Asian J. Exp. Sci., Vol. 22, No. 3, 2008; 411-414 **Short Communication**

Bioaccumulation of Cadmium in Tissues of *Cirrihna mrigala* and *Catla catla*

Jyotsna Singh[1], K. Kant[2], H.B. Sharma[3] and K.S. Rana[4]

1 Department Zoology, K.L. Mehta Dayanand College for Women, Faridabad-121001 (Haryana); India.
2 Department Physics, K.L. Mehta Dayanand College for Women, Faridabad-121001 (Haryana); India.
3 Department Zoology, BSA College, Mathura (U.P.); India
4 Department Zoology, Agra College, Agra (U.P.); India

Abstract : Increasing industrialization, along with the violation of effluent disposal norms, has caused heavy contamination of water bodies. Fish and other aquatic biota in the vicinity of industrial areas are a good indicator for gauging the level of pollution. Heavy metals like Cadmium (Cd), Chromium (Cr), Zinc (Zn), Copper (Cu), Plumbum (Pb), Nickel (Ni), and Mercury (Hg) have proven to be persistent pollutants. Though present in traces and being lipophilic, heavy metals tend to bioaccumulate and biomagnify. Their accumulation in biotic tissues causes toxic effects. The present study is undertaken to gauge the accumulation of Cadmium in fish tissue, when live fish is subjected to sublethal dose of Cadmium for a period of 15 to 60 days in controlled environments of Aquaria. The tissues from liver, gill, muscle and kidney were subjected to Atomic Absorption Spectroscopy (AAS) and electrophoresis for assessing the amount of Cadmium accumulated in various tissues at the end of 15 days and then after 60 days. Atomic absorption spectrum showed that the tissues of Mrigala were more resistant to accumulation of Cadmium than those of Catla. Maximum accumulation was found in the gills and liver, followed by muscles, while minimum accumulation was seen in kidneys. In the above estimation it has been found that tissues of Mrigala were more resistant to accumulation of Cadmium than those of Catla. These fishes are used as bio-indicators because they tend to accumulate heavy metals and show their effects. As these fishes are extensively used for human consumption, this finding urges either greater regulation for industrial effluent discharge, or exploration of alternative fish species that accumulate less pollutant.

Key words : Pollution, Heavy metals, Cadmium, Tissue, Water.

Introduction

Faridabad is the industrial hub of Haryana (India) where a large number of diverse products are manufactured. There are numerous industrial units dealing in production of lubricants, glues, rubber paints, pigments and dyes, pesticides, fertilizers, pharmaceuticals, ceramics, metallurgy, refrigeration, machine tools, textiles, dyeing, printing, electrical equipment, batteries, inverters, electroplating, asbestos sheets, bricks etc. Despite the instructions of Pollution Control Board to install ETPs and discharge the effluents only after the pollutants have been removed, there is no strict vigil and the rules are conveniently flouted. The untreated effluents are discharged into water or dumped in ground from where they may seep into underground waters and into the local water bodies due to which it suffers the scourge of soil, air and water pollution. Heavy metals like Zinc, Copper, Lead, Chromium, Nickel and Cadmium are

*** Corresponding author :** Jyotsna Singh, Department Zoology, K.L. Mehta Dayanand College for Women, Faridabad-121001 (Haryana); India; E-mail: *divyajyotsnasingh@gmail.com*

discharged in the water bodies without extracting the pollutants (Singh *et al*., 2006). Cadmium is discharged in large quantities from battery and inverter manufacturers, dyeing, printing and electroplating units. It tends to accumulate in tissues of biotic, flora- fauna and has deleterious effect on fish (Barman and Lal, 1994). Fish, as they come into intimate contact with large amounts of polluted water, can be used as early warning biological indicators of polluted environment (Das and Kaviraj, 1990; Faiberg *et al*., 1986; Sherry and Abidi, 2002; Pasco *et al*., 1986; Ashram *et al*., 2003; Shastry *et al*., 1997; Shukla and Shastry, 1998). In the present study, the accumulation of Cadmium in fish tissue (live fish was subjected to sublethal dose of Cadmium for a period of 15 to 60 days in controlled environments of aquaria) has been gauged.

Materials and Methods

a) *Collection And Acclimatization of Fish*

The fingerlings of *Catla catla* and *Cirrihna mrigala* were collected from the department of Fisheries, Badkhal Lake, Faridabad (Haryana). The fishes were acclimatized for one month in separate aquaria in the laboratory at room temperature in chlorine- free tap water and food was given in measured quantities at fixed time. The fish of each species were separated in two batches each: one for control and the other for subjection to sub lethal doses of Cadmium sulphate (Finney, 1978). One batch from each species was sacrificed after 15 days and the other after 60 days. Tissue samples were collected and prepared for Atomic Absorption Spectroscopy (AAS) (Curry *et al*., 1969).

(b) *Tissue Collection and Digestion for AAS*

The first batch of fish was sacrificed after 15 days of exposure and the second after 60 days. Tissue from liver, muscle, gills, and kidneys was collected and weighed quickly 1gm each and digested to prepare a clear solution by heating it in 5 ml mixture of Nitric Acid + Sulphuric acid+ Perchloric acid in Kdjeldal Flasks at 125°C for many days and adding nitric acid very slowly at intervals till the brown fumes of the Sulphuric acid ceased and the volume of the residue was made to 50ml by addition of distilled water (Curry *et al*., 1969).

(c) *Atomic Absorption Spectroscopy (AAS) for Heavy Metal Assay*

Atomic Absorption Spectroscopy is an optical technique based on characteristic pattern emission or absorption of light by atoms or molecules and suitable for estimation of metals (Lindsay and Norvell, 1978; Cyril *et al*., 1994; Thiruvalluvam *et al*., 1997; Nussey *et al*., 2002). Atomic Absorption measurements were carried out and calculations made.

Analyte concentration was expressed as % of metal calculated from the following formula:

$X = m*100/M$

X – Standard for weight of the metal in sample

m- Microgram of the metal per milliliter of test solution (obtained from reading)

M- The mass in micrograms per milliliter of the sample in test solution.

Result and Discussion

Accumulation of Cadmium in tissues of experimental fish in ppm as shown by Atomic Absorption Spectroscopy is given in Table-1. The bioaccumulation of Cadmium is much lesser in Mrigala than those of Catla. Hence, Mrigala appears resistant to Cadmium and efficiently excretes it. In the gills, there is maximum accumulation in both the fishes as they are maximally exposed to water for branchial respiration. There is substantial accumulation of cadmium in liver also followed by muscle while minimum accumulation is seen in kidneys.

Table 1 : Accumulation of Cadmium in Tissues of Experimental Fish in ppm as shown by Atomic Absorption Spectroscopy

Name of Fish	Name of Tissue	Control	Exposure 15 Days	Exposure 60 Days
Catla	Gill	<5	20	55
	Muscle	<5	25	55
	Liver	<5	25	50
	Kidney	<5	20	40
Cirrihna	Gill	<5	<5	15
	Muscle	<5	<5	5
	Liver	<5	<5	8
	Kidney	<5	<5	5

In Catla gills, the level of Cadmium rose from < 5 ppm (in control specimen) to 20 ppm after 15 days and to 55 ppm after 60 days exposure. In Catla muscle, the level of Cadmium rose from <5 ppm (in control specimen) to 25 ppm after 15 days and 55ppm after 60 days exposure.

In Catla liver, the level of Cadmium rose from < 5 ppm (in control specimen) to 25 ppm after 15 days and 50 ppm after 60 days exposure. In Catla kidney, the level of Cadmium rose from < 5 ppm (in control specimen) to 20 ppm after 15 days and 40 ppm after 60 days of exposure. The results show that in Catla tissues, accumulation of Cadmium doubles after 60 days exposure when compared to that of 15 days exposure.

In Cirrihna mrigala tissues, the concentration did not rise in 15 days of exposure and rose only minimally from <5 to 15 ppm in gills, 5 ppm in muscle, 8 ppm in liver and 5 ppm in kidneys.

The results show that the accumulation is maximum in gills and minimum in kidneys.

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