Hg, Cd and Cu which were (0.0680, 0.0420, 0.0152, 0.0105, 0.00581, 0.0003 and nil) respectively. The concentrations of Cr(0.0680) and As(0.448) in Bottled water samples were

higher than the permitted concentration established by FAO/WHO which were (0.05 and 0.01) respectively. On the other hands the concentrations of Ni, Pb, Zn, Hg, Cd, and Cu which were (0.0420, 0.0152, 0.0105, 0.00581, 0.0003 and nil) respectively Seem to be lower than the permitted concentration established by FAO/WHO.

Table 2: The mean concentration of the tested elements for Bottled water with standards levels of FAO/WHO.

No.	Elements	Bottled water (p.p.m.)	FAO/WHO standards (p.p.m.)
1	Cr	0.0680	0.05
2	Cu	Nil	2
3	Ni	0.0420	0.07
4	Zn	0.0105	3
5	Pb	0.0152	0.01
6	As	0.448	0.01
7	Hg	0.00581	0.006
8	Cd	0.0003	0.003

Nil= no concentration detected

River bed water

The data in table 3, shows that the highest concentration for River bed water samples were in As (0.754) followed by Pb, Ni, Cr, Zn, Cd, Hg and Cu which were (0.0874, 0.0774, 0.0446, 0.0162, 0.0041, 0.00299 and nil) respectively. The concentrations of As(0.754) in River bed water samples were higher than the permitted concentration established by Central Organization for Standardization and Quality Control which were (0.05). On the other hands the concentrations of Pb, Ni, Cr, Zn, Cd, Hg and Cu which were (0.0874, 0.0774, 0.0446, 0.0162, 0.0041, 0.00299 and nil) respectively Seem to be lower than the permitted concentration established by Central Organization for Standardization and Quality Control in Iraq.

Table 3: The mean concentration of the tested elements for River bed water with standards levels of Central Organization for Standardization and Quality Control.

No.	Elements	River bed (p.p.m.)	Standards of C.O.S.Q.C (p.p.m.)
1	Cr	0.0446	0.1
2	Cu	Nil	0.1
3	Ni	0.0779	0.1
4	Zn	0.0162	5
5	Pb	0.0874	0.1
6	As	0.754	0.05
7	Hg	0.00299	0.005
8	Cd	0.0041	0.1

Nil= no concentration detected

River cliff water

The data in table 4, shows that the highest concentration for River cliff water samples were in As (0.245) followed by Ni, Cr, Pb, Cd, Zn, Hg and Cu which were (0.0690, 0.0435, 0.0223, 0.0067, 0.0065, 0.00516 and nil) respectively. The concentrations of As(0.245) in River cliff water samples were higher than the permitted concentration established by Central Organization for Standardization and Quality Control which were (0.05). On the other hands the concentrations of Ni, Cr, Pb, Cd, Zn, Hg and Cu which were (0.0690, 0.0435, 0.0223, 0.0067, 0.0065, 0.00516 and nil) respectively Seem to be lower than the permitted concentration established by Central Organization for Standardization and Quality Control in Iraq.

Table 4: The mean concentration of the tested elements for River cliff water with standards levels of Central Organization for Standardization and Quality Control.

No.	Elements	River bed (p.p.m.)	Standards of C.O.S.Q.C (p.p.m.)
1	Cr	0.0435	0.1
2	Cu	Nil	0.1
3	Ni	0.0690	0.1
4	Zn	0.0065	5
5	Pb	0.0223	0.1
6	As	0.245	0.05
7	Hg	0.00516	0.005
8	Cd	0.0067	0.1

Nil= no concentration detected

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Conflict of Interest: None to declare.

Ethical Clearance: All experimental protocols were approved under the College of Food Science and all experiments were carried out in accordance with approved guidelines.

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