Volume : 6 | Issue : 3 | March - 2017 ISSN - 2250-1991 | IF : 5.761 | IC Value : 79.96

Original Research Paper Education

Estimation of heavy metals in Sediment of Euphrates river in Nassiriyah City / Iraq

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ABSTRACT

The study was conducted on March 2016 in the seven locations on the Euphrates river. The seven locations were fixed to achieve the study on the map of Nasiriyah to study the concentration of six trace metals (cadmium, lead, nickel, copper, zinc and manganese) and were measured in the sediment phases. The results showed that the main heavy metal in sediment to cadmium were (1.03, 0.978, 1.99, 4.79, 5.0, 3.2 and 2.98) mg/L. Also, the concentration of lead at sediment was (41.75 , 28.93 , 29.31 , 25.1 , 29.44 , 30.9 and 34.8) mg/L. Moreover, the concentration of nickel at sediment were (21.92, 23.98, 31.72, 15.93, 20.01, 22.8 and 23.9) mg/L for the locations 1 , 2 , 3 , 4 , 5 , 6 and 7 respectively.

Finally, the concentrations of manganese at sediment were (21.92, 23.98, 31.72, 15.93, 20.01, 22.8 and 23.9) mg/L to the locations 1 , 2 , 3 , 4 , 5 , 6 and 7 respectively. There was a significant differencebetween all heavy metals to all locations and for each heavy metal between different locations. The result showed that the total of organic carbon ranged between (0.456 – 1.14) % in the locations of study. The lowest content was recorded in location (7) and highest content wasrecorded on location (3). The total organic matter were ranged between (0.786 – 1.96) % of all study locations.The lowest content was recorded on location (7) and the highest content was recorded on location (3). The values of electric conductivity (EC) were ranged between (3.83 – 12.8) d/m. The lowest content was recorded onlocation (4) and the highest content was recorded in location (1).The values of PH were ranged between (7.65 – 7.81).The lowest content was recorded in location (6) and the highest content was recorded in location (4).The texture of sediment to seven locations were range sandy loam to locations 1 , 2 , 3 , 5 , 6 and 7 and loamy sand to location (4). The percentage of moisture of sediment were ranged between (1.004 – 1.013)% . The cadmium element at (4, 5 and 6) locations were recorded high content and more than standard limiting world (WHO) compared with other locations.

KEYWORDS Heavy metals , Euphrates river , Nassiriyah , Iraq .

Introduction

The Euphrates river is one of the main rivers that passes from northern Iraq to the south with the distances are very long and measures with thousands of kilometers.This river is the oldest using for irrigation agricultural land in Iraq.This river has many pollutants with water and sediment by many pollution like (industrial and agricultural). (Al-kinany , 2015)

Water pollution is defined as an added material and energy by human to the aquatic environment so as to be sufficient to cause damage to human health or the living resources and ecosystem or between them. (Thurman and Webber , 1984).

These pollutants divided in to two groups some of this is biological degradation by some microbes and others does not analysis, all these pollutions cause dangers for fish , plants and human health. (Kassim and Ali , 1989)

The sources of pollutions to this rivers are divided to three groups (Fairbridge , 1972)

1- Physical pollutants contains (wind , storms , earth quakes , volcanoes and natural sources).
2- chemical pollutants and divided in to two groups
a- Organic pollutants like sewage , fertilizer , insecticides and industrial waste.
b- Inorganic pollutants are including inorganic acids and heavy metals.
3- Biological pollutants are including bacteria , virus , fungi , actinomyces and alage.

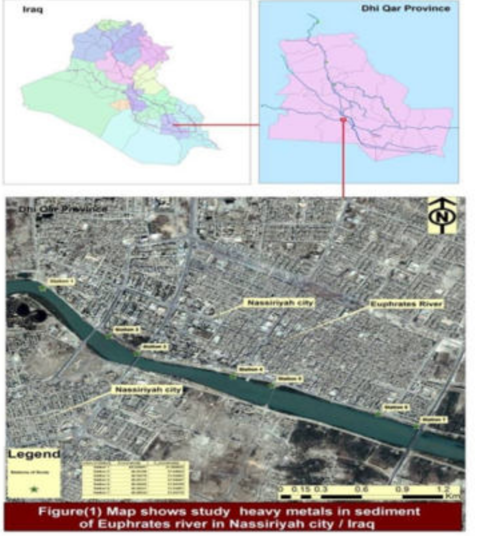
All these pollutants cause accumulation heavy metals in sediment of river for long years that come from the dust , industrial , agriculture materials , remnant of car exhaust and waste water. (Islam and Amara , 2006)

Some of heavy metals are very toxity to human and cause pathological changes like Cd , Hg , Pb , Al and As . and trace heavy metals have essential rolefor human like Co , Mo , Cu and Mn .and the heavy metal is essential for normal growth like Zn , Fe and iodine . (Alcock , 2003 ; Insel *et al* , 2003)

So these reasons we look for on heavy metal in sediment Euphrates river and amounts of these heavy metals in the sediment of Euphrates river for 50 years and depth 2.5 m and for distances 10 meter beside the river.

Materials and Methods

Sediment samples were collected from seven stations on the Euphrates river to three replications for each stations to study the properties of chemical, physical and heavy metals of sediment (Map 1).



Figure(1) Map shows study heavy metals in sediment of Euphrates river in Nassiriyah city / Iraq

The samples were brought to the laboratory then Sediment samples were dried in an oven at 50°C for overnight. Finally grinding in an agate mortar and sieved through 63 μm mesh sieve. Trace metals were performed on 63 μm fractions of the sediment. The digestion occurred by adding 10 ml (mixture 4ml HCl and 1.5ml HNO3) to each sample which evaporated until almost dry on the hot plateat 80°c, and then a mixture of concentrated HClO4 and HF (1:1). Finally the samples are transferred to 25 ml volumetric flask and served at room temperature. The volume is completed up to 50 ml by adding deionized water. All samples were stored in a cool place at 4°c with plastic bottles. The trace metals were determined by using FAAS (M.S.C) as recommended by (Kamal et al , 2004).

Measurement of physical and chemical properties of soil:

soil hydrogen ion concentration (pH)

It was measured by using a digital portable multi meter model Hanna PH 21 .

Determination of total organic carbon (TOC %)

The TOC % content in sediment was measured according to (ICARDA, 1996). The samples are dried in the oven at 110°C for three hours to remove the moisture and get on stable weight and the grinded. After that, one gm of sediment sample was taken to be oxidated with chromic acids.

The organic carbon content can be determined by back titration of excess chromic acids with ferrous ammonium sulphate by using diphenylamine as an indicator. Then, it applied the following calculating processes:

$\% TOC = (N_1 V_1 - N_2 V_2) \times 0.003 \times 100 \times 1.19 / \text{Weight of soil}$

$\% O.M = \% TOC \times 1.724$

Where the V_2 = Volumeof ferrous ammonium sulphate required for the sample.

N_2 = Normality of ferrous ammonium sulphate.

0.003 = meq. weight of carbon.

V_1 = Volume of potassium dichromate.

N_1 = Normality of potassium dichromate.

W = weight of sediment sample.

1.19 = Constant

Soil moisture Percentage :

It was measured by a weighting method according to (Page et al ,1982)

Electrical conductivity:

It was measured by EC. Meter model Hanna EC (2014) according to (Black, 1965)

Sediment texture:

It was measured by the hydrometer method describing by (Black , 1965)

Statistical analysis :

The data of the study were used to analyze the variance, T test, mean, standard deviation and correlation coefficient to find the significance among the stations and months of the study by using SPSS Statistical program version 7. Data has been analyzed by using a statistical analysis system (SAS - 2004).

Result and discussion

Table (2) expands effect different locations of sediment samples fromthe bottom of Euphrates river for founding and accumulation Cd in the sediments.

The location 4 , 5 and 6 recorded a signification difference p∝ 0.05 with the other locations and with (WHO) standard for sediment and were 4.79 , 5.0 and 3.2 mg/L respectively. The three locations 4 , 5 and 6 were difference significant p ∝0.05 compounds with locations 1 ,2 and 3 but the location 1 was not different significantly with location 7. This different many locations cause by near and far sources of Cd like oil and fuel on wastewater because of human density near locations, and the industrial activity (Al-Khafaji,2005 b). The results of different heavy metals were similar to the results of (Al-Khafaji, 2005 b) and (Al-kinany , 2015), with sediment of Euphrates river in southern of Iraq.

(Al-kinany , 2015) explaines that the reasons for the difference are due to human activity , population density , industrial waste, agricultural waste and sewage according to theProximity and beyond from the studied site.

Table (2) indicated that there was a significant difference for lead p ∝0.05 between the different locations with themselves, were 41.75 , 28.93 , 29.31 , 25.1 , 29.44 , 30.9 and 34.8 mg/L to the locations 1 , 2 , 3 , 4 , 5 , 6 and 7 respectively because difference of lead sources that caused the difference between locations to values . All locations were not reaching to the levels of lead to the standard (WHO) in the world.The first location get a significantly different among the other locations because of high human density to this location and other because near drainages and swage carrying pollutions to the river.The pollutions recorded to the location that's near to this location (Al-Khafaji, 2005 b) and (Ezerone and Ubalua ,2005). The Values of Ni for seven locations were 21.92 ,23.7,17.39, 19.7, 18.39 ,20.99 and 20.0 mg/L to 1,2,3,4,5,6 and 7 respectively. The Values of Ni were different significant between themselves p∝ 0.05.

The Locations 1 ,2 and 6 of sediment caused a significant difference P∝ 0.05 compared with locations 3,4,5 and 7.

The reason of polluting with Ni element to all location depended on high activity human's density, wastewater, and near by location from drainages (Neghamish et al, 2008).

All results ofNi in all locations did not reach to standard limiting ofthe world (WHO).

The cupper recorded a significantly different between the locations 1,2,3,4,5,6 and 7 and were 10.95, 18.64, 48.73, 36.46, 37.9, 32.98 , 22.4 mg/L respectively.

The location 3 recorded the highest values, but the location 1 recorded the lowest values. All values of locations did not reach to world standard limiting (WHO) for soils and sediments. The reasons of distribution Cu with sediment back to the concentrations of Cu were a signification different p∝ 0.05 among them because of different copper sources that reached into river water like wastewater, industrial water and human activities (Al-Khafaji,2005 b).

Table (2) explained distributions of the Zn element with all locations 1,2,3,4,5,6 and 7 and were 31.75, 27.44, 54.81 , 80.1, 75.4,69.39, 35.91 mg/L respectively.

All values of an element did not reach to world standard limiting (WHO), but they were a significant difference between the locations p∝ 0.05.

The Manganese values of the seven locations were 21.92 ,23.98, 31.72, 15.93, 20.01, 22.8, 23.9 mg/L respectively. These values did not reach to world standard limiting with (WHO) ofMn and the highest value appeared to with a location (3) but the lowest value ofMn element was in location 4.The results to all heavy metals did not reach to world standard limiting (WHO) except Cd element with locations 4, 5 and 6 were significant difference p ∝0.05 for the locations to all elements

The values of Mn and Zn were different with themselves because of the difference of pollution sources like drainages, wastewater and human's activities beside the river. All concentrations of Zn and Mn get less limiting with (WHO) (Al-kinany , 2015).

The increasing and decreasing of heavy elements in the water came back to dilution of factor water or result for changing with bio activities to some microorganism. That effected by many factors like (nutrition, respiration and long lighting).

Some of changes of heavy metals in the water at some seasons to take the pollution by biological factors in the locations or to ability of these elements to accumulation inter bodies of organisms adsorption by some materials in the water and sediment of these elements in the bottom of river (AL-Hayali, 2001).

No of location	PH	Ec ds/m	TOC %	O.M %	Moisture %	Sand %	Clay %	Silt %	Texture
1	7.75	12.80	0.684	1.17	1.013	62.4	15.1	22.5	Sandy loam
2	7.65	11.00	0.85	1.8	1.010	63.7	13.8	22.5	Sandy loam
3	7.80	10.06	1.14	1.96	1.011	67.2	12.6	20.2	Sandy loam
4	7.81	3.83	1.026	1.76	1.004	82.5	10.0	7.5	Loamy sand
5	7.70	6.70	0.912	1.57	1.0098	67.2	15.4	17.4	Sandy loam
6	7.65	6.30	0.684	1.17	1.0085	72.3	10.4	17.3	Sandy loam
7	7.66	6.32	0.456	0.786	1.0083	77.1	10.8	12.1	Sandy loam

Table (1) explains physical and chemical of sediment in Euphrates river

No. of location	Cd	Pb	Ni	Cu	Zn	Mn
Loc.1	**1.03 d**	**41.75 a**	**21.92 ab**	**10.95 h**	**31.75 f**	**21.92 d**
Loc.2	**0.978 d**	**28.93 f**	**23.71 a**	**18.64 f**	**27.44 g**	**23.98 b**
Loc.3	**1.99 c**	**29.31 e**	**17.39 c**	**48.73 a**	**54.81 d**	**31.72 a**
Loc.4	**4.79 a**	**25.1 g**	**19.7 bc**	**36.46 c**	**80.1 a**	**15.93 f**
Loc.5	**5.0 a**	**29.44 a**	**18.39 bc**	**37.9 b**	**75.4 b**	**20.01 e**
Loc.6	**3.2 b**	**30.9 c**	**20.99 ab**	**32.98 d**	**69.39 c**	**22.8 c**
Loc.7	**2.98 b**	**34.8 b**	**20.0 bc**	**22.4 e**	**35.91 e**	**23.9 b**
Who standard of sediment	**3**	**100**	**50**	**100**	**300**	**2000**
R.L.S.D 0.05	**0.59**	**0.081**	**3.4**	**0.23**	**0.34**	**0.5**

Table (2) explains concentrations of heavy metals in sediment in Euphrates river at Nasiriyah city.

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