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Determination of some Heavy Metal in sediments of Tigris River in Nasiriya City, Iraq

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Abstract - Topsoil samples (0–15cm) were collected from the sediments of Tigris River in April,2014.Total concentrations of five heavy metals, Lead (pb) , Nickel (Ni), Palladium (pd), Cobalt(Co) and Bismuth (Bi) were determined using atomic absorption spectrometry in order to assess their contamination levels of the sediments . Four stations were chosen in the Tigris at Nasiriya city. Results showed that the average concentrations of these heavy metals in the sediments were significantly higher than those previous and similar studies. But the study showed no contamination for Co, and Bi, in all stations. Location variations were detected in these metals. The highest conc. of Cd was (38µg/g) and the lowest (15µg/g) were recorded in sta.3,4 respectively, Cu revealed the highest conc. 416 µg/g at sta.3. The lowest (317µg/g) was recorde8d in sta.1.The highest conc. of Fe was encountered in sta.2 (384µg/g) ,while lowest values were recorded from sta.1 was (840 µg/g). Co showed increments in sta.3 (370 µg/g) and the lowest values were recorded in stas.1 was (327µg/g). Similarly, the highest conc. of Bi were recorded sta.2(96 µg/g) and lowest was (84 µg/g)at sta.1. The study showed that pollution with some of this metals compared with global standard request watching period and continue test in regular periods .

Index Terms: Topsoil samples, sediments, Tigris River, metals, Lead (pb) , Nickel (Ni), Palladium (pd), Cobalt(Co) and Bismuth (Bi)

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1 INTRODUCTION:

Water pollution is considered as the most complex problem because of its wide defects and its close relationship to human and its diffusion[1].

Metals that are naturally introduced into the Rivers come primarily from such sources as rock weathering, soil erosion, or the dissolution of water-soluble salts [2]. Naturally occurring metals move through aquatic environments independently of human activities, usually without any detrimental effects. The metals added by human activities have affected the water quality. Some of these metals are essential for proper metabolism in all living organisms yet toxic at high concentrations; other metals currently thought of as non-essential are toxic even at relatively low concentrations. [3] Major sources of toxic metals arising from human activities are domestic and industrial wastewaters and their associated solid wastes.

In the most cases trace element concentrations in bottom sediments indications of water pollution. Soluble fractions of trace elements are, in most aquatic environments, rapidly absorbed either by clay or organic compounds and deposited in sediments or they are caught by plankton and root tissues of aquatic plants. Thus, concentrations of trace elements in selected samples of aquatic compartment reflect either chemical composition of bedrocks or anthropogenic influence[4].

Trace elements which are absorbed and thus immobilized in bottom sediments constitute a potential hazard to water quality and aquatic life as they may be released as a result of physico-chemical changes. These changes are most commonly stimulated by a change in the redox conditions and by microbial activity [5].

Smith and Huyck (1999)[6] described metal mobility under different environmental conditions. Although it is rather difficult to predict trace element mobility in soils and other terrestrial compartments, the authors referred to the capacity of an element to move with fluids after dissolution in surficial environments.

The concentrations of some elements measured in the solution obtained by various techniques from uncontaminated sediments [7], as follows (in µg g^{-1}): Cd, 0.08–5; Fe ,0.08–29; Cu, 0.5–135; Mn, 25; and Zn, 0.1–750.

As instance, In several sediment or in some layers, oxides and hydroxides of Fe and Mn play very important roles in the distribution and behavior of trace elements, and may fix great amounts of some trace metals[8].Cationic species can be relatively easily sorbed onto clay minerals and onto oxy/hydroxides of Fe and Mn, as well as on organic compounds that can highly control its behavior in soils [9].

The present study included determination of five heavy metals cadmium, Iron, copper, zinc and manganese in sediment of the Tigris River which is the most important river and sources of water in the area surrounding of Nasiriya City.

Four sampling sites were selected to represent different region of Tigris River . A stations was chosen along the Tigris River in center at Nasiriya city included in the present survey and their stations are show(Figure 1) .The sampling program carried out through a period September 2011.

2 MATERIALS AND METHODS

Subsurface (0-15cm) water samples have been collected from four stations utilizing the sampling devise recommended by EPA 2004[10]. The samples analysis by using Atomic Absorption methods. Texture of sediment was determinate according to Czaban (2005) [11].Statistical

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analysis was conducted by SPSS program version 11 .

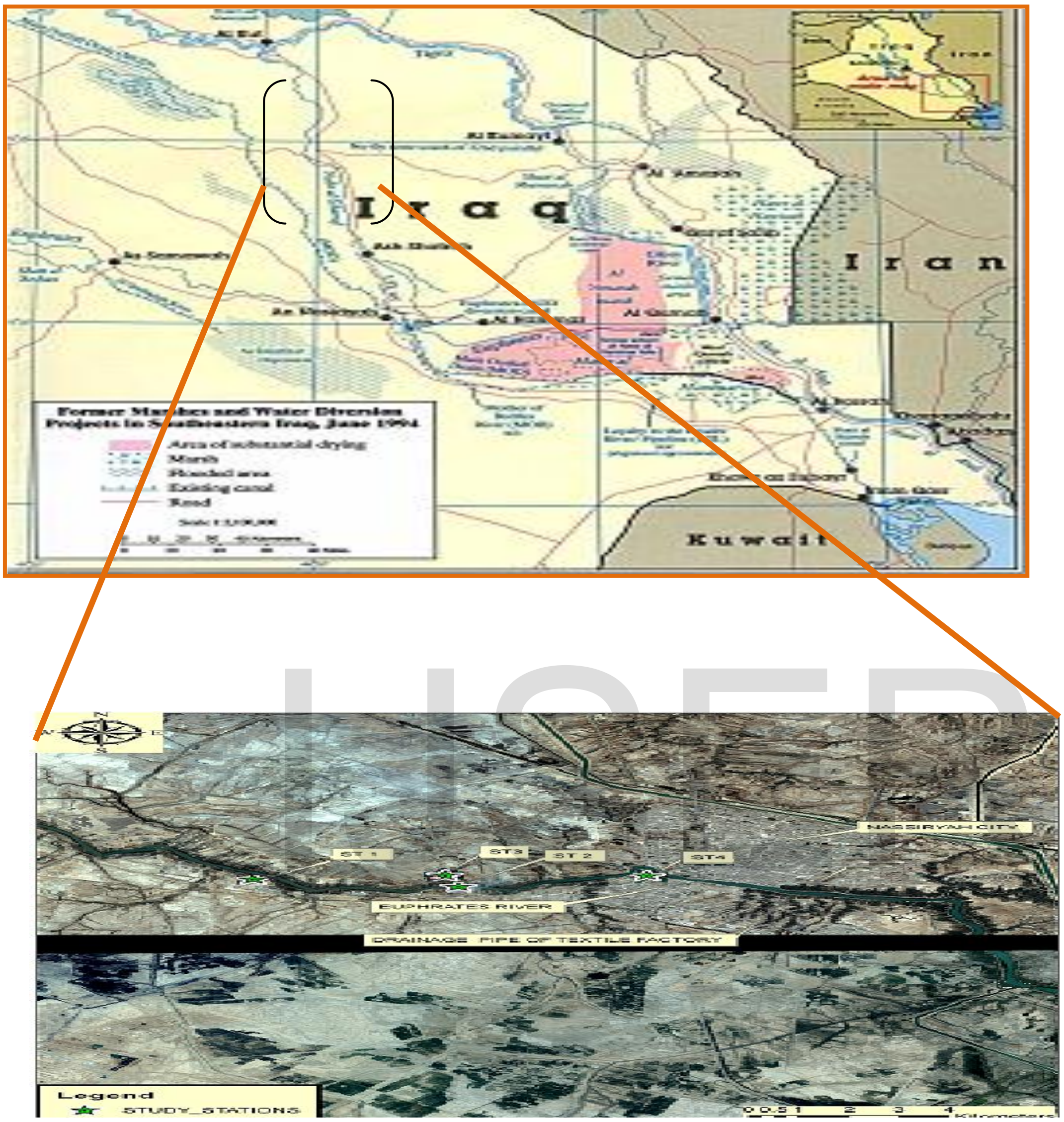

Fig (1) Map of Tigris river showing the sampling stations

be consider as the most significant sources of metals entering Tigris River .

Zinc is easily accumulated in bottom sediments. Its background contents in sediments of rivers are estimated at 110 and 115 mg kg^{-1} for Vistula and Rhein River, respectively. However, in polluted rivers its contents may reach up to 2000 and 14000 mg kg^{-1}, as reported for these two rivers [12];[13].

This metal has quite a low abundance in the Earth's crust and consider form compounds in which their oxidation states are usually not higher than +2. Main Zn sources are related to non ferric metal industry and to agricultural practices. Some fertilizers and in particular

3 Resultes and Discussion

Heavy metals released into the Tigris River by both natural processes and human activities, can be distributed among several different stations within the water environment and the level of metals in Tigris River is listed in table 1.

Our data indicate that the level of **Zn** observed in Tigris River water lie at the range of values reported by EPA standard . The highest conc. of Zn were recorded sta.2(96 μg/g) and lowest was (84 μg/g)at sta. 1.This indicate that Tigris River pollution has possibly discharge and Urban runoff and electricity generation station may copper generally increase in the downriver direction, especially near urban centers. In many areas, sediments of rivers may be sinks for Cu, with little release to the water body. Usually increased concentrations of Cu are observed near sewage outletsthat that's compatible with value of Cu in sta. 3 where lie under effect of sewage of city center . Increased Cu contents in surface layers of bottom sediments are reported as follows (in mg kg^{-1}): India, rivers near the megacity Chenai [19]: 760 –939 Poland, highly industrialized region[20]: 17 –278 Russia, lake[21]: 905 Sweden, lake[22] , up to 2 000 UK, southwest industrialized region[23].

Copper contents in sediments of lakes and rivers of uncontaminated regions are reported to range (in mg kg^{-1}) between: 36 and 74 in Lake Asosca, Nicaragua[24]18 and 39 in Lake Ro, Poland[25] 57 during wet and, karstic river Nahr Ibrahim, Lebanon [26].

The highest concentration of **Cd** was (38µg/g) and the lowest (15µg/g) were recorded in sta.3,4 respectively .During weathering processes, Cd forms simple compounds, such as CdO, $Cd(OH)_2$, $CdCl_2$ and CdF_2 that are easily mobile and follow Zn, especially in sedimentation processes. Marine biota bioaccumulates Cd from sediment and they may act in the biomonitoring of aquatic pollutants[27].

The highest conc. of **Fe** was encountered in sta.2 (384µg/g) , while lowest values were recorded from sta.1 was (840 µg/g). The relationship between Fe contents and some trace metals indicates an impact of soil Fe on the distribution of some trace metals. However, this relationship is significantly high only for Cu,Cd [28].

Statistical analysis of dissolved heavy-metal concentrations measured at locations of the Tigris River during September 2011. Location variations were detected in this metals. We can say the location variations in heavy metals due to these metals are released to the Tigris River from numerous sources. Typical sources are municipal wastewater-treatment plants, manufacturing industries, and rural agricultural cultivation and fertilization

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super phosphate can significantly contribute to Zn levels in water. Zinc may enter into waters from numerous sources including mine industrial and municipal wastes, urban runoff, but the largest input occurs from the erosion of soil particles containing Zn [14].

The elements of Group 7 only **Mn** is essential to living organisms Manganese is one of the most abundant trace elements in the lithosphere. Its common occurrence in rocks ranges from 350 to 2000 mg kg^{-1} and higher concentrations are associated with mafic rocks In some soils, redox potentials have a crucial impact on the behavior of some metals, in particular of Fe and Mn. The reduction of Mn^{3+} to Mn^{2+} by: Fe^{2+}, Cr^{3+}, Co^{2+}, reduced S, phosphate ligands (e.g.,P_2O7^{4-}),phenols, and other easily oxidizing organic compounds[15].

Mn showed increments in sta.3 (370 µg/g). and the lowest values were recorded in stas.1 was (327µg/g). Low level of comparative with other metals due to a few loads transported by suspended sediment than the dissolved loads because Mn is a strongly "hydrophobic" element-that is, it adsorbs on to sediment particles more readily than remaining in solution by a factor of thousands to one.

Salomons and F○rstner[16](1984) reported the content of Mn in sediments of Rhine River at the value of 960 mg kg^{-1}, whereas the highest Mn concentration in sediments of Odra River was 770 mg kg^{-1} [17]. The distribution of Mn in the surface sediments of the Baltic Sea varies from 120 to 2290 mg kg^{-1}, and the highest concentrations, up to 7 260 mg kg^{-1}, are in sediments of gulfs and lagoons [18].As well as Zn, Mn complex compounds of a relatively high stability constant occurring in soils solution are:, $MnSO_4$, $Zn(OH)_2$.

The largest proportion of Fe being inorganic. Cadmium and copper, on the other hand, have much greater levels than Zn, Mn inorganic metals.

Cu revealed the highest conc. 416 µg/g at sta.3. The lowest (317µg/g) was recorded in sta.1. Copper dissolved in the Tigris River comes mostly from industrial and municipal wastewaters. Concentrations of dissolved

Table 1 . Average of Concentration* of heavy metals in studied stations

Stations	Cu	Zn	Mn	Fe	Cd
1	317	84	327	420	22
2	386	96	330	884	28
3	416	89	370	680	38
4	390	94	365	634	15
Average	377.25	90.75	348	570.5	25.75
EPA10 Standard	110-16	820-120	1100-460	400-200	10-0.6

*Units by ug \ g

Table 2 . Average of Soil isolated in studied stations

Soil isolated%	St.1	St.2	St.3	St.4
clay	14.5	32	28	27
Silt	42.2	24.8	24.8	35.2
Sand	43.2	43.2	47.2	37.8

Table 3: Statically Analysis of Elements at confidence limit 95%

Elements	Station1	Station2	Station3	Station4
Cadmium (Cd)	A 5.77 ± 32.2	AB 7.22 ± 31.03	C 8.3 ± 29.6	BC 7.61 ± 30.65
Copper (Cu)	A 5.84 ± 22.95	B 5.31 ± 21.3	AB 5.82 ± 2201	B 5.89 ± 21.7
Manganese(Mn)	A 2.43± 17.68	B 2.85 ± 15.64	A 4.73 ± 17.38	C 3.30 ± 14.48
Iron (Fe)	A 0.87 ± 8.20	A 0.78 ± 8.15	A 0.87 ± 8.06	A 0.89 ± 8.07
Zinc (Zn)	A 140.10 ± 662.5	A 159.61 ± 663	A 135.55± 662.5	A 150.23 ± 676.0

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