Distribution of Cobalt and Nickle in plankton and it's aquatic surround habitats in Euphrates and Al-Garaf rivers at Al-Nassiria city, southern of Iraq.

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ABSTRACT

The study was carried out to investigate the distribution of concentrations two heavy metals Cobalt (Co) and Nickle (Ni) [as heavy metals] in plankton (phytoplankton and zooplankton) and in its surrounded habitats(water, sediment and aquatic plants) in two rivers (Euphrates and Al-Garaf) at Al-Nassiria city ,southern of Iraq, for one year (January-December,2004) .

Results showed considerable seasonal variations in the concentrations of these two metals. Ni concentration in plankton and aquatic plants were found to be greater than that of Co in both rivers, while the concentration factor (plankton /water) and (aquatic plants /water) for Ni was greater than for Co in both rivers.

الملخص

أجريت الدراسة الحالية لمتابعة توزيع تراكيز عنصري الكوبلت والنيكل (معادن ثقيلة) في الهائمات (النباتية والحيوانية) وبيئتها المائية المحيطة بها(الماء ،القاع والنباتات المائية) في نهري الفرات والغراف جنوب العراق ولمدة سنة كاملة (كانون الثاني – كانون الأول).

لوحظ وجود تغيرات موسمية واضحة في تركيز تلك المعادن، وكان تركيز النيكل في الهائمات والنباتات المائية أعلى من تركيز الكوبلت فيهما ولكلا النهرين. بينما كان عامل التركيز (الهائمات /الماء) و (النباتات المائية/الماء) للنيكل أعلى منه للكوبلت وفي كلا النهرين.

INTRODUCTION

Phytoplankton are responsible for most of the primary productivity in aquatic ecosystems, some of algae like *Cladophora glomerata* (green algae) is generally consider as the most proper bioindicator of heavy metals in aquatic bodies (Chmielewska and Medved, 2001).

Metals occur naturally, and several of them are essential components of global ecosystems (Pinto *et al.*,2003) . In aquatic ecosystem ,the heavy metals are considered as an essential

pollutants for this ecosystem, and these metals effect all the components of aquatic ecosystem because the heavy metals are known to be potentially toxic (Sobha *et al.*,1992), the toxic effects of heavy metals are due to its accumulation in almost all of the organs and attach with sulphydral group for proteins that cause change of structure and activity of enzymes (Hodson,1988) . So they are of great ecological significance.

These elements contrary to most pollutants, are not biodegradable and undergo a global ecobiological cycle in which natural waters are the main pathways (Nurnberg,1984). Rivers are more complicated with regard to transformation and accumulation of these metals (Wolfe and Rice,1972).

The study of distribution of metals concentrations in aquatic ecosystems (seasonally) is consider a method to understand the cycling of metals in these ecosystems and understand the role of aquatic ecosystem components in this cycling (Wolfe and Rice,1972 ; George and Kureishy,1979 ; Lyengar *et al*.,1984 ; Gajbhiye *et al*.,1985 ; Kesavarao and Indusekhar,1986 ; Subrananyam and Ananthalakshmi,1990).

The present study deals with the distribution of two heavy metals Co and Ni in the main components of aquatic ecosystem which are :water,sediment, plankton (phytoplankton and zooplankton) and aquatic plants of the Euphrates and Al-Garaf rivers (branch of Tigris river). Althoug very little studies were made on the heavy metals in Euphrates river (Al-Zaidi and Al-Rekabi,1996), and there is no study on the heavy metals distribution in each river.

MATERIALS AND METHODS

Two stations were selected at Al-Garaf and Euphrates rivers in the south of iraq, the Al-Garaf river (station 1)is branched from Tigris river in Al-Kut city and go to Al-Shattra city northern of Al-Nassiria city, the Euphrates river (station 2) pass through Al-Nassiria city, (Fig.1). Both rivers are from the most important fishing grounds along this city.

The study was carried out over a period of one year (January to December,2004) at monthly intervals. Samples (Eight samples from each station)were collected and transported to the laboratory by ice box. Duplicate of water samples (200-500) ml were filtered through GF/C filter papers, and evaporated to dryness, and the residue dissolved in (10) ml of 0.3M HNo_3 ,and then stored until analysis. Each of the sediment, plankton (collected by net 20µm) and aquatic plant [*Ceratophyllum demersum* (very dominant in both stations)] samples were oven dried at 60 °c and then ground to powder, duplicate samples of sediment, plankton and aquatic plants of (1) g of ground material were then digested in concentrated Nitric acid and Perchloric acid (4/1 v/v),and evaporated nearly to dryness and then residue was dissolved quantitavely in (20) ml 0.1N HCl and diluted to (100) ml with distilled water. The metal concentrations in them were determined by Atomic Absorption Spectrophotometer (AAS) adopting the procedure recommended by Romes and Nicholas (1986). While in water the metals were estimated according to (Brooks *et al*.,1967).

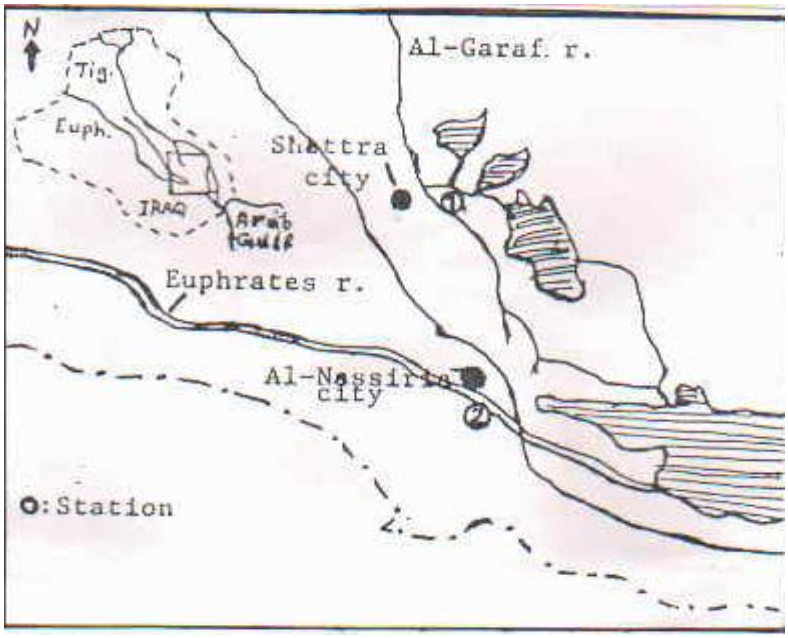


Fig. 1 :Map of study area

RESULTS AND DISCUSSION

Concentrations of Co and Ni in water, sediment, plankton and aquatic plant showed clear seasonally variations (Fig.2).

Concentrations of Co (0.13-7.7) µg/L and Ni (0.19-8.9) µg/L were recorded in Al-Garaf river water (station 1),while the concentration in Euphrates river water (station 2) varied between (0.11-4.7) for Co and between(0.14-10.1) µg/L for Ni (Fig.2 C). the concentration of metals in plankton in (St.1) varied between Co(6.5-54.5) and Ni(12.8-108.9) µg/g dry wt., whereas in (St.2) the range in Co (6.7-42.7) and Ni (9.9- 99.4) µg/g dry wt. were observed (Fig.2 A). The concentration of Co and Ni in the sediment of (St.1) varied between Co (6.4-92.8) and Ni(7.3-102.4) while for (St.2) were varied between Co(2.3-61.4) and Ni(5.9-100.4) µg/g dry wt. (Fig.2 D). Co and Ni concentrations in the aquatic plants of (St.1) ranged between Co (0.93-4.9) and Ni (0.23-26.4) but in (St.2) its ranged from (0.14-5.8) for Co and (0.34-29.4) µg/g dry wt. for Ni (Fig.2B).

Co and Ni concentration in water of both rivers showed seasonal variation (Fig.2 C), the metal concentrations in both rivers were higher during the July – October months than other parts of year , it was due to heavy drainage of washing water from the neighboring agricultural lands into the rivers and may be due to the increase of dead organisms decomposition because of the increase in temperature during this period (Abaychi and Douable,1985). The correlation coefficient " r " between the concentrations of heavy metals in water and sediment were higher than between water and other components (Table 1) , that's may be due to the water in an image to sediment and vice versa, that's water and sediment are the essential components of aquatic ecosystem, the sedimentation processes effects on the sediment content and at the same time ,the motivation processes for sediment (because the natural circumstances or aquatic organisms) effect on the water content, that agrees with (Knauer and Martin,1973 ; Kesavarao and Indusekhar,1986 ; Romes and Nicholas,1986).

The direct uptake of metals from the medium usually takes place by adsorption into the body surface and penetration across the permeable membrane (Fowler and Small,1967 ; Fowler *et al.*,1969 ; Small,1969 ; Knauer and Martin,1973 ;Davis,1978 ; Romeo,1982) . In the present study the metal concentrations in plankton of both the rivers were found to be higher during May (Fig.2 A).

A similar trend was observed in the other temperate regions of the world (Subrananyam and Ananthalakshmi,1990 ; Sampathkumar and Kannan,1994). High concentrations of Ni and Co in plankton were recorded during the March-May months(Fig.2 A),when the concentrations of these metals in water were low which was due to the adsorption of metals from water by the plankton, and that's showed too from very weak correlation between water and plankton (Table 1). And we know the aquatic plants and plankton make on concentrate the heavy metals in its bodies in millions times more than in water (Thomas,1972). According to Sclater *et al* (1976) Ni could be removed from aquatic plant by similar other biological processes and remineralization in association with both labile and relatively refractory biogenic components.

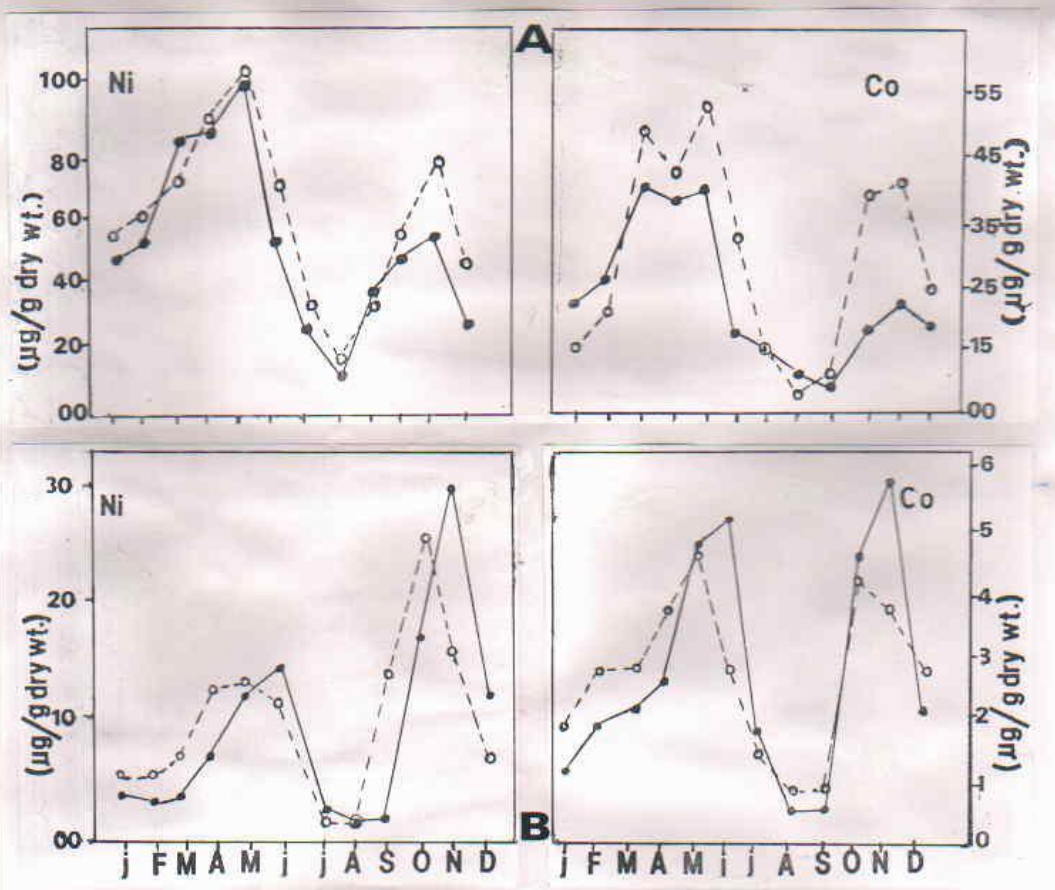
In sediment, the highest concentration of both metals were recorded during autumn season (especially for Co) (Fig.2 D), that may be due to an increase in the decomposition processes in the end of summer season. The concentrations of heavy metals in sediment were higher than its in water in all the months because the sediment is considered as a trap for the metals(Thomas,1972).

From the available literature, it was found that the Co and Ni concentrations in aquatic plants of the present study were equal to that occuring in other rivers of some temperate regions of the world, the highest concentrations of heavy metals in studied aquatic plants were recorded in the end of autumn season, that's may be due to this period is a peak growth period (flowering period) of studied species (highest activity period like absorption and storage), while the lowest concentrations were showed in summer season which are characterized by increase the temperature which causes increase the aquatic plants decomposition (Kesavarao and Indusekhar,1986) while the concentration was lower than those of other areas like Shatt Al-Arab, Arab Gulf and rivers (Lyengar *et al*.,1984 ; Abaychi and Douable,1985 ; Sobha *et al*.,1992). Generally , the high bioaccumulation abilities of green algae for selected metals have been confirmed (Chmielewska and Medved, 2001).

Maximum values of concentration factors (CF) in plankton and aquatic plants were observed in Al-Garaf river as compared to Euphrates river. The CF values of Ni were more than that of Co, that may be due to that the southern of iraq is considered as a rich region in oil (Abaychi and Douable,1985), CF values were higher in summer season in comparison with other seasons in both rivers.

Finally,we can could there are clear seasonal variation in the concentrations of heavy metals in all the studied essential components of aquatic ecosystem,which are (these components) may be consider as a sources add heavy metals to aquatic ecosystem especially during decomposition processes, and theres a strong correlation cofficient between heavy metals concentration in water and sediment in comparism with other components.

We recomende,for making more studies for other metals and for all aquatic ecosystems in the south of iraq,and making monitoring stations for heavy metals along the rivers in iraq.


A
Ni
Co
(µg/g dry wt.)
100
80
60
40
20
00
55
45
35
25
15
00
B
Ni
Co
30
20
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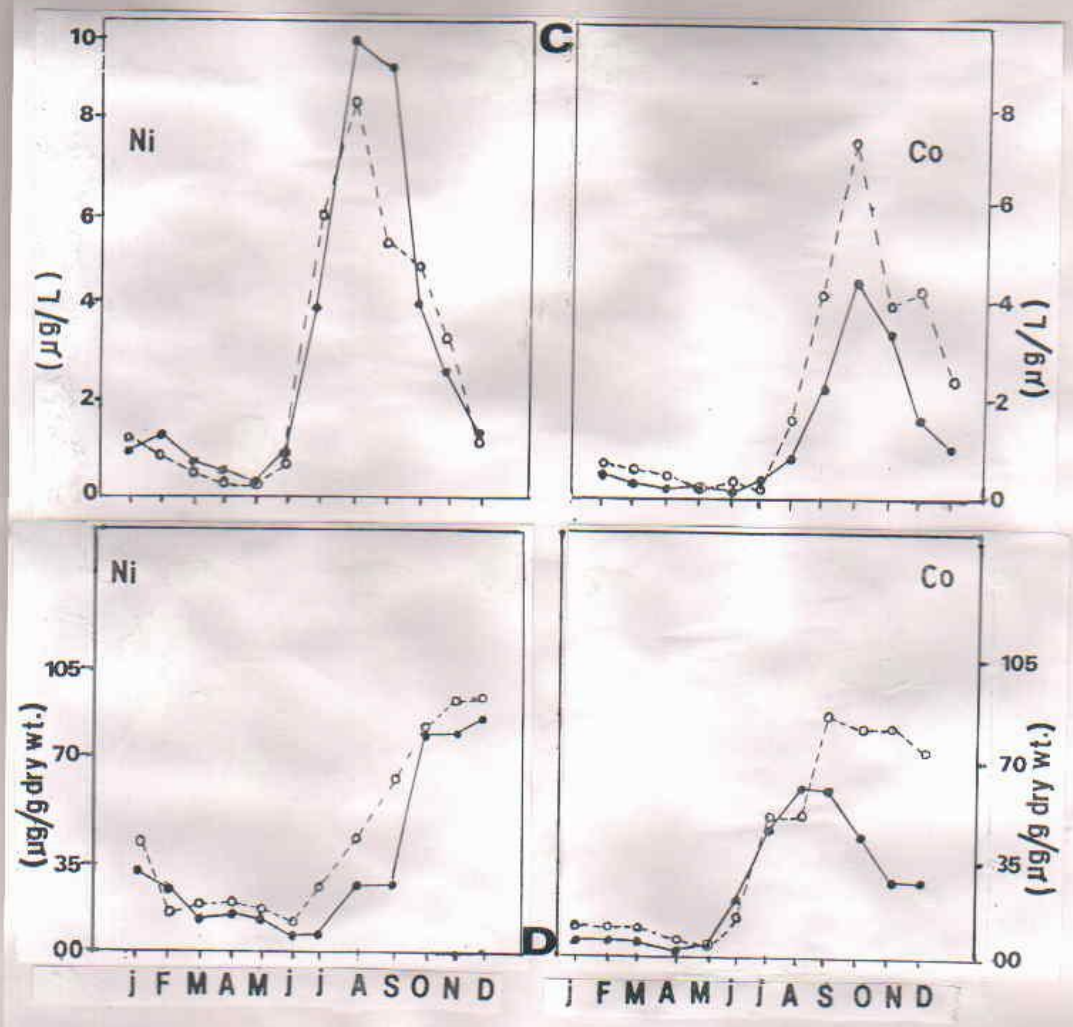

Fig.2:Seasonal variations in heavy metals concentrations in plankton (A);aquatic plant(B);water (C)and sediment (D) in Euphrates (●---●)and Al-Garaf (o---o) rivers.

Table 1:Correlation cofficient "r" between the concentrations of heavy metals in water, sediment, plankton and aquatic plants.

Correlation		"r" value	"p"value
Ni in water	X in sediment	0.8593	<0.01
= = =	X in plankton	-0.6803	<0.02
= = =	X in aquatic plants	0.1625	<0.02
= = sediment	X in plankton	0.0012	<0.02
= = =	X in aquatic plants	0.5553	<0.01
= = plankton	X in aquatic plants	0.7149	<0.05
Co= water	X in sediment	0.8021	<0.01
= = =	X in plankton	-0.3712	<0.02
= = =	X in aquatic plants	0.1149	<0.05
= = sediment	X in plankton	0.0113	<0.02
= = =	X in aquatic plants	0.5865	<0.01
= = plankton	X in aquatic plants	0.7375	<0.02

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