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Amaricf_Basra office@yahoo.com
abdulalwan@yahoo.com
.marshbulletin@yahoo.com

Bioaccumulation of some heavy metals (Pb, Cd and Cu) in common carp *Cyprinus carpio* relevant to their concentration in water and sediment of Al-Masab Alamm for Al-Nassiriyia city.

BasimY.ALKhafaji⋆ Yahya T. Dawood⋆⋆ A frah A. Maktoof⋆

⋆Biology Department –Science Collage-Thi-Qar University

⋆⋆Biology Department –Science College For woman -Baghdad University

Abstract

Concentration of some heavy metals (Pb, Cd, Cu) were determined in water, sediments and tissues of *Cyprinus carpio* collected from Al-Masab Alamm during winter 2010.The concentrations of the heavy metals in water were within the international permissible level Cu had the highest accumulating level in liver and muscles, whilst Cd had the lowest.

The Bio-Concentration Factors (B.C.F) and Bio-Sedimentation Factors (B.S.F) of all metals in fish from water were greater than those from sediments. This lead to the conclusion that fish bioaccumulationsource with these metals was from water.

Key words: Heavy metals, bioaccumulation, *Cyprinus carpio*, Al-Masab Alamm.

1- Introduction

Anthropogenic activities continuously increase the amount of heavy metals in the environment, especially in aquatic ecosystem which is growing at an alarming rate and has become an important worldwide problem (Malik, *et.al.*,2010).

Increase in population, urbanization, industrialization and agricultural practices have further aggravated the situation (Giguere, *et.al.*,2004; Gupta, *et. al.*,2009).As heavy metals cannot be degraded, they are deposited, assimilated or incorporated in water, sediments and aquatic animals (Linnik and Zubenko,2000) and thus,

causing heavy metals pollution in water bodies (Al-Khafaji,2010).Therefore, heavy metals can be bioaccumulation and biomagnified via the food chain and finally assimilated by human consumers resulting in health risks(Agah, *et.al.*,2009). As a consequence, fish are often used as indicators of heavy metals contamination in the aquatic ecosystem because they occupy high trophic levels and are important food source (Blasco, *et.al.*,1998).

The objective of the present study was to determine the level of certain heavy metals in water, sediments and some organs (liver, gills, muscles and kidney) of *Cyprinus carpio* from Al-Masab Alamm in Al-Nassiriyra city.

2- Materials and Methods :

Study area :

Al-Masab Alamm is a river use to discharge the effluents of agriculture activites from its both side. It is extended from Al-Shaklawiya at the north until Shatt Al-Arab at the south with length about 565 km(Al-Kubaysi,1996).It is dividing into three sectors (North, Mid and South),the south sector (which the present study area is a part of its) extended from the end of the mid sector until Shatt Al-Basarah in the south, with length about 165 km. The discharge of water is 220m^3/sec in this sector (Fahad,2006). New branch was opend in this sector with length 7 km, use to transform the water to the marshes south Al-Nassiriya city.

Three stations were selected in the south sector of this river to implemented, the present study, these are station 1(st.1) was near Al-Holandee Bridge and the general caragge in the center of Al-Nassiriya city, St.2 was 20 km far away from the first station, while st.3 was in the beginning of the new branch as shown in (Fig.1).

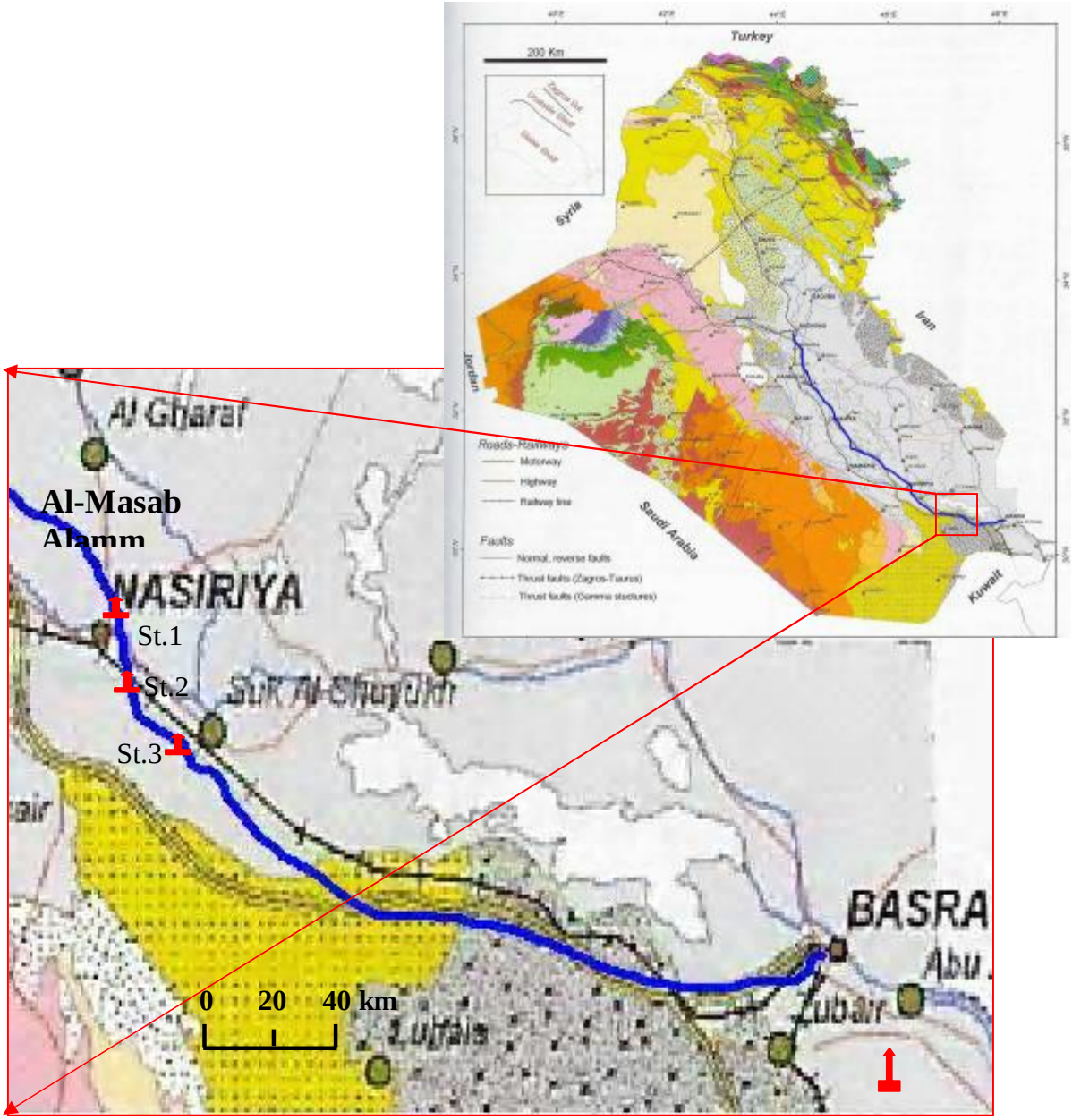

Figure 1: Map of the study area showed the study stations.

Collection of sample:

Samples of water, sediments and *C.carpio* were collected from Al-Masab Alamm during (January, Feburary and Decmber) winter 2010. The water was preserved in plastic bottles by the addition of few drops of nitric acid. Sediments was collected by van veen grab samples then preserved in plastic bags. Fish were collected by using gill nets(25*25) mm mish size and preserved in ice box. In laboratory, The length of the fish collected ranges (depending on the species) between 16 - 35 cm . Dissection has been performed to separate different organs (muscle, gills, kidney, liver, ovary and frozen until ready for acid digestion.

Procedure:

Water samples were digested according to the method described in APHA(1992), while sediments were digested after drying according to Chester and Voutsinou(1981) method. The mentioned fish organs were digested after drying according to R.O.P.M.(1983) methods. The levels of Pb, Cd and Cu in extractions were determined by (Shimadzn-630-12) air–acetylene flame atomic absorption spectrophotometers using different cathodes lamps with air a acetylene flame method. The cathode lamps had wave length range from 190 to 900 nm.

Bio-Concentration Factors (B.C.F) and Bio-Sedimentation Factors (B.S.F):

The Bio-Concentration Factors (B.C.F) and Bio-Sedimentation Factors (B.S.F) in muscle from the aquatic ecosystem, which include water and sediments, was calculated according to Evans & Engel(1994) as follows:

$$B.C.F = M_{muscle} / M_{water}$$

$$B.S.F = M_{muscle} / M_{sediment}$$

Where, M_{muscle} is the metal concentration in muscle fish; $M_{water\ or\ sediment}$, metal concentration in water or sediment.

3- Results:

Heavy metals in water :

The average concentrations of heavy metals Pb, Cd and Cu in the water samples of Al-Masab Alamm were 0.2, 0.05 and 0.034 µg/l respectively; (Table 1). Pb content was the highest and that of Cu was the lowest in water. The order of heavy metals accumulation in water was Pb>Cd> Cu.

Heavy metals in sediments:

The mean values of Pb, Cd and Cu in sediments of Al-Masab Alamm were 24.73, 3.76 and 25.94 ppm, respectively; (Table 2). The order of heavy metals concentrations in sediment was Cu> Pb> Cd. The data were indicated that Cu was maximally accumulated in sediments whereas Cd got the lowest concentration.

Bio-Concentration Factors (B.C.F) and Bio-Sedimentation Factors (B.S.F):

The values of (B.C.F) and (B.S.F) in the muscle of *C.carpio* shown in Table(4). The results showed that (B.C.F) of water were greater than those of sediments (B.S.F).

Table(1): Mean heavy metals concentrations(µg/l) in water of Al-Masab Alamm compared with the international permissible limits (ppm).

Parameter	Lead	Cadmium	Copper
Mean	0.2±0.057	0.05± 0.054	0.034±0.001
USEPA(1986) 5.00	5.00	5.00	1000.00
WHO(1985)	10.00	3.00	1000.00

Table(2): Mean heavy metals concentrations(µg/g) dry weight in sediments of Al-Masab Alamm.

Parameter	Lead	Cadmium	Copper
Mean ±Sd.	24.73 ±1.34	3.76±0.51	25.9±3.60

Table(4): Bio-concentration and Bio-Sedimentation of heavy metals concentrations in muscles of *C. carpio* from Al-Masab Alamm (water and sediment).

Metals	Metal concentrations		*Cyprinus carpio*		
	Water(µg/l)	Sediment(µg/g)	Muscle	B.C.F	B.S.F
Pb	0.2	24.73	5.61	28.05	0.22
Cd	0.05	3.76	0.04	0.8	0.01
Cu	0.034	25.94	18.05	530.88	0.69

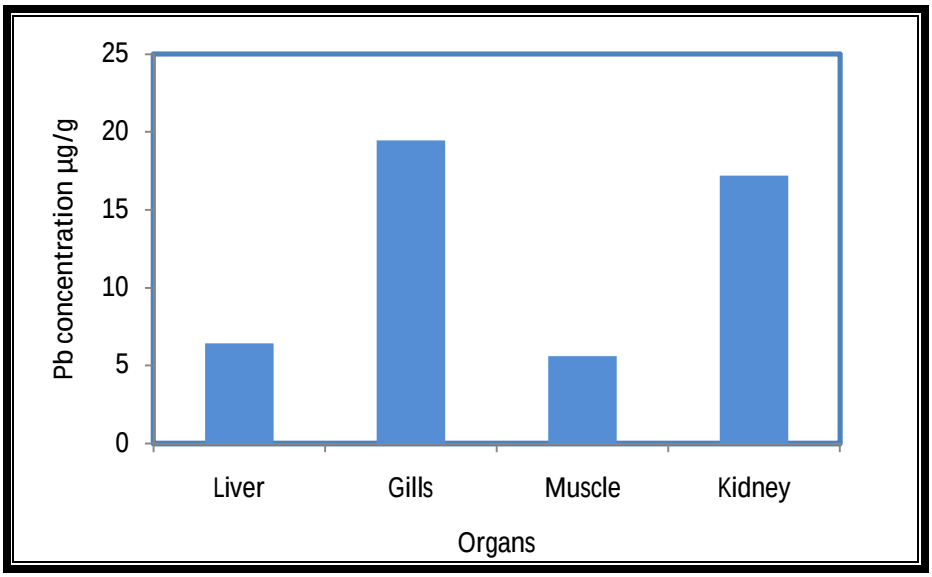

Figure 1: Concentrations of Pb in organs (µg/g) of *C. carpio.*

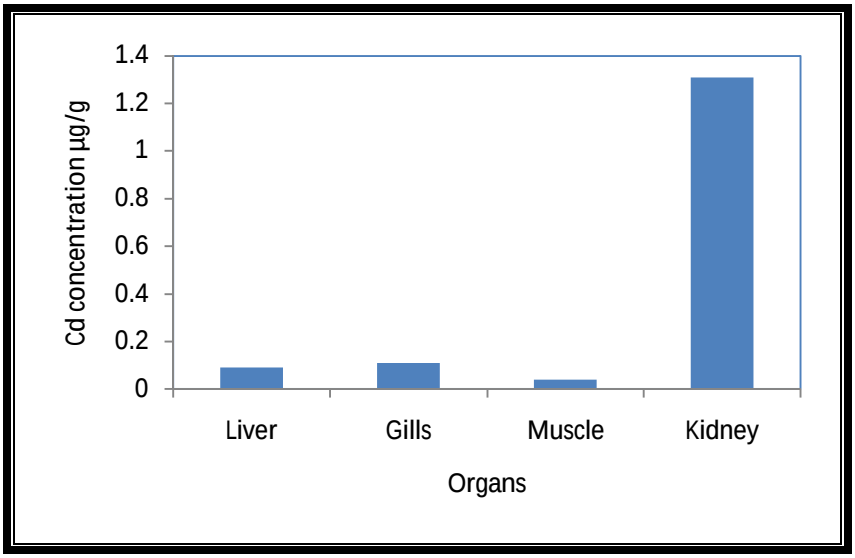

Figure 2: Concentrations of Cd in organs (µg/g) of *C. carpio.*

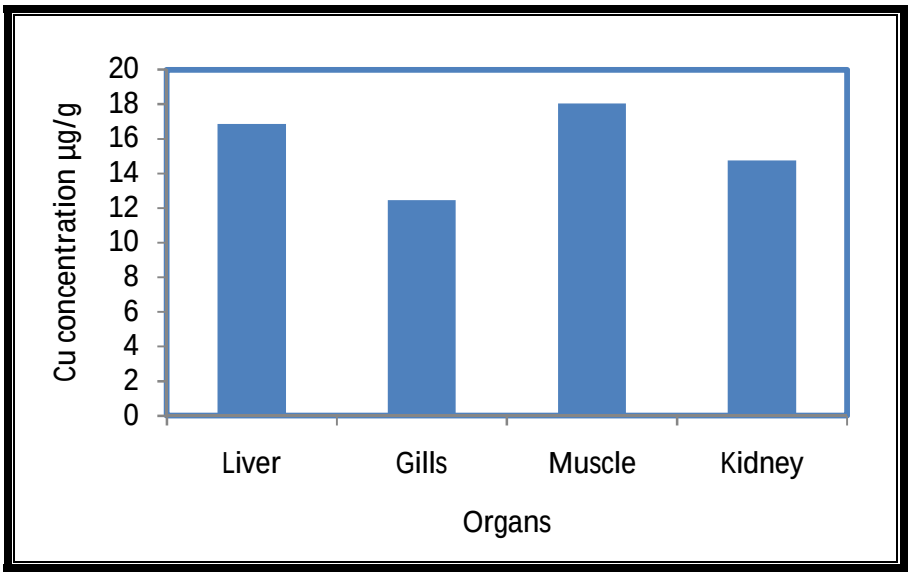

Figure 3: Concentrations of Cu in organs (µg/g) of *C. carpio.*

4- Discussion :

In natural aquatic ecosystem, metals occur in low concentrations, normally at the nanogram to microgram per liter level. In recent times however, the occurrence of metal contaminants especially the heavy metals in increasing concern. This situation arisen as a result of the rapid growth of population, increased urbanization and expansion of industrial activities, exploration and exploitation of natural resources extension of irrigation and other modern agriculture practices as well as the lake of environmental regulations (FAO,1992). The level of heavy metals recorded in water in this study were generally low when compared with the limit of chronic reference values suggested by WHO(1985) and USEPA(1986). This study revealed that the sediment from Al-Masab Alamm contained very high significant amounts of heavy metals when compared with their concentration in water. Sediments act as the most important reservoir or sink of metals and other pollutants in the aquatic environment (Gupta, *et.al.*,2009). Heavy metal contamination in sediment can affected the water quality and bioaccumulation of metals in aquatic organisms, resulting in potential long-term implication on human health and ecosystem (Fernandes, *et.al.*,2007). The results of the present study was showed that, liver and muscle accumulate and concentrate highest concentrations of Cu. Jent, *et.al.*(1998) found that Cu concentration increased in fish liver collected from water near the agricultur areas. Rashed(2001) found the same results

in Tiliapia fish collected from Nassar lakes as well as obtained by (Benson,*et.al*,2006; Ali,2007; Al-Saad and Al-Nagar,2010; Al-Khafaji, *et.al*.,2011) reported that the liver was the major site for Cu accumulation because liver is the responsible organ in controlling the toxicity of heavy metals. The high accumulation in the kidney of Cd and Pb corroborated the results obtained by (Latif,1980; Al-Maliky,2009; Malik, *et.al*.,2010). Also, Abdell- Baki, *et.al*.(2011) reported that the kidney was the major site for Cd accumulated. Muscle are the main edible part of fish and can directly influence human health. Therefore, most governorates have established toxicological limits for heavy metals in sea food(Agah, *et.al*.,2009). According to WHO(2005), the allowable concentration for Pb, Cd and Cu were 200, 50 and 10000 ppm, respectively. However, such food limits are not defined to all the elements (Agah, et.al.,2009). The elements level of fish muscles in this study were below the allowable concentration suggested by WHO(2005) and have no threat to public health. The results was showed that the Bio-Concentration and Bio-Sedimentation factors of all elements in fish from water were greater than sediments, this agree with obtained by (Al-Khafaji,1996; Al-Taee,1999; Rashed, 2001). This result might be due to the feeding behavior of fish which is bottom feeder and the result was concordant with the findings of Ali and Fisher(2005).

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التراكم الحيوي لبعض العناصر الثقيلة في سمكة الكارب الاعتيادي ذات الصلة المشتركة إلى تراكيزهم في الماء ورواسب المصب العام– لمدينة الناصرية.

باسم يوسف الخفاجي* يحيى توما داود أفراح عبد مكطوف***

قسم علوم الحياة – كلية العلوم – جامعة ذي قار*

قسم علوم الحياة–كلية العلوم للبنات–جامعة بغداد**

الخلاصة

حددت تراكيز بعض المعادن الثقيلة في الماء ورواسب وأنسجة سمكة الكارب الاعتيادي الذي جمعت من المصب العام إثناء شتاء 2010. كانت تراكيز المعادن الثقيلة في الماء ضمن المستوى الدولي المسموح به. وكان التراكم الأعلى للنحاس في الكبد والعضلات بينما كان التراكم الأوطىء للكادميوم.

سجل عامل التركيز الإحيائي لجميع العناصر في السمكة المدروسة من الماء أعلى قيمة من عامل الترسيب الإحيائي (الرواسب). نستنتج من ذلك أن التراكم الإحيائي لجميع هذه العناصر يأتي من الماء.

كلمات دالة : المعادن الثقيلة ، التراكم الحيوي ،الكارب الاعتيادي، نهر المصب العام .