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Concentration of some Heavy Elements in Water , Sediment and Plants in Al-Gharraf River in Thi-Qar Province –South of Iraq

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***Abstract*: The present study was included to estimate the Concentration and distribution of selected Heavy elements Cadmium, Lead, Nickel and Zinc from water, sediment and two species of plant (Phragmites australis and Ceratophyllim demersum). Also same physical characteristic of this river in water , samples were collected of three stations in Al-Gharraf River in order to investigates the possibility of pollution in this area with these elements .three station (Al-Fajr districts , Qal'at Sukkar districts and Al-Rifa'I districts) were chosen to execute this study during the period from May 2018 until February 2019. And the high temperature was recorded (13 °C in winter to 30 °C in summer), pH (7.44 to 7.8) and Turbidity (2.41 to 10.2)NTU. and salinity (0.01 to 0.069) ppt. Also all the heavy metals recorded a significant increase in water and Ceratophyllin demersum plant samples in the winter higher than summer and in the sediments and Phragmites australis plant the rise in the winter was only in the elements nickel and zinc, but in cadmium and lead were concentration low or do not make a big difference in the winter compared to the summer , Where the highest percentage of nickel and zinc in the sediments in the second and third stations respectively reached 86.2 mg / kg dry weight . The lowest concentration of cadmium concentration in water samples at the first station for the summer was 0.0021 mg / L . Where there is a positive relationship between the increase in concentrations of heavy metals in the samples studied and increase in the amount of rain , speed of runoff and the rise in water level in the river in winter due to the volume of rising smoke as a result of pollution which descends during the rainfall and erosion of the edges of the river and lack of control over the domestic sewage that has been brought into the river . As well as probable cause to exist Al-Gharraf oil field that newly established and located north of Fajr city, was considered a control station and opposite to the Qal'at Sukkar city and south of Al-Rifai city we can be observed through the results which show a gradual rise in the second and third stations and third station was higher than stations 1 and 2.**

Keywords Heavy metals , Water , Sediment , Phragmites australis , Ceratophyllin demersum , Al-Gharraf River and Al- Gharraf oil field

I. INTRODUCTION

Generally, the human environment is defined as a biosphere that includes the land cover, atmosphere ,water and many types of organisms.The biosphere is large and complex, but it is divided to many units per to the relation between living beings and arranges environment such as earth, water, and air (FAO, 1994).

Pollution is defined as any change (sudden or gradual) in environment and its compostions from the side the chemical, physical and bioproperties (Irabii, 2001) . The main subject of pollutants in river water is suspended solids, heavy metals, oils and greases, oxygen requirement and organic compound (UNEP, 2003).

The healthy aquatic environment have a balance of plant and animal life represented by great species diversity. Pollution creates a disturbance in this balance, resulting in a reduction in the variety of individuals and dominance of the The remaining living organisms alive (Viessman et al., 1985).

Over the past decade, although there has been an increasing attention to persistent organic Pollutants and greenhouse gases resulting from fuel combustion and global warming, toxic heavy metals in the aquatic environment remains an enduring risk. Continued flow of metals into the water by industrial activities, domestic practices and mining have ensured that the levels of Pollutants continue to be a problem Anthropogenic emissions of heavy metals exceed the fluxes from natural sources (Nriagu, 1990).

The investigation of the existence and concentration of heavy metals in water, sediment and aquatic plants is fundamental to the study of the water pollution by these types of pollutants (Al-Khafaji, 2001).

Heavy metals are dangerous pollutants of aquatic environment because of their persistence , toxicity in low concentration and their abilty to inserted in to food chains and fixed by aquatic organisms such as fish (Fahmey, 1981).Heavy metals appear in the aquatic environment naturally and in trace concentrations and varied according to

type of sediment (Evans, 1994) .These metals have strong affinities for sediment, so sediment can serve as an marker of time history and extension of pollutant inflow in a specific locale (Al-Khafaji, 1996).

II. AIM OF STUDY

Because of there is no any Comprehensive study about the present study area . so the present study deal with measurement of four heavy elements (Cd , Pb , Ni and Zn) in water ,sediments and plants in Al-Garraf river near oil field to use the result of the present study as a baseline to compare with result of the future studies in this field .

A. Study Area

Three areas were Selected on Al- Gharraf River to execution the current study as in Fig (1)

To determine the probability of pollution of the area by Heavy metals (HMs), and the problem of pollution spread result of human activity because of the presence of Al-Gharraf oil field was selected part of the Al- Gharraf river Which extends from Al-Fajr city through Qalat Sukkar city and up to Al- Rifai district Where this area is located near this oil field where is distance about 10 km north of the Al-Rifai district and this area has been divided into three section :

Station (1) : North at the Al- Fajr district and Selected is a control station, which is far from the oil field area 23 km.

Station (2): At the Qalqat Sukkar city, which is located along to the oil field.

Station (3): In the Al- Rifai district south of the Al- Gharraf oil field , which is distance about 10 km from the oil field.

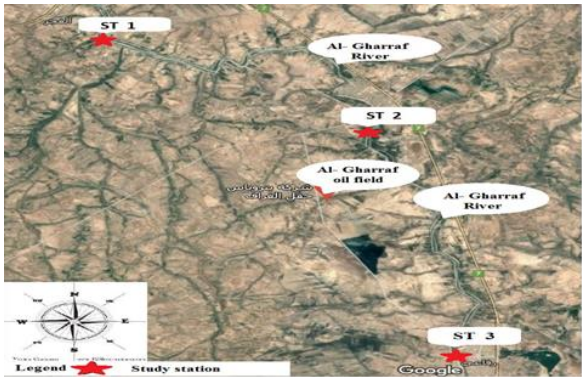

Fig (1):- Three stations on Al- Gharraf River

B. *Samples Collection*

1- Water samples were collected from three stations in a region in the summer of 2018 and in the winter of 2019 from the center of the river and at a depth of approximately 30 cm below the water surface, from the first station to the third station, The samples were collected using plastic bottles (Polyethylene) , 5 liters per sample, three random replicates at each station for physical analysis, and heavy metal tests , Adding a few drops of concentrated nitric acid equivalent to 2 ml per liter of the sample as a stabilizer for the conservation of heavy metals in water, the samples were examined for each season .

2- Samples of sediment were collected by using the Van Veen Grab Sampler sediment from the center of the river and stored in nylon bags marked in a cooled box (IMRP, 2006) .

3- Samples of aquatic plants were collected by hand after being washed in river water to get rid of the suspended materials and were kept in plastic bags until they reached the laboratory.

C. Methods of extraction:

- Extract Heavy metals from water

Heavy metals were extracted from the water by following way (Riley and Talyor, 1968)

- Extract Heavy metals from sediment

Heavy metals were extracted from the sediment by following way (Yi et al., 2007)

- Extract Heavy metals from from Phragmites australis and Ceratophyllin demersum :

Heavy metals were extracted in plants depending on the method (Barman et al., 2000)

III. RESULTS AND DISCUSSION

A. *Heavy Metals in Water Samples*

The analysis of heavy metals the samples show a gradual increase starting from the first station in Al-Fajr district and passing through the second station at Qal'at Sukkar district which is adjacent to Al-Gharraf oil field and ending with the third station in Al-Rifa'I district which lies south of the oil field and in both seasons (summer 2018 and winter 2019) apparently in table (1). Water is exposed to a lot of sources of pollution, including industrial designs resulting from various industries such as oil refineries and gas associated with oil extraction, paper industry, fertilizers, spinning, weaving, rubber and petrochemical industries (Irshad *et al.*, 1997). In 2004, Aziz explained that the sources of TPH and heavy metals in the aquatic environment are due to the heavy sewage discharged into the river without treatment (Aziz, 2004).

We also note in table (1) that show concentrations in the winter of 2019 are higher than those recorded in the summer

of 2018 , the waste from cities or agricultural land and It is considered from sources that are difficult to treat Most of them reach to rivers through Rainfall or melting of snow (Talal, 2008).

Table (1) :-The concentration of heavy metals in water samples from Al- Gharraf river during the seasons summer 2018 - winter 2019 (µg / L)

	Stations 1		Stations 2		Stations 3	
metals	Concentrations in summer 2018 (µg / L)	Concentrations winter 2019 (µg / L)	Concentrations in summer 2018 (µg / L)	Concentrations winter 2019 (µg / L)	Concentrations in summer 2018 (µg / L)	Concentrations winter 2019 (µg / L)
Cd	0.0021	0.0052	0.0037	0.0058	0.0091	0.0067
Pb	8.0	8.4	9.87	9.8	14.8	10.7
Ni	4.0	6.36	4.2	7.43	5.3	7.92
Zn	22.3	42.8	27.5	51.4	35.4	77.8

B. Heavy Metals in Sediment Samples

In the sediments, the concentrations were also gradually increasing from the first station through the second station and ending with the third station apparently in table (2) and this situation is similar to that in water samples seasons (summer 2018 and winter 2019) , except Cd and Ni in the first station is higher than the second station in summer 2018 , when comparing the metals concentrations between the summer 2018 and the winter 2019 we notice a decrease in the concentrations of Cd and Pb in the winter 2019 as opposed to that of Ni and Zn the concentration in winter 2019 higher than in the summer 2018.

Table (2) :-The concentration of heavy metals in Sediment samples from Al- Gharraf river during the seasons summer 2018 - winter 2019 (mg /kgm) D.W

	Station 1		Station 2		Station 3	
metals	Concentrations in summer 2018 (mg /kgm) D.W	Concentrations winter 2019 (µg /g) D.W	Concentrations in summer 2018 mg /kgm) D.W	Concentrations winter 2019 (mg /kgm) D.W	Concentrations in summer 2018 (mg /kgm) D.W	Concentrations winter 2019 (mg /kgm) D.W
Cd	0.021	0.0133	0.019	0.0152	0.022	0.0167
Pb	2.23	2.00	2.54	2.07	3.2	2.13
Ni	61.3	75.9	58.9	86.2	67.4	86.1
Zn	45.4	69.3	48.7	73.9	59.3	86.2

C. *Heavy Metals in plants Samples (Phragmites australis and Ceratophyllin demersum)*

In table (3)and (4) all concentrations of heavy metals in plants showed a gradual increase, as in water, where the lowest concentration of metals was recorded in the first station followed by the second station and the highest concentration was recorded in the third station in both seasons (summer 2018 and winter 2019) , except for Zn, its concentration in the second station was higher than the third station by very small amount . this confirms that the increasing activity in Al-Gharraf oil field of human activities and oil operations have a significant impact in increasing concentrations of heavy metals in the waters of the Al- Gharraf river . Because of the rain water and during the fall and in large quantities during this year has washed all the pollutants on the surface of the soil (heavy metals and hydrocarbons) and carry it to the course of sewage water, and increase the speed of this water inside the Sewage channels led to carry a lot of pollutants from within these channels and throwing it to the river .

Table (3) :-The concentration of heavy metals in Phragmites australis samples from Al- Gharraf river during the seasons summer 2018 - winter 2019 (µg / kgm) D.W

	Station 1		Station 2		Station 3	
metals	Concentrations in summer 2018 (µg /kgm) D.W	Concentrations winter 2019 (µg / kgm) D.W	Concentrations in summer 2018 (µg / kgm) D.W	Concentrations winter 2019 (µg / kgm) D.W	Concentrations in summer 2018 (µg / kgm) D.W	Concentrations winter 2019 (µg / kgm) D.W
Cd	0.057	0.056	0.067	0.062	0.070	0.071
Pb	0.22	0.227	0.31	0.293	0.37	0.299
Ni	0.012	0.228	0.022	0.371	0.022	0.298
Zn	8.92	15.429	9.2	16.921	12.4	15.412

Table (4) :-The concentration of heavy metals in Ceratophyllin demersum samples from Al- Gharraf river during the seasons summer 2018 - winter 2019 (µg / kgm) D.W

	Stations 1		Stations 2		Stations 3	
metals	Concentrations in summer 2018 (µg /kgm) D.W	Concentrations winter 2019 (µg / kgm) D.W	Concentrations in summer 2018 (µg / kgm) D.W	Concentrations winter 2019 (µg / kgm) D.W	Concentrations in summer 2018 (µg / kgm) D.W	Concentrations winter 2019 (µg / kgm) D.W
Cd	0.016	0.175	0.017	0.231	0.019	0.292
Pb	0.073	0.374	0.098	0.429	0.075	0.321
Ni	0.031	0.117	0.079	0.189	0.1	0.167
Zn	5.5	15.47	6.2	19.47	5.98	21.43

You can also observe the high concentrations of zinc in all samples of the study , where the concentration was higher than the concentrations of other metals and this is due to several reasons Plants take heavy metals with Passive Transport (moving from high concentration to low concentration). Examples of negative elements are nickel and lead, while copper, zinc and others actively absorb active transport (Transfer against concentration) (Schnoor and McCutctcheon, 2003; Sahi et al., 2002) .

Concentrations (copper, lead and zinc) were also studied at 29 sites in some of the rivers on an island Fiji Japanese It was found that the increase and distribution of these metals is related to the type of industrial waste produced from the various factories on this island as well as the activities of fishermen (Gangaiya *et al.*, 2001).

D. Physical Characteristics

a.Temperature

In Table (5) we can show the high temperature was recorded in Summer 2018 for Stations 3 in air and

lower temperature in Winter2019 for water in Stations 1and 2

Table (5) Temperature

	Temp . Station 1	Temp . Station 2	Temp . Station 3
Summer 2018 in air	41	40	42
Summer 2018 in water	29	30	28
Winter 2019 in air	14	15	16
Winter2019 water	13	13	14

b.Turbidity

Table (6) record show lower in station 1 , it was 2.41 in Summer 2018 While the highest rate was at station 2 it was 10.2 in Winter 2019

Table (6) Turbidity

	Turbidity in Station 1	Turbidity in Station 2	Turbidity in Station 3
Summer 2018	2.41	2.93	2.74
Winter 2019	9.8	10.2	9.93

c-pH

Table (7) turbidity It was in both seasons (Summer 2018 and Winter 2019) at the station 1 higher than the station 2 and then go back to go up once again at the station 3

Table (7) Turbidity

	pH Station 1	pH Station 2	pH Station 3
Summer 2018	7.46	7.44	7.49
Winter 2019	7.8	7.64	7.71

d-Salinity

Salinity in the winter 2019 was much higher than in the summer 2018 And high Salinity was recorded in station 2 in Winter 2019 it was 0.069

Table (8) Salinity

	Salinity Station 1	Salinity Station 2	Salinity Station 3
Summer 2018	0.011	0.01	0.021
Winter 2019	0.052	0.069	0.066

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