Determination Of Lead And Cadmium In Drinking Water At Khartoum State By Atomic Absorption Spectroscopy

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مستخلص:

هدفت هذه الدراسة لتحليل عينات مختلفة من مياه الشرب في مواقع مختلفة بولاية الخرطوم,لتقدير نسبة وجود الكادميوم والرصاص فيها,وهذه المشكلة ذات اهمية بيئية وصحية وحياتية , تتمثل اهميه الدراسة لتحديد اثر التلوث في البيئة بولاية الخرطوم تم جمع عينات مياه الشرب وصنفت لثلاثة مجموعات ، حسب الموقع (مناطق سكنية،زراعيةوصناعية) في أم درمان ،بحري والخرطوم.عولجت العينات للقراءة بواسطة مطياف الامتصاص الذري وغيرها من الأدوات التحليلية بالطرق القياسية لتحديد المعادن الثقيلة -الكادميوم والرصاص. وجد ان تركيزالكادميوم في الماء في امدرمان في المناطق السكنية ، الزراعية,الصناعية -(022,0 - 036,0جزء من المليون-032,0 - 038,0جزء من المليون-026,0 - 030,0جزء من المليون) على التوالي 0في بحري في المناطق السكنية ، الزراعية,الصناعية -(027 ,0 - 031,0جزء من المليون-034,0 -492, 0جزء من المليون-035,0 - 810,0جزء من المليون) على التوالي.في الخرطوم في المناطق السكنية ، الزراعية,الصناعية -(024,0 - 031,0جزء من المليون-030,0 - 037,0جزء من المليون-030,0 - 4 03,0جزء من المليون) على التوالي. والرصاص لم يقدر في جميع العينات. مستويات الكادميوم في مياه الشرب اعلى من المستويات الموصى بها من قبل منظمة الصحة العالمية,بالاضافة الى ان تركيزه في المناطق الزراعية اعلى من السكنية والصناعية وهذا بسبب استخدام الاسمدة الفوسفاتية في هذه المناطق.

Abstract:

The purpose of this study is to analyze drinking water in Khartoum state different location. The Importance of the study is to determine the impact of pollution in the environment at Khartoum state . The samples of water were collected classified for three groups ,according location; residential, Agriculture and industrial area in Khartoum,Bahri and Omdurman and were treated, and analysed using atomic absorption spectroscopy (AAS) and other analytical tools with standard methods for determination of heavy metals ;cadmium and lead. The results of cadmium con-

centration are in Omdurman; residential, agriculture and industrial areas are ,(0. 022 to 0.036 mg l^{-1}, 0.032 to 0.038 mg l^{-1} 0.026 to 0.030 mg l^{-1}). Respectively. In Bahri ;residential, agriculture and industrial areas are (0.027to 0.031 mg l^{-1} ;, 0.034to 0.492 mg l^{-1} , 0.018to 0.035mgl^{-1}in industrial areas) Respectively. In Khartoum; residential, agriculture and industrial areas are (0. 024 to 0.031 mg l^{-1}, 0.030 to 0.037 mg l^{-1} , 0.030 to 0.034 mg l^{-})Respectively. The lead were not indicated in all the samples. The research has revealed that levels of cadmium in Khartoum state are higher than maximum limit levels of World Health organization. In addition, cadmium levels in water at agriculture areas were highest from residential and industrial areas; This is due to the use of phosphate fertilizers in these areas.

Key ward: Agriculture area, residential ,pollution, Who ,phosphate .

Introduction:

Pollution may be defined as addition of undesirable material into the environment as a result of human activities. A pollutants may be defined as a physical, chemical or biological substance unintentionally released into the environment which is directly or indirectly harmful to humans and other living organisms**.** cadmium and lead are very toxic to humans and other organisms ,and their effects can be long-lasting.

Sources of cadmium and lead:

Concentrations of cadmium and lead in rocks are approximately 1.0, 5.0 and 0.5 mg/kg (parts per million). These chemicals are not very soluble and natural concentrations in ground water will be less than 0.5 µg/L (parts per billion). Cadmium and lead

have many anthropogenic sources. It is found in industrial wastes, sewage sludge, mining wastes, and fossil fuel combustion products. Lead found in sewage wastes and in fossil fuel combustion products.

Safe levels of cadmium and lead:

The Minnesota Department of Health (MDH) established a health risk limit (HRL) of 4 µg/L (parts per billion) for cadmium. A HRL is the concentration of a contaminant in water that is safe to ingest daily over a lifetime. The HRL was based on kidney effects in animal studies. Health-based drinking water criteria have not been established for lead. The maximum Contaminant Level of cadmium in water (MCL) of 0.005 milligrams per liter (mg/L) for cadmium in drinking water. No level of lead is considered safe in drinking water, although an action level of 15 µg/L at the tap can be used to identify highly impacted water.

Health effects of cadmium and lead: -

Exposure to cadmium can lead to a variety of adverse health effects including cancer. Acute inhalation exposure (high levels over a short period of time) to cadmium can result in flu-like symptoms (chills, fever, and muscle pain) and can damage the lungs. Chronic exposure (low level over an extended period of time) can result in kidney, bone and lung disease. Lead affects all organs and functions of the body to varying degrees. The frequency and severity of symptoms among exposed individuals depends upon the amount of exposure.

- Materials and Methods:

-Apparatus :

The concentrations of cadmium and lead were determined in

an air-acetylene flame. Instrumental parameters were optimized in accordance with manufacturer's recommendations. AAS working conditions are givenin Table 1.

-Materials and Methods:

All chemicals used were of analytical-reagent grade. Deionized water was used throughout. Standard (various concentrations) and model solution were prepared by dilution of single element 1000 mg l-1stock
solutions of Lead and Cadmium (Merck).

-Sampling:

Cadmium and lead concentrations were determined from a total of 45 water samples selected from different areas For each area there were taken 15 samples from different locations .

-Sample analysis:

all samples were analyzed for Cd and Pb using atomic absorption spectroscopy (AAS).

-Preparation of stock solution:

-Preparation standard solution of cadmium:

The standard solution of cadmium has concentration 100ppm prepared by dissolved 0.21032 gram of cadmium (II) nitrate tetra hydrate $Cd(NO_3)$ .4H2O in deionizer water and added 5 cm^3 concentrated nitric acid and completed the volume to 100cm^3.

-Preparation standard solution of lead:

The standard solution of lead has concentration 100ppm prepared by dissolved 0.1598 gram of lead(II) nitrate pb(NO3) in deionizer water and added 5 cm^3 concentrated nitric acid and completed the volume to 100cm^3.

-RESULTS AND DISCUSSION

-Results:

Table1:Operating conditions of flame atomic absorption spectrometry

Analised metal	Cd	Pb
Wavelength (nm)	228.8018	217.0005
Flame Length Burner(mm) Flame	100	100
Gas mixture flow (L/h)	Air-Acetylene	Air-Acetylene
	50	65

Table2: concentration of cadmium and lead in Omdurman

location	Sample Number	Concentration of cadmium(mg l^{-1})	Concentration of lead(mg l^{-1})
residential area	A1	0.036	N.D
	A4	0.030	N.D
	A7	0.028	N.D
	A8	0.022	N.D
Agriculture area	A3	0.037	N.D
	A41	0.032	N.D
	A31	0.038	N.D
Industrial area	A10	0.028	N.D
	A2	0.030	N.D
	A9	0.026	N.D

Table3: concentration of cadmium and lead in Bahri

location	Sample Number	Concentration of cadmium(mg l^{-1})	Concentration of lead(mg l^{-1})
Residential area	Br1	0.027	N.D
	Br2	0.029	N.D
	Br3	0.033	N.D
	Br4	0.031	N.D
Agriculture area	Ba1	0.034	N.D
	Ba2	0.037	N.D
	Ba3	0.492	N.D
Industrial area	Bf1	0.018	N.D
	Bf2	0.033	N.D
	Bf3	0.035	N.D

Table4: concentration of cadmium and lead in Khartoum

location	Sample Number	Concentration of cadmium(mg l^{-1})	Concentration of lead(mg l^{-1})
Residential area	Kr1	0.025	N.D
	Kr2	0.029	N.D
	Kr3	0.024	N.D
	Kr4	0.031	N.D
Agriculture area	Ka1	0.030	N.D
	Ka2	0.037	N.D
	Ka3	0.034	N.D
Industrial area	Kf1	0.032	N.D
	Kf2	0.034	N.D
	Kf3	0.030	N.D

Fig 1: concentration of cadmium in water at Residential area for Khartoum state:

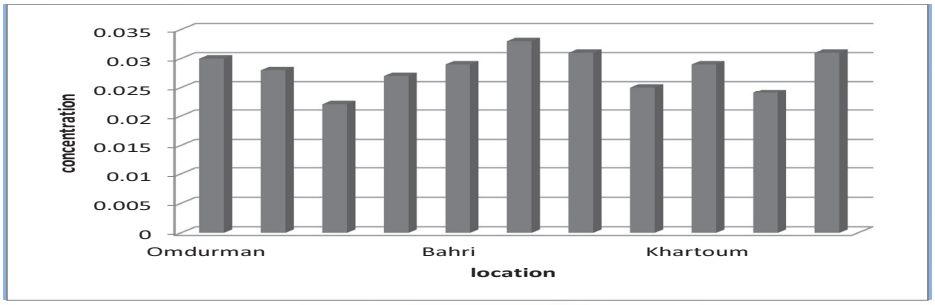


Fig 2: concentration of cadmium in water at Agriculture area for Khartoum state :

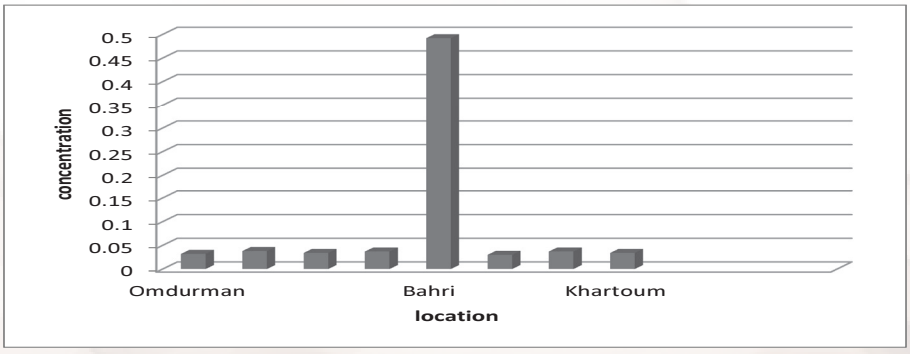
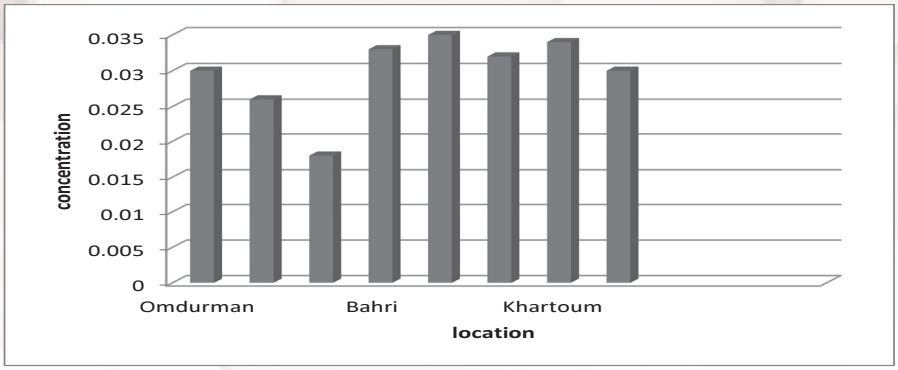


Fig 3: concentration of cadmium in water at Industrial area for Khartoum state :



-DISCUSSION:

Table 2 shows the lead and Cadmium concentrations in Omdurman, cadmium ranged(0. 022 to 0.036 in residential areas , 0.028 to 0.032 in agricultural areas and 0.037 to 0.038 in industrial areas).lead not found

Table 3 shows the lead and Cadmium concentrations in bahri values ranged from(0.018 to 0.492 ; in residential areas , 0.018to 0.027 ,in agricultural areas 0.029to 0.492 and from 0.031to0.034in industrial areas). And lead not found.

Table 4 shows the lead and Cadmium concentrations In Khartoum ,cadmium ranged from 0. 025 to 0.037 in residential areas , 0.025 to 0.032 ,in agricultural areas 0.030 to 0.037 and 0.029 to 0.030 in industrial areas. And lead not found.

From the results in Tables 2 –4, the mean concentrations of lead within World Health Organization (WHO) permissible limits for portable and drinking water.

But cadmium is higher than World Health Organization (WHO) permissible limits for portable and drinking water. And the values in agriculture areas are highest than residential and industrial areas. This is due to use phosphate fertilizers in these areas.

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