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# A STUDY OF ACCUMULATION OF SOME HEAVY METALS IN FISH (*CYPRINUS CARPIO*) IN EUPHRATES RIVER IN BABYLON

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## Abstract

This study was conducted in the period from July 1st to September 30st, 2018 to evaluate contamination in common carp in Euphrates river with heavy metals (Cd, Pb, Zn, Cu and As). Fish samples were randomly collected in various lengths and weights from two points on Euphrates: the first point was in Barnoon area and the other one was Al-Shawi (18 kilometers from city center). Samples were examined in Modern Science Lab in Diwaniyah. There were a significant differences($p \leq 0.01$) between the two points in terms of water pollution as sample from the second point contained higher pollution level (Cd in liver, gills and muscles = 3.330±0.114, 3.130±0.321, 2.785±0.205; Pb in gills, liver and muscles = 22, 121±1.222, 12.655±0.092, 3.873±0.205; Zn, in liver, muscles, and gills = 16.021±2.983, 27.179±1.329, 18.616±0.261; Cu in liver, gills and muscles = 17.358±0.617,6.964±0.530,4.112±0.341; and As in liver, muscles and gill = 16.732±2. 700, 7.097±0.494, 4.045±0.165. respectively). Fish contamination depends on water pollution, nutrition, environment and the place where fish live in the water column. Liver and gills were found to be more contaminated than muscles, as they showed high levels of heavy metals beyond the permissible limits set by FAO, especially in Zn and As. This has negative impact on fish growth, reproduction and health, which in turn has improper effect on public health. This pollution is the product of dumping industrial waste and sewage water into the river. Such fish became inconsumable for people as they cause accumulation of toxic materials in there bodies and might lead to certain diseases like cancer.

***Keywords*** : Heavy Metals, Fish, Euphrates River.

## Introduction

Water is a natural resource people need for many life uses like drinking, farming, industry, etc. however, wastes from households, industrial activities, mining and farming activities involving the use of pesticides and fertilizers render water polluted (Canli & Kalay, 1998). Such water is contaminated with toxic pollutants that affect people, animals and water creatures. People are working to preserve food quality including fish products. It is very important to identify heavy metals pollution in water regularly by examining fish as it has negative effects on public health due to the potential of various diseases (Benoff and Jacop, 2000). Water can be polluted by toxic heavy metals that affect fish due to the lack of water treatment before releasing water to rivers and fish and aquatic life can be affected by heavy metals when fish feed on water organisms, zooplankton and phytoplankton, or through skin and gills (Kominkova, 2007).

Water pollution with heavy metals can cause abnormal effects on the ecological balance as such materials can be introduced to the biochemical cycle and accumulate in water life, especially in fish living in such habitats and cannot escape pollution (Olaifa *et al.,* 2004). Several studies on fish show changes in the physiological activities and biochemical parameters in fish blood and tissue due to heavy metal buildup (Basa & Rani, 2003), which can alter the structure of living membrane by activating the initial oxidation of fat. Some chemical used in textile industries, which contain chlorine, arsenic, bromine, dipluran and mercury. The increase in lead concentration in the tissue of water organisms can decrease their populations and affecting fish reproduction and growth and render then vulnerable to diseases (Clesceri and Greenberg, 1999). Such pollutants differ in their impacts on aquatic organisms due to the differences in the types and quantities of the introduced textile chemicals. Textile factories are considered among the major sources of water pollutants (Babu *et al.,* 2007), which consume significant amounts of oxygen, increase water turbidity and increase chlorine levels that hinders the auto-purification process of water and concentrates toxic heavy metals in aquatic organisms by increasing heavy metals level that affects all life forms in rivers. Heavy metals exist naturally in the environment, as some of them are necessary for living organisms. However, they become effective when they increase over the permissible level (Forestr & Wase, 1997), and they accumulate in the fish tissue in higher levels than their natural level in the environment (El-Shenawy, 2002). Therefore, concentration of such materials can be said to depend on the organ they buildup in (May Al-Dhaima, 2010). There are other factors influencing the buildup of heavy metals like their reaction to each other, fish growth, the relevant organ, nutrition, absorption rate of the living organism (Karadede, 2003), temperature, length of food chain, age, sex, size, physiology, nutrition behavior, growth rate and growth stages (Windom, 1973) & (Chapman, 1996). Fish absorb pollutants and chemicals via three media: water, food and atmosphere (indirectly). Accumulation rate of pollutants and chemicals inside fish depends on several factors (chemical, physical, biological and ecological) like the chemicals available for consumption by fish and other organisms, Water quality, temperature and length of the food chain (Al-Nagare, 2009). Food chain scheme includes algae, plants as food for zooplankton, water insects as food for small fish (and then bigger fish up in the chain). Each step in the food chain increases the accumulation output (Balasubramanian *et. al.,* 1997) & (Abdelhusein, 2014).

Organisms living up in the food chain have higher levels of chemical pollutants and usually in bigger predators and other fish feeding on other fish and animals (Al-Nagare, 2012).

## Materials and Methods

### Study Area

Two points on Euphrates were chosen on the basis of the observations made during field survey visits conducted by the researchers. The first point (A) was in Barnoon area, which is an agricultural and orchard area where no drains or factories are found. The first point is about 18 kilometers from the second point (B), which is in the city center of Hilla. Crowded residential areas are found on both river banks along with grocery shops, a hospital and a carpet factory, which all dump their wastes in the river through the urban sewage system. Common carp samples were collected randomly and directly from the river at the sewage drain of the carpet factory, which dumps its sewage directly in the river, as the study required to identify the difference between the two points in terms of heavy metals concentrations in the common carp's gills, livers and muscles. Samples were collected from fishermen who use fishing nets and then the samples were kept in in small cork containers with crushed ice and delivered to Modern Science Lab in Diwaniyah Governorate. Livers, gills and muscles were extracted from fish and examined for heavy metals traces (Cd, Pb, Zn, Cu and As). (IBM corp. released 2012) one-way ANOVA table were used to determinate significant differences between two points of river fishes by calculating (LSD) Means and stander error (SE) were also measured by using SPSS18.0 (SPSS21.0).

### Digestion and extraction of fish samples

### Concentration testing

Fish tissue samples (gills, livers and muscles) were dried, crushed and then sieved with 0.5mm sieve. Then, 1g off muscle and 0.5g of each of the gills and livers were extracted and put in test tubes made of Pyrex and 10mL of nitric-pyrochloric-hydrogen peroxide mix (2.0: 2.0: 4.0 mL respectively) with continuous steering for 4-6 hours to blend acids with tissue. The resulting sample was heated to 100-200 ºC for one hour and then cooled. After that, the sample moved to 150ml Teflon baker to wash digestion tube twice and add washing water to the baker and then vaporize the solution under 70-8 ºC using heating plate to nearly dry. The residue was dissolved with 5ml concentrated nitric acid and then with 25 ml diluted nitric acid for about 5%. Later, heavy metals were measured using flame atomic absorption spectrophotometer.

## Results and Discussion

Results showed significant difference in pollution between the two sampling points. Fish samples in point B were higher in pollutant content than (Cd in liver, gills and muscles =3.330±0.114, 3.130±0.321, 2.785±0.205; Pb in gills, liver and muscles = 22, 121±1.222, 12.655±0.092, 3.873±0.205; Zn, in liver, muscles, and gills = 16.021±2.983, 27.179±1.329, 18.616±0.261; Cu in liver, gills and muscles = 17.358±0.617, 6.964±0.530, 4.112±0.341; and As in liver, muscles and gill = 16.732±2.700, 7.097±0.494, 4.045±0.165 respectively).

Besides, rates of heavy metals vary among glimpse, liver and muscle samples depending on water pollution level, nutrition, habitat, and water column. Liver and glimpse samples were found to be more polluted than muscles, as they showed higher rates of heavy metals than the permissible levels set by (FAO, 1989) & (FAO, 1983) especially Pb and As. This negatively affect fish growth, reproduction and health, which influence public health directly. Such contamination was caused by the wastes dumped in the river by factories and sewage systems. Such fish are not suitable for human consumption as they can cause accumulation of toxic materials in the human body and therefore can be source of disease, especially cancerous. In addition, tests revealed difference in the concentrations of heavy metals among liver, glimpse and muscle samples. Heavy metals quantity in muscles was the least (table 1)& (figure1) due to the lack of adipose tissue in muscles .Such materials couldn't get rid of if they penetrate deep into the tissue, especially fat tissue, which face difficulty in disposing such materials because of the weak blood circulation inside such tissue. This agree with (Agha *et al*., 2007) study, as they found that concentrations of heavy metals in the muscles of four fish species in the Persian Gulf were less than that in other body parts. Heavy metals accumulate in fish bodies, especially livers, in various concentrations from one organ to another. Studies asserted that the accumulation of heavy metals in the liver was higher than that in the muscles (Table 2) & (figure 2) due to the strong vulnerability to such accumulation in the tissue because of their favorable position in the circulation system that enables the absorption of more heavy metals, which travel via blood on one hand, and due to the metalothionine function of the liver that is vital to bind metals together to be moved to other body parts where they wait to be disposed outside the body for liver tissue are very active in absorbing and stocking heavy metals (Chaffai *et al*., 1997). Gills are normally in direct contact with water, therefore heavy metals levels in them vary according to the concentrations of the those metals in water (Evans, 1987). Gills are one place where ionic exchange happen between the living organism and the environment because of the nature of such organism, especially in terms of respiratory function. Therefore, gills are major absorption and disposing stations for pollutants and chemicals (Table 3) & (Figure 3).

**Table 1 :** The heavy metals mg/kg in the gills of the region A and B.

| Positions / Heavy metals | Area A | Area B | Significance |
|---|---|---|---|
| Cd | 1.776±0.071 | 3.130±0.321 | ** |
| Pb | 9.668±0.081 | 22.121±1.222 | ** |
| Zn | 11.476±0.078 | 18.616±0.261 | ** |
| Cu | 2.521±0.024 | 6.967±0.530 | ** |
| As | 1.921±0.026 | 4.035±0.165 | ** |

**p≤ 0.01

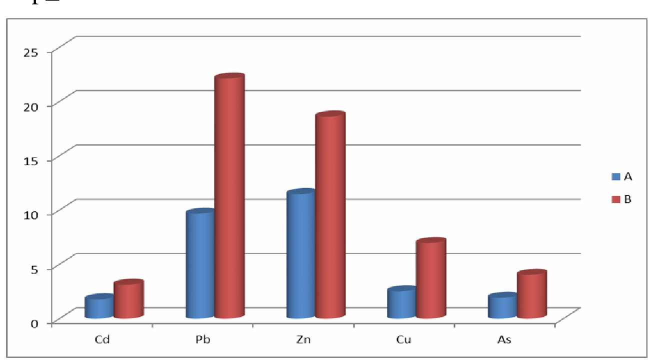


**Fig. 1 :** Heavy metals in the gills of 2 river regions

**Table 2 :** The heavy metals mg/kg in the muscles of the region A and B.

| Positions / Heavy metals | Area A | Area B | Significant |
|---|---|---|---|
| **Cd** | 1.638±185 | 2.785±0.205 | ** |
| **Pb** | 2.957±0.26 | 3.873±0.205 | ** |
| **Zn** | 21.716±0.074 | 27. 179±1.324 | ** |
| **Cu** | 1.929±0.078 | 4.112±0.341 | ** |
| **As** | 2.797±0.221 | 7.097±0.494 | ** |

**p≤ 0.01

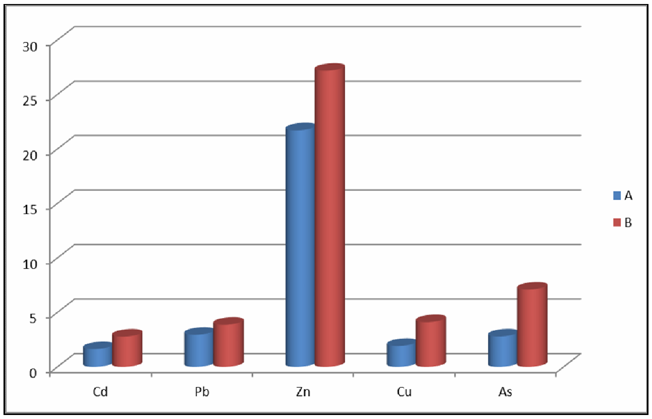


**Fig. 2 :** Heavy metals in the muscles of 2 river regions

**Table 3 :** The heavy metals mg/kg in the Lever of the region A and B.

| Positions / Heavy metals | Area A | Area B | Significant |
|---|---|---|---|
| **Cd** | 1.836±0.041 | 3.330±0.114 | ** |
| **Pb** | 3.655±0.101 | 12.655±0.092 | ** |
| **Zn** | 42.23±1.322 | 61.021±2.983 | ** |
| **Cu** | 13.138±0.465 | 17.358±0.617 | ** |
| **As** | 9.020±0.217 | 16.732±2.700 | ** |

**p≤ 0.01

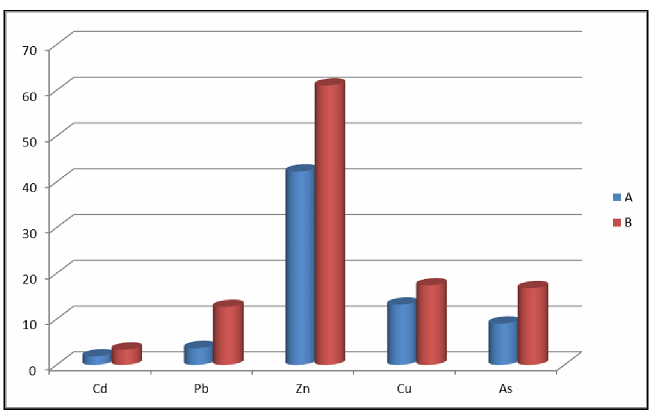


**Fig. 3 :** Heavy metals in the liver of 2 river regions

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