



## Determination of some heavy metal pollution in fish and water samples from Khartoum State

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### Abstract

Heavy metals (lead, cadmium, chromium and Nickel) were determined in thirteen tilapia fish samples (fresh and cooked) and three water samples collected from Jabel Awlia, Alozozab, Almourada and Alsamrab.

Analysis of Three fish samples (flesh, skin and crust) collected from Jabel Awlia, Alozozab and Almourada, the flesh show the presence of (Pb :0.253 ppm and Ni :0.094 ppm), the skin show the presence of (Pb :0.862 ppm and Ni :0.1740 ppm) and the crust show the presence of (Ni :0.623 ppm). In Alozozab samples, the flesh shows the presence of (Ni: 0.498 ppm and Cd: 0.0006 ppm), the skin show the presence of (Ni: 1.202ppm and Cd: 0.346 ppm) and the crust show the presence of (Ni: 0.344 ppm). In Almourada samples, the flesh show the presence of (Pb: 0.682 ppm, Ni: 0.163 ppm, Cr: 0.0137ppm and Cd: 0.004 ppm), the skin show the presence of (Ni: 0.003 ppm) and the crust show the presence of (Ni: 0.101 ppm and Pb: 0.077 ppm). Two cooked fish samples (flesh and skin) collected from Almourada and Alsamrab, the flesh show the presence of (Ni: 0.394 ppm, Cr: 0.106 ppm, Cd: 0.089 ppm and Pb: 0.002 ppm) and the skin show the presence of (Ni: 0.299 ppm). In Alsamrab samples, the flesh show the presence of (Ni: 0.168 ppm and Pb: 0.122 ppm) and the skin show the presence of (Ni: 0.928 ppm, Pb: 0.356 ppm and Cd :0.250 ppm).

Analysis of water sample collected from Jabel Awlia, show the presence of (Pb: 0.366 ppm, Cr: 0.150 ppm and Ni :0.033 ppm). Two samples collected from Alozozab (Bridge and Drainage water), the Bridgewater sample show the Presence of (Cd :0.025ppm and Cr: 0.242ppm) and Drainage water sample show the presence of (Ni: 0.206 ppm, Pb: 0.157ppm and Cr: 0.0194 ppm).

**Keywords:** Pollution, heavy metals, fish, water

### Introduction

Pollution is the introduction by human, directly or indirectly, of substances or energy into the environment resulting in deleterious effects of such nature, as to endanger Human health, harm, and living resource or interfere with, amenities or other legitimate use of the environment <sup>[1]</sup>.

Heavy metals are a group of elements between copper and lead on the periodic table of the element having atomic weights between 63 and 200, specific gravities greater than 4.0 and density exceeds 5 g/ cm, <sup>[3]</sup> they are natural constituents of the earth's crust and are present in varying concentrations in all ecosystems.

Human activity has, drastically, changed the biogeochemical cycles and balance of some heavy metals. They are stable and persistent environmental contaminants since they cannot be degraded or destroyed. Therefore, they tend to accumulate in the soils, sea water, fresh water, and sediments.

Excessive levels of metals in the marine environment can affect marine biota and pose risk to human consumers of seafood. Living organisms require trace amounts of some heavy metals such as mercury, lead and cadmium have no known vital beneficial effect on organisms and their accumulation, over time, in humans causes serious illness.

A stricter definition restricts the term to those metals heavier than the rare earth metals, at the bottom of the periodic table. In medical usage, the definition is considerably looser, and heavy metal poisoning can include excessive amounts of iron and manganese <sup>[2, 3]</sup>.

One such pollution is marine pollution by heavy metals. Heavy metals accumulate in the marine environment then are transferred to the marine organisms e.g. Fish by different ways. When their concentrations are in excess, they became toxic and cause several health problems, the fish become sick then die when certain levels of contamination are exceeded <sup>[4]</sup>.

The first Case of Cadmium poisoning was reported in Japan in the form of "itai itai" or "ouch ouch" disease a large number of people suffered from the disease where their bones became fragile <sup>[5]</sup>.

Heavy metals such as mercury (Hg) cadmium (Cd), arsenic (As), lead (Pb), chromium (Cr) are dangerous to human health or to the environment. some may cause corrosion, However, some of these elements are, actually, necessary for humans in minute amount such as cobalt (Co), copper (Cu), chromium (Cr) nickel (Ni), while others are carcinogenic, effecting the central nervous system (Hg, Pb, As) the kidney or liver (Hg, Pb, Cd, Cu) or skin, bones or teeth (Ni, Cd, Cu, Cr) <sup>[6]</sup>.

The Objective of this investigation is to determine the extent of heavy metal pollution in fish and water sample from Khartoum State.

### Materials and Methods

#### 1. Materials

Fish and water samples were, randomly, collected as shown in Table 2.1 and 2.2 below.

**Table 2.1:** Sample type and collection area

Sample	Type	Collection area
1	Flesh	Jabel Awlia
2	Skin	Jabel Awlia
3	Crust	Jabel Awlia
9	Flesh	Alozozab
10	Skin	Alozozab
11	Crust	Alozozab
4	Flesh	Almourada
5	Skin	Almourada
6	Crust	Almourada
7	Flesh	Almourada (cooked)
8	Skin	Almourada (cooked)
12	Flesh	Alsamrab (cooked)
13	Skin	Alsamrab (cooked)

**Table 2.2:** Water Sample and collection area

Sample	Type	Collection area
14	Water	Jable Awlia
15	Water	Alozozab (Bridge)
16	Water	Alozozab (Drainage)

## 2. Methods

Standard AAS procedures were used to determine Pb, Cr, Cd and Ni<sup>[7,8]</sup>.

## Results and Discussion

Table (3.1) and (3.2) show Analysis results of Fish and water samples which were taken from Jabel Awlia showed that the concentration of Pb in fish (flesh, skin, crust) and water samples were more than accepted values in WHO in Table (3.3).the highest concentration recorded is 0.862ppm in fish sample (skin),while Cd was not detected in fish (flesh, skin and crust) and water sample,the concentration of Cr in fish sample (flesh, skin and crust) were not detected

but the water samples given high concentration (0.1596 ppm), while the concentration of Ni in fish (flesh, skin and crust)and water samples varies the highest concentration recorded (0.622ppm) in fish sample (crust). These high concentrations may result from human activities in this area such as contamination from car washing materials and discharged residues of oils, in directly the Nile, which has significant effect on the ecological balance of the Nile and the Nile organism.

Analysis results of fish sample which was taken from Almourada market showed that the concentration of Pb in fish sample (flesh and Skin) were more than the accepted values in WHO in Table (3.3), the highest concentration recorded is 0.6824ppm in fish sample (Flesh), the concentration of Cd and Cr in fish sample (Flesh and Skin) were not detected except in fish sample (Flesh) recorded of Cd (0.0043ppm) and this value was less than the Accepted values in Table (3.3) while of Cr was given high concentration (0.0137ppm),the concentration of Ni in fish sample (Skin and Flesh) varies. These high concentrations may result from human activities in this area such as agriculture waste.

Analysis results of fish sample which was taken from Almourada market (cooked) showed that the concentration of Pb in fish sample (flesh and Skin) were less than the accepted values in WHO in Table (3.3) ,the concentration of Cd in fish sample (flesh and skin)were not detected accept in fish sample (flesh) were more than the accepted values in Table (3.3) while the concentration of Cr and Ni in fish sample (flesh and Skin) were high, These high concentrations recorded in Almourada and Alsamrab market (cooked sample) may result from exposed the sale of foods to contamination by fluently.

### 1. Concentration of heavy metals in (fish and water) samples:

**Table 3.1:** Concentration of Heavy metals in fish samples

Sample	Type	Collection Areas	Concentration of metal, mg/Kg			
			Pb	Cd	Cr	Ni
1	Flesh	Jabel Awlia	0.253	ND	ND	0.094
2	Skin	Jabel Awlia	0.862	ND	ND	0.174
3	Crust	Jabel Awlia	ND	ND	ND	0.623
9	Flesh	Alozozab	ND	0.0006	ND	0.498
10	Skin	Alozozab	ND	0.346	ND	1.202
11	Crust	Alozozab	ND	ND	ND	0.344
4	Flesh	Almourada	0.682	0.0043	0.0137	0.499
5	Skin	Almourada	ND	ND	ND	0.003
6	Crust	Almourada	0.077	ND	ND	0.101
7	Flesh	Almourada (cooked)	0.002	0.089	0.106	0.394
8	Skin	Almourada (cooked)	ND	ND	ND	0.299
12	Flesh	Alsamrab (cooked)	0.122	ND	ND	0.169
13	Skin	Alsamrab (cooked)	0.356	0.250	ND	0.928

**Table 3.2:** Concentration of Heavy metals in water samples

Sample	Collection areas	Concentration of metals(mg/L)			
		Pb	Cd	Cr	Ni
14	Jable Awlia	0.366	ND	0.157	0.033
15	Alozozab (Bridge)	ND	0.025	0.242	ND
16	Alozozab (Drainage)	0.157	ND	0.0194	0.206

**Table 3.3:** Levels of some heavy metals in fish which reported by WHO

Heavy metal	Concentration (mg/kg)
Cd	0.030
Pb	0.050

**ND= Not Detected**

Analysis results of fish and water samples which were taken from Alozozab bridge showed that the concentration of Pb in fish (flesh, skin and crust) and water samples were not detected except in the water sample (drainage) were more than the level in WHO in Table (3.3), the concentration of Cd in fish (flesh, skin and crust) and water samples were less than the accepted values in Table (3.3), except (0.346ppm) in fish sample (Skin) more than the accepted values in Table (3.3), the concentration of Cr in fish sample (flesh, skin and crust) were not detected, while the water sample (drainage) recorded high concentration (0.242ppm), the concentration of Ni in fish (flesh, skin and crust) and water samples varies the high concentration recorded is (1.202ppm) in fish sample (skin), The concentration of Cr may result from discharge chemical and paint industries and domestic waste directly into White Nile without treatment it first, the concentration of Ni and Cd in water sample were not detected, These high concentrations may due to from discharge that pollutant and heavy metals are accumulated in Nile environment then transfer to Nile Organisms.

Analysis results of fish sample which was taken from Alsamrab market (cooked) showed that the concentration of Pb in fish sample (flesh and Skin) were more than accepted values in WHO in Table (3.3), the high concentration recorded is (0.3561ppm) in fish sample (skin), the concentration of Cd in fish sample (Skin) recorded is (0.2497ppm) and that value was more than accepted in values in Table (3.3), the concentration of Cr in fish sample (flesh and skin) were not detected, the concentration of Ni in fish sample (flesh and Skin) were high and high concentration recorded is (0.9285ppm) in fish sample (Skin).

**Conclusion**

- Results of analysis by using A.A.S for tilapia fish and water samples shown that the concentration of Pb in Jabel Awlia area were high in Fish, skin and water, in Almourada area were high in Flesh and crust, in Alozozab area was high in water (Drainage), in Alsamrab area (cooked) were high in Flesh and skin.
- The concentration of Cd in Almourada area (cooked) was high in Flesh, in Alozozab area were high in skin and water (Bridge), in Alsamrab area (cooked) was high in skin.
- The concentration of Cr in Jabel Awlia area was the highest in water, in Almourada area (cooked) was the highest in Flesh, in Alozozab area was the highest in water (Bridge).
- The concentration of Ni in Jabel Awlia were the highest in skin and crust, in Almourada area was the highest in Flesh, in Almourada area (cooked) was the highest in Flesh, in Alozozab area were the highest in Flesh and skin, in Alsamrab area was the highest in skin.

**Recommendation**

1. Car washing on the Niles banks, should be prohibited as the practice pollute Niles water and damage the environment of living organisms.
2. The practice of selling food on public road should controlled to prevent food pollution from cars exhauste.
3. Promote public heath awareness of the dangers of pollution.

4. Promote the use of easily hydrolysed chemicals to prevent chemical pollution by accumulation of toxic elements.
5. Promote public awareness with importance of environment protection as a collective responsibility the public and state.
6. Promote the use of clean Energy resource.

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