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Distribution of Heavy metals in Sediments of North Zone of Basrah Governate

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Abstract

The determination of heavy metals (Cu, Cd, Co, Mn and Ni) in 4 locations of sediments of north zone Basrah were achieved by means of Atomic Absorption spectroscopy were determined in sediments samples . The results showed that the higher concentrations of Cu were (14.42 µg/gm)at station (4), Cd (19.596 µg /gm) at Station (1) , Co (24.309 µg/gm) at station (2) , Mn(111.577 µg/gm) at station (1) , and Ni (207.319µg/gm) at station (2) . The sediment pollution with heavy metals thought to be due to different sources such as urban wastes , industrial of different sources such as urban wastes , industrial effluents , land washout and boats activates.

1- Introduction

Heavy metal pollution in air, water, soil and plant systems is one of the major environmental concern on a world scale with the rapid development of the industry (Waqar Ashraf, 2006).

In natural aquatic ecosystems, metals occur in low concentrations normally at the nanogram to microgram per litre level. In recent times, however, the occurrence of metal contaminants' especially the heavy metals in excess of natural loads, has become a problem of increasing concern. This situation has arisen as a result of the rapid growth of population, increased urbanisation, expansion of industrial activities, exploration and exploitation of natural resources, extension of irrigation and other modern agricultural practices as well as the lack of environmental regulations (Barsytelovejoy, 1999).

Unlike other pollutants e.g. petroleum hydrocarbons and litter which may visibly build up in the environment, trace metals may accumulate, unnoticed, to toxic levels. Thus problems associated with trace metal contamination were first highlighted in the industrially advanced countries because of their larger industrial discharges and especially by incidents of mercury and cadmium pollution in Sweden and Japan (Anazaw *et al.*, 2004).

In spite of the relatively low level of industrial activity in less developed regions such as Africa, there is nevertheless growing awareness of the need for rational management of aquatic resources including control of waste discharges into the environment. This becomes even more important in view of the expected increases in industrial and urban activities in all parts of the continent.

Beside their natural occurrence , heavy metals may enter the ecological system through anthropogenic activities ,such as , sewage sludge disposal, application of pesticides and inorganic fertilizers as well as atmospheric deposition (Ali and Abdel-Satar , 2005) .Contamination with heavy metals may have ecological balance if the diversity aquatic environment and the aquatic organism becomes limited with extent of contamination, sediments are important sinks for various pollutants like pesticides and heavy metals and play a significant role in the remobilization of contaminants in aquatic system under favourable conditions and in interactions between water and sediments (Voigt, 1999).

The direct transfer of chemicals from sediment organisms is now considered to be a major species (Zauke , *et al* ., 1994).

The main natural source of heavy metals in water, is weathering of minerals (Klavins *et al*, 2000). Industrial effluents and non point pollution sources, as well as changes in atmospheric precipitation, all these can lead to local increase in heavy metal concentrations in waters. Total heavy metals concentrations in aquatic components can be a mirror the present pollution status of these areas (Haiyan and Stuanes , 2003) . The main objective of this study is to determine the concentrations of some heavy metals (Cu,Cd,Co,Mn and Ni) in the sediments of the river at North Zone of Basrah and the distribution of metals at every station in this important area.

2-Materials and Methods

Sediment samples were collected from North Zone Basrah area during summer2007 Fig (1). Four stations were selected in this area depending on their special features .Surficial sediment samples were obtained by mean of a Van Veen grab sampler .Trace metals analysis was performed on the <63 um fraction of the sediment which has been separated by sieving and grinding .The determination of trace metals in sediment samples was done according to the following procedure described by Sturgeon *et al*., (1982).Concentrated HC1 and HNO3 (1:1) was added to each sample and evaporated to near dryness on the hotplate at 80 °C ,then mixture of concentrated $HClO_4$ and HF (l:1)was added .After heating to near dryness, 20 ml of 0.5N HC1 were added and cooled for 10 minutes The extraction was decanted into 25 ml plastic volumetric flask. This step was repeated twice and all supernatant were combined. Finally the volume of samples were stored for analysis using a Pye-Unicame Atomic Absorption.

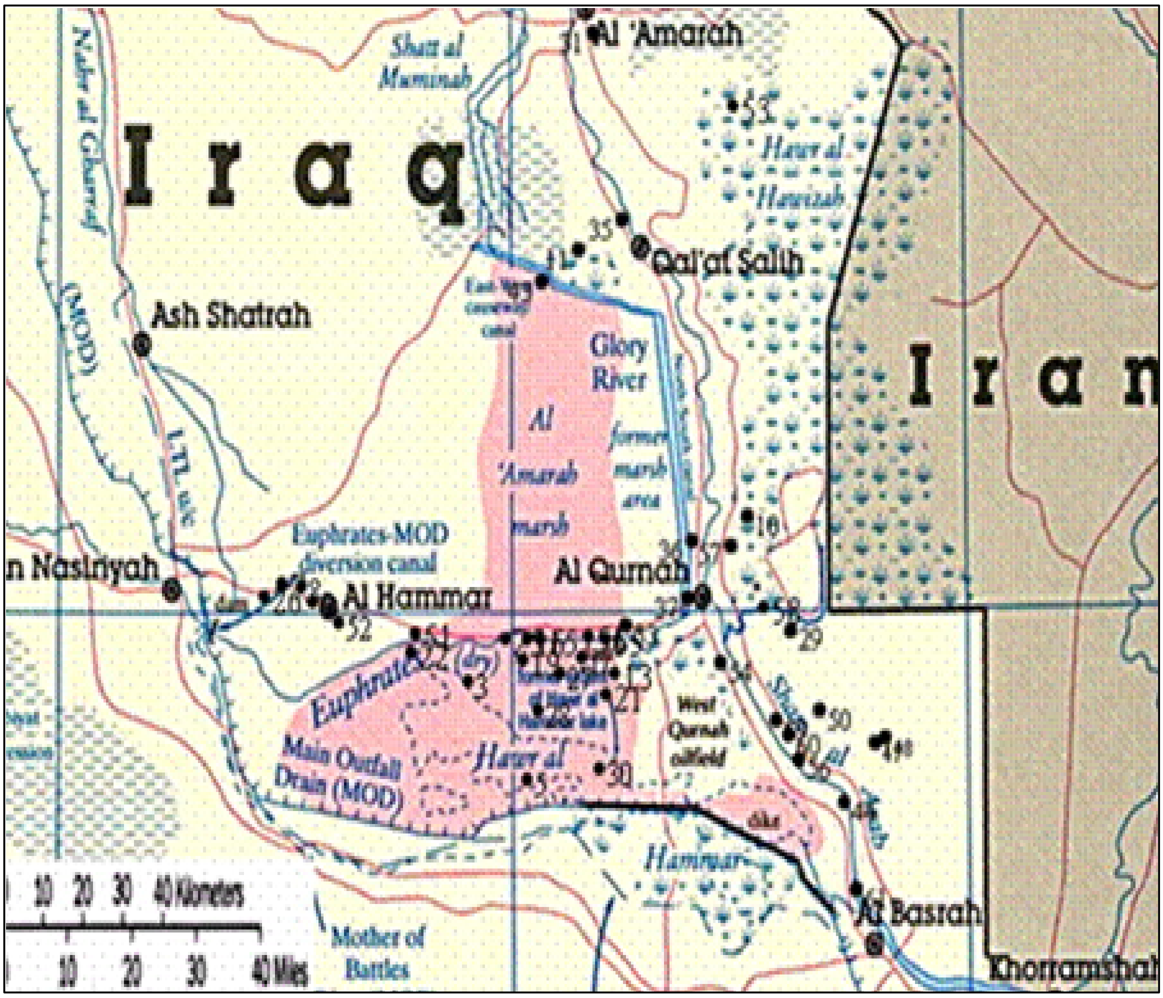

Fig.1. Location map of the study area showing the sampling stations (●)

3- Results and Discussion

Once in the aquatic environment, metals are portioned among the various aquatic environmental compartments (water, suspended solids , sediments and biota). The metals in the aquatic environment may occur in dissolved , particulate and complexed form . Table (1) presents examples of potential sources for metals in the environment. The main processes governing distribution and partition are dilution, advection, dispersion, sedimentation, and adsorption/desorption. Nonetheless, some chemical processes could also occur. Thus speciation under the various soluble forms is regulated by the instability constants of the various complexes and by the physico-chemical properties of the water (Anazawa *et al*, 2004).

Table (1): Industrial and agricultural source for metals in the environment

Use	Metal
Batteries and other	Cd, Hg, Pb, Zn, Mn, Ni
Electrical	Ti, Cd, Hg, Pb, Zn, Mn,Sn, Cr, Al
Pigments and paints	As, Cu, Fe
Alloys and solders	Cd, As, Pb, Zn, Mn,Sn, Ni, Cu
Biocides (pesticides, herbicides, preservation)	As, Hg, Pb, Cu, Sn, Zn, Mn
Catalysts	Ni , Hg, Pb, Cu, Sn
Glass	As, Sn, Mn
Fertilizers	Cd,Hg,Pb,Al,As,Cr, Cu, Mn, Ni,Zn
Plastics	Cd, Sn, Pb
Dental and cosmetics	Sn , Hg
Textile	Cr, Fe, Al
Refineries	Ni, V, Pb, Fe, Mn, Zn
Fuel	Ni, Hg,Cu,Fe,Mn,Pb,Cd

Adsorption could be the first step in the ultimate removal of metals from water. In the course of distribution, permanent or temporary storage of metals takes place in the sediments of both freshwater and marine environments. Microbial activity and redox processes may change the properties of sediments and affect the composition of interstitial water. As a result, iron and manganese oxides may be converted to carbonates or sulphides, leading to a decrease in the adsorption capacity of the sediments. Reworking of the sediments by organisms will also bring sediments to the surface, where a significant fraction of the metal will be released.

Sediments could be used as indicator for trace metal pollution. Moreover, the concentrations of trace metals in sediments are 1000-100000 times higher than their concentrations in overlying water), and their concentrations are effected by a number of factors such as grain size, total organic carbon and carbonate content of the sediments as well as other physical and chemical parameters. The high concentration of trace metals in the sediments of areas close to highly dense cities could be arises from sewage discharge as well as industrial pollution, ship wrecks, oil enrichment and transportation, Table (2) gives the range and the mean concentrations of the metals (Cu,Cd,Co,Mn,and Ni) in sediment samples at the four stations.

The higher concentration of copper (Cu) was(14.42 µg / gm)at station (4) ,and lower concentration was (6.18 µg / gm) at station (1) Cadmium(Cd ,the higher concentration was found (19.596 µg/gm) at station (1) ,while the lower concentration ND was found at station (2) . Table (2) shows that the higher concentration of cobalt (Co) (24.309 µg /gm) can be observe at station (2), whereas the lower concentration (4.861µg/gm) was found at stations (1 and 3), for manganese metal (Mn), the higher concentration, was (111.577 µg /gm)at station (1) ,and lower conc. was (91.652 µg/gm)at stations (3,4) , and for nickel(Ni), the higher cone. Was (207.319 µg/gm) at station (2) , and lower cone. Was (59.234 ug /gm) at stations (1, 3).

Table (2) shows that the concentration of metals at station (1) arranged as follow (Bahattin and Gulsen, 2001):

Mn > Ni> Cd > Cu > Co

Table(2) :Concentration of metals (ug /gm) in sediment samples

Metal	Stations	Range	Mean	+SE	SD
	1	6.079-6.266	6.180	0.077	0.094
Cu	2	8.191-8.314	8.240	0.053	0.065
	3	10.267-10.342	10.300	0.031	0.038
	4	14.380-14.453	14.420	0.030	0.037
	1	19.544-19.618	19.595	0.034	0.042
	2	-------	ND	------	-------
Cd	3	9.720-9.925	9.796	0.092	0.112
	4	19.396-19.740	19.522	0.155	0.190
	1	4.683-4.984	4.861	0.129	0.158
	2	24.094-24.543	24.309	0.184	0.225
Co	3	4.730-4.955	4.861	0.108	0.133
	4	9.596-9.841	9.723	0.100	0.123
	1	111.399-111.764	111.577	0.149	0.183
	2	95.256-95.866	95.637	0.271	0.332
Mn	3	91.412-91.894	91.652	0.197	0.241
	4	91.491-91824	91.652	0.167	0.183
	1	58.614-59.962	59.234	0.556	0.680
	2	207.001-207.940	207.319	0.439	0.538
Ni	3	58.899-59.686	59.234	0.426	0.466
	4	88.706-89.094	88.851	0.173	0.212

Table(3) Comparison of heavy metals conc. (ug/g) sediment of various rivers, seas and oceans

Location	Cu	Cd	Co	Mn	Ni	Refrences
Western part of Lithuania	1.4-3.4	ND	-----	ND	1.0-1.8	BARSYTELOVEJOY(1999)
Tigris river- Tuerky	719.22-728.96	ND	30.78-32.01	ND	63.72-6635	Bahattin and Gulsen (2001)
Southeast Atlantic and Gulf of mexico coast USA	16.0-72.0	0.21-1.2	ND	400.0-614.0	18.0-25.0	HANSON (1997)
North Bohemia Czech Republic	18.1-32.0	0.68-1.89	16.0-21.7	272.0-844.1	41.1-72.2	Kuhn (1996)
Misato villege- Japan	21.9-595	0.45-4.91	-----	301-723	-----	Anazaw *et al.* (2004)
EL-FAYOUM PROVINCE- EGYPT	24.2-50.3	3.3-10.8	-----	301-723	-----	ALI and ABDEL-SATAR (2005)
Khor Al-Zubair	7.565-72.739	------	------	353.77-570.60	34.56-69.13	AL-Saad *et al* (2006)
Marshes of Souther Iraq	16.63-38.3	------	------	408.6-506.3	68.3-90.3	AL-Saad *et al* (2007)
North Zone of Basrah	6.18-14.42	4.861-24.31	9.796-19.595	91.652-111.577	59.234-207.319	Present Study

At station (2) as follow

Ni>Mn>Co>Cu>Cd ,

While at station (3),the arrangement was

Mn > Ni > Cu> Cd> Co ,

And at station (4) was

Mn>Ni>Cd>Cu>Co,

The increased urbanization, expansion of industrial activities, exploration and exploitation of natural resources ,extension of irrigation and other modern agricultural practices as well as other sources(Al-Saad *et al* 2007) Trace metals enter the aquatic environment of southern Iraq from both natural and anthropogenic sources (Al-Saad *et al*. 2006). Natural sources include storm dustfall ,erosion or crustal weathering and and dead decomposition of the biota in water, whereas the anthropogenic sources include sewage wastes, industrial effluent, automobile effluent, petroleum and fertilizer industry effluent .

The concentration of elements at stations (1,2 and 4) result from human activities at area of (A1-Mudina, Al-Qurna and Garmatt Ali) in which biocides used heavily, at station (3), there is an industrial activity (Paper factory) which causes increasing of the concentration. of element as maintained above. Table (3) shows the comparison of heavy metals concentration (μg/g) in sediment of worldwide rivers, seas and oceans to this study.

As a conclusion the sediment has been polluted with heavy metals came from different sources such as urban wastes, industrial effluents, land washout and boats activities.

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توزيع العناصر الثقيلة في رواسب المنطقة الشمالية من محافظة البصرة

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الملخص

تم في هذا البحث تقدير تركيز عدد من العناصر الثقيلة (النحاس ، الكادميوم ، الكوبلت ، المنغنيز والنيكل) في رواسب اطيان منطقة شمال البصرة حيث اخذت نماذج من اربعة محطات في المنطقة ، استخدم جهاز طيف الامتصاص االذري لقياس التراكيز . اظهرت النتائج التي اجريت عام 2007 بان اعلى تركيز للنحاس كان في المحطة (4)(14.42 µg/gm) وللكادميوم كان في المحطة (2) (19.596 µg /gm) وكان اعلى تركيز للكوبلت في المحطة (2) (24.309 µg/gm) وللمنغنيز كان في المحطة (1) (111.577 µg/gm) وللنيكل كان اعلى تركيز في المحطة (2) (207.319µg/gm) ، يعزى سبب التلوث في المنطقة الى الاستخدام الجائر للمبيدات الزراعية والاسمدة الكيمياوية ولوجود بعض المعامل الصناعية ومحطات الكهرباء وكذلك وسائط النقل النهري .
