Study the concentrations of Ni, Zn, Cd and Pb in the Tigris River in the city of Baghdad

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Abstract*— *Four heavy metals were selected to estimate their concentrations on the Tigris River in the Baghdad area, the water samples collected from three stations on the river represented the northern, central and southern Baghdad, using apolyethylene bottles of 2-liter for the period from March 2010 until February 2011 and then on a monthly basis.

It observed from the results, that all of the concentrations of heavy metals under the study, were within the permissible limits for the three stations depending on the values of Iraqi Rivers Maintenance Regulation No. 25 of 1967.In many of the recoding data it was within intangible readings because of the low concentration of the heavy metals in the sample.

Keywords*— *Tigris River, Ni, Zn, Cd, Pb, Baghdad.

I. INTRODUCTION

The man tamed himself to be the primary interface of the uses of heavy metals in his life by finding out heavy metals cycle and re-distributed in the environment, where the natural levels of these metals are not harmful to the environment and living organisms. Arising from mining and the use of various chemicals has increased the metals pollution, as well as, the agricultural and industrial sewage and fossil fuel activities give a high level of these metals in the environment (Tulonen, *et al.* 2006).

Human activities recorded clear excesses for most of the heavy metals such as lead, mercury, cadmium and zinc,which have been accumulated in the various structures of the environment (Atici, *et al.* 2008).

Heavy metals are working as received the electrons interact with the donor material for electrons to be varied markedly different chemical compounds, but biochemically the term (heavy) metals used for indicating a certain order of most metals harmful to the environment, and that density is equivalent to 4-5 times more than the density water (Goel, 2008).

The industrial plants are an important source of heavy metals and some of the flow of it disbursed to surface and ground water, especially if the industrial clay as it is an important source of pollution (Teplyakov & Nikanorov, 1994).

II. MATERIALS AND METHODS

Description of studying stations:

Three stations were selected on the River Tigris(Figure 1), these are:

1-North Baghdad (Altaqi region) This station is located near Al-Muthana bridge. The two sides of the station are almost identical. The width of the Tigris River section of this station up to 250 meters long and 4.8 meters in depth (Iraq Water Resources, 2011).

2-Center of Baghdad (Al-Aathamiah region) This station is located near the Iron Sarafiya bridge. The downstream section of this region like U-shaped and the tendency has a sharp and deep toward the right bank(Iraq Water Resources, 2011).

3-South Baghdad (Al-Zaafraniah region).
This station is located at the convergence of the Diyala River withthe Tigris River, a section width of the river is up to 200 meters. Where abundant agricultural areas and are considered a last resort for the discharge of pollutants flowing from the north and center of Baghdad.

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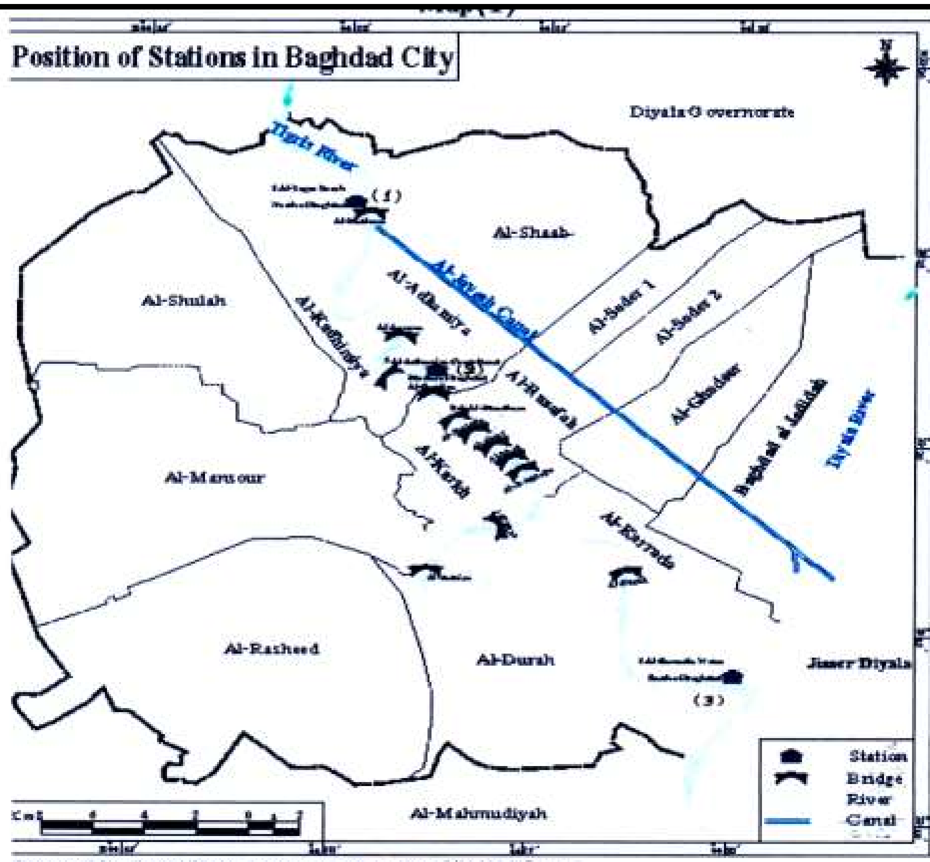

Fig.1: Map of sampling stations (Iraq Water Resources, 2011)
(Source: Ministry of water Resources, Map Scale 1/10000

Sampling collection
Water samples collected from the surface of the water depth (30 cm) for the period from March 2010 until the month of February 2011 and placed in bottles of polyethylene thoroughly washed with river water (2 liter per each station) .

Four heavy metals have been selected which are, Nickel (Ni^{+2}), Znic (Zn^{+2}), Lead (Pb^{+2}) and Cadmium (Cd^{+2}) for the calculating concentrations quantified using Flamless Atomic Absorption Spectrophotometer type Buck, USA),as the most common metals in some industries and perhaps can be inferred in the Tigris River (Al-Saadi,2006), which have been measured in the filtered water river, to estimate the dissolved concentrations of these metals depending on (APHA, 1998).

III. RESULTS AND DISCUSSION

Nickel (Ni^{+2})
The concentration of nickel in three stations were ranged from non-detectable to 0.2 mg / L, with a minimum value recorded of about 0.01 mg / L, which was repeated more than once, as recorded in April 2010 in the stations 1 and 3, and on May 2010 at station (1) in the month of November 2010 at station (2), respectively, while the maximum value was in the month of June 2010 at the station (2) (Table 1) (Figure 2).

Table.1: The minimum and maximum values, mean, SD and analysis of variance for the values of the heavy metals measured in the Tigris River (middle of Baghdad)

	Parameters	Station 1	Station 2	Station 3	Significance
1.	Nickel mg/ℓ	0.01 – 0.17 0.08 ± 0.02**a**	0.01 – 0.2 0.023 ± 0.005**b**	0.01 – 0.04 0.004 ± 0.0002**c**	$P \leq 0.05$
2.	Znic mg/ℓ	0.01 – 0.08 0.045 ± 0.008**a**	0.01 – 0.04 0.017 ± 0.004**b**	0.01 – 0.02 0.022 ± 0.002**b**	$P \leq 0.05$

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3.	Lead mg/ℓ	0.01 – 0.13 0.027 ± 0.009**a**	0.01 – 0.2 0.026 ± 0.005**a**	0.03 – 0.09 0.014 ± 0.001**b**	P ≤ 0.05
4.	Cadmium mg/ℓ	0.01 – 0.19 0.063 ± 0.002**a**	0.01 – 0.07 0.038 ± 0.001**b**	0.01 – 0.03 0.015± 0.005**c**	P ≤ 0.05

Small letters mean no significant differences at the level of probability (P ≤ 0.05)

While significant difference was observed between the three stations at (p≤0.05) between the nickel and cadmium and its value (r=0.964)(Table 2).

Table.2: the correlation coefficient (r) of heavy elements in the studied stations

Mg/L	Ni	Zn	Pb	Cd
Ni	1.0	0.964	-0.219	0.476
Zn		1.0	-0.416	0.167
Pb			1.0	0.091
Cd				1.0

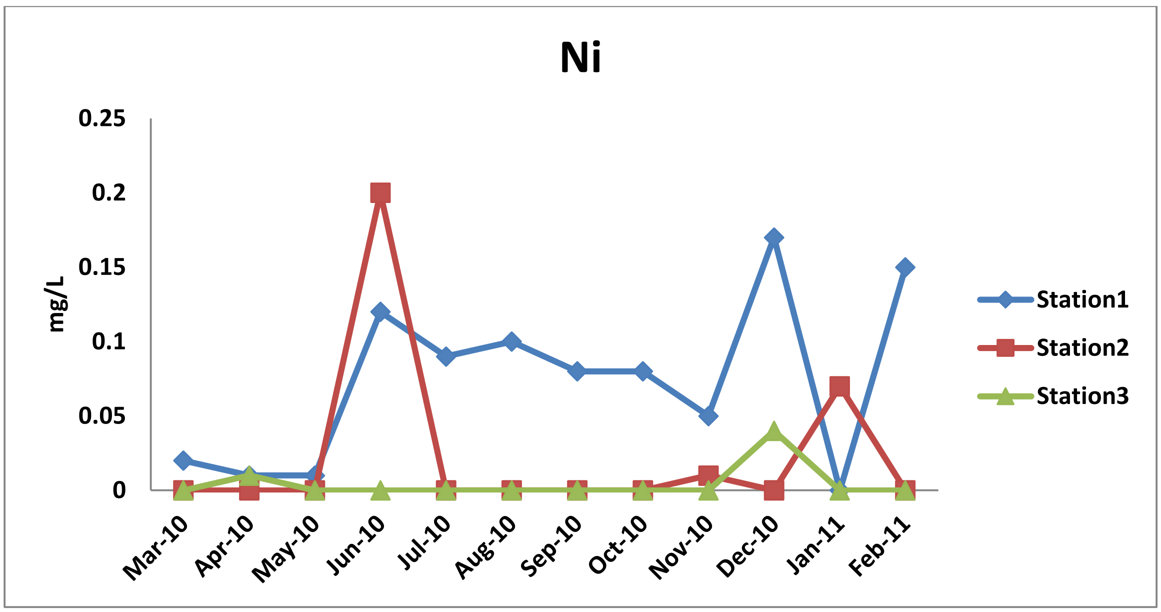

Fig.2: Nickel concentration in the study stations from March 2010 to February 2011.

Zinc (Zn^{+2})

The results showed that the concentration values of zinc ranged from non-detectable to 0.08 mg / L. But adopted the 0.01 mg / L as the value of a minimum which have been repeated more than once, It was in March 2010 at the station (1) In each of April, May, September and October 2010 at the station (2) as well as in June 2010 at a station (3).

While the maximum value recorded in the month of February 2011 at a station (1), also it found a significant difference at the level of probability (p≤0.05) between the study stations, as shown in Figure 3 and Table 1.Statistically, there is a negative correlation (p≤0.05) between the zinc and lead reached (r = -0.416), as in Table 2.

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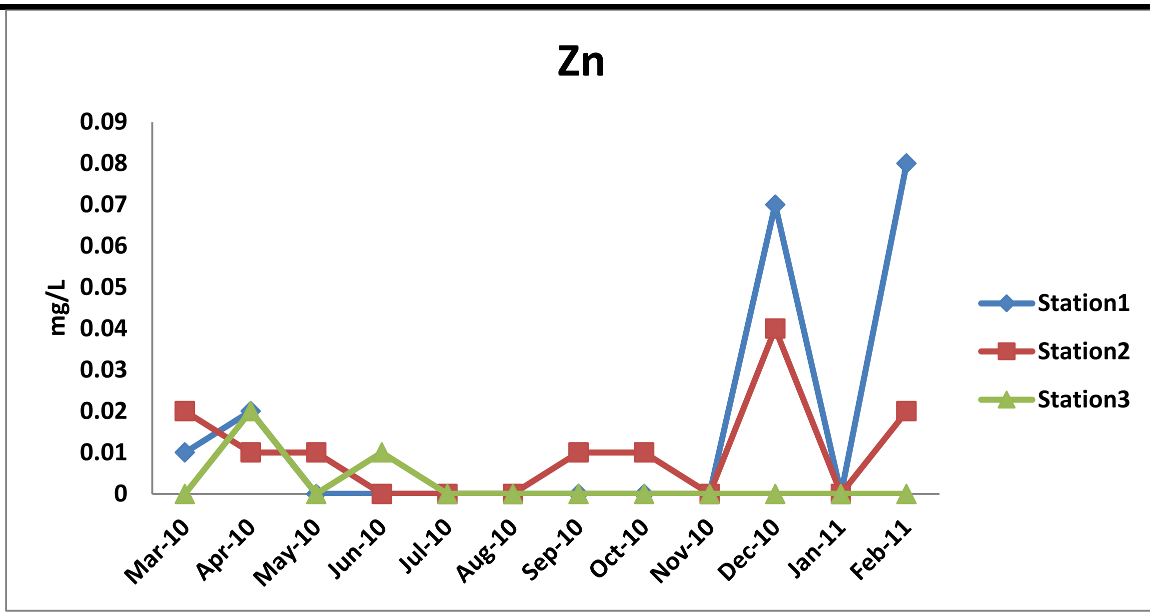

Fig.3: Concentration of zinc in the study stations from March 2010 to February 2011.

Lead (Pb^{+2})

The concentrations of lead variedin all studied stations, as there were values is not detectable in more than once and more than station and are generally recorded a minimum value of about 0.01 mg / L and maximum value of about 0.2 mg / l.,This minimum value have been repeated in more than once, as in May and December 2010 at the station (2) and in January and February 2011 at the station (1), while the maximum value in the month of February 2011 at the station (2).

It was observed a significant difference in the concentrations of lead recorded in the study of different stations at the level of probability ($p \leq 0.05$) as shown in Table 1 and Figure 4.

Statistically a significant negative correlation was found at a level factor ($p \leq 0.05$) between lead and zinc and its value ($r = -0.416$), as shown in Table 2.

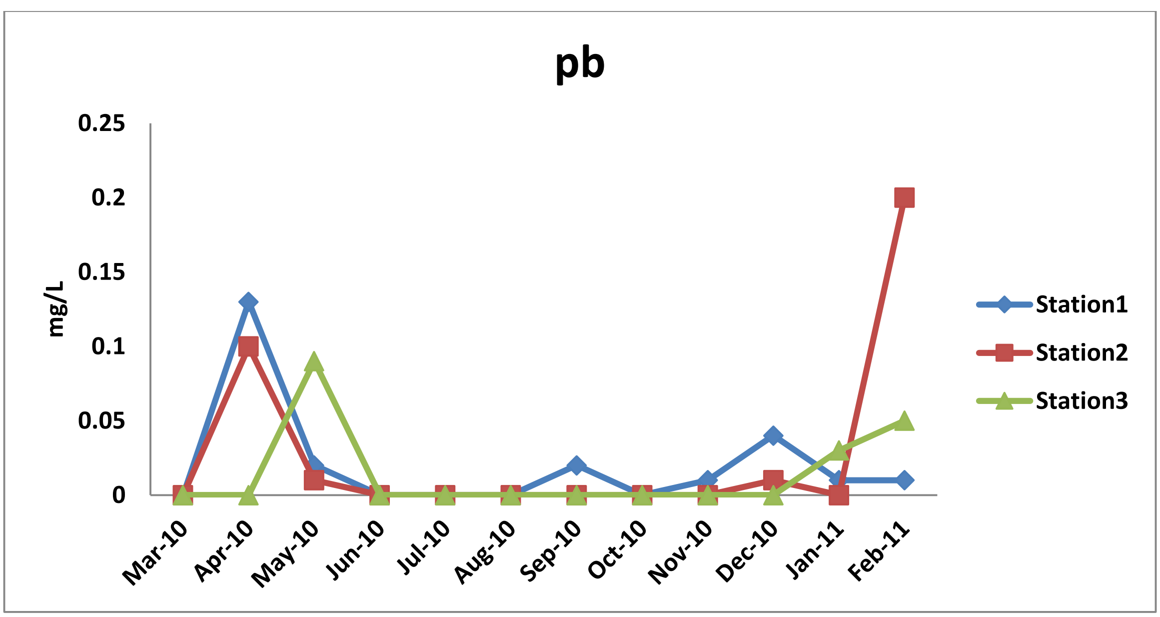

Fig.4: The concentration of lead in the study stations from March 2010 to February 2011.

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Cadmium (Cd^{+2})

Some data recorded for cadmium was intangible, especially at stations 2 and 3, and in general the minimumvalues concentration of cadmium recorded with about 0.01 mg / L and higher concentrations of about 0.19 mg / L. The minimum value repeated the for most of the time, which shown in the station 1 in the months of March 2010 and January 2011,and repeated in the station (2) in the months of May 2010, and the station 3 in the months of April 2010 and January 2011. While, the upper value was recorded in the month of July 2010 at the station (1) (Figure 5).

No significant differences appear at the level of probability ($p \geq 0.05$) between the concentrations of cadmium in the study stations, it was found a statistically significant positive correlation factor ($p \leq 0.05$) between the nickel and cadmium (r = 0.476).

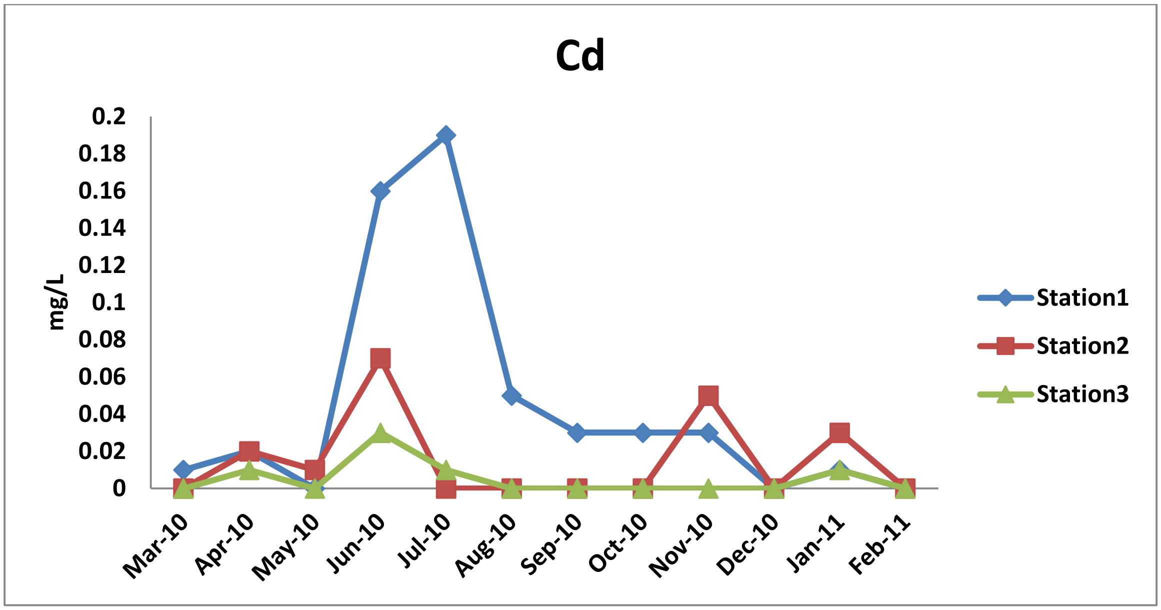

Fig.5: Concentration of cadmium in the study stations from March 2010 to February 2011.

The results of the current study showed that the concentrations of the fourth metals mostly are within the permissible limits by the Iraqi Rivers Maintenance Regulation No. 25 of 1967 and in many of the recorded data were within intangible readings at the low concentration of these metals in the sample.

Nickel scored the highest concentration of it in the month of June 2010 at two stations 1 and 2 and the focus was the highest in Station 1, as well as in the month of December 2010 and February 2011 at the same station.

As for zinc, all recorded concentrations were below the permissible limits, while lead exceeded for all recorded concentration the limits and that was in March 2010 at two stations (1 and 2), and in November 2010 at station (1) and also in February 2011 at station (2).

While, the concentration of cadmium exceeded the permissible limits of this study in June 2010 and the second one which was the highest in August, 2010 at station (1).

The concluding from the foregoing and overview of the figures (16, 17, 18, 19), that the increase in the concentration of the four heavy metals are the highest in station (1) and decreases toward the station 2 and fade sometimes in station (3), this probably indicates the presence of a source poses these heavy metals be the closest to the station (1),the decreases of the concentration of the four metals with downstream, and this reduction in emphasis may by dilution or depositing metal during the flow of the river or combined with organic compounds formingchelating agents turn into sediments. Morel *et al.* (1973) shows that the most metals werein the liquid state, to a free state at a low pH (acidic), especially with aerobic conditions and at increasing of the pH (or about basal) carbon consist of metal first and then to the oxidation view, as well as can be going into silica metal forming at the same time and deposited.

Tulonen, *et al.* (2006) found that the concentrations of metals in the water are much lower than in the humus lakes and there is no relationship between the humus lake waters and the fact that metals are associated with organic matter and humus deposited with them, but the current study was limited to the measurement of heavy metals dissolved in water only.

It also found a significant difference between the current study stations for heavy metals concentrations, this

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indicates that the concentrations were varied in the water of the river on the study period and for the three stations, and the proportions of the presence of metals vary depending on the surrounding ecological conditions, and this is what trailed study (Perez and Sumngat, 2001).Drever (1997) in his study also showed, that these metals have common characteristics, where, when present in the oxidizing environment becomes acidic in the form of oxides or carbonate or silicate with iron, and these three metals there among them positive correlation factor it changes according to the same conditions affecting. The lead tends to be associated with various liquid organic ingredients, where, lead comes from human activities, such as pesticides, sewage and industrial batteries and printing processes and fuel (Alloway and Ayres, 1997) and this study is consistent with (Al-Malikey, 2009) and (Abdul-Kareem, *et al.* 2011).

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