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Bioaccumulation of Lead In Freshwater Fish *Channa punctatus*

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ABSTRACT

Bioaccumulation of Lead in the freshwater fish *Channa punctatus* was investigated after exposure to a sub lethal concentration of 5ppm of Lead acetate in the aquarium containing 41L of water and was examined after 30 days of exposure. The maximum level of accumulation of lead was observed in the liver whereas the lowest level of lead was observed in the muscle tissues at the end of 30 days of exposure period. It thus exhibits that accumulates primarily in the liver tissues of *Channa punctatus* exposed to sublethal concentration of lead acetate.

Key words : Bioaccumulation, Lead and *Channa punctatus.*

INTRODUCTION

The aquatic environment plays a vital role for functioning of ecosystem and is intimately related with human health. The increasing human population and industrial development has worsened the problem of disposal of anthropogenic chemicals and wastes in the aquatic environment.

Among all types of aquatic pollutants, heavy metals are of greatest concern because after reaching in the aquatic bodies they not only deteriorate the life sustaining quality of water but also cause damage to both flora and fauna. Heavy metal contaminants in aquatic ecosystems pose a serious environmental hazard because of their persistence and toxicity. Study of toxicology pertaining to aquatic animals has become important in water pollution studies in the present days.

Metals can accumulate in aquatic organisms, including fish, and persist in water and sediments (Luoma and Rainbow, 2008). Since fish occupy the top of the aquatic food chain, they are suitable bioindicators of metal contamination. Fish take up metals through the gills, digestive tract and body surface (Tao *et al.*, 2001; Kamunde *et al.*, 2002). Various metal ions are involved in oxidative stress in fish. The most im-portant and most studied metals are Fe, Cu, Cr, Hg and Pb and metalloids As, Se. Among the heavy metal pollutants, Lead is a major environmental pollutant in many parts of the world. It is one of the most toxic and non-biodegradable elements. Lead accumulation in sediment is of significance for aquatic organisms. Lead can induce oxidative damage through direct effects on the cell membrane, interactions between lead and hemoglobin, which increase the auto-oxidation of hemoglobin. The toxic effect of lead is primarily the

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inactivation of enzymes and proteins by the binding with sulfhydryl group etc. It is an immunotoxicant which through human exposure results in immune function changes and has the potential to adversely affect human health.

Fishes absorb lead by different ways through gills and skin or by ingestion of contaminated water and food; and may lead to high mortality rate or cause many biochemical and histological alterations in survived fish (Coetzee, L. 1998). The accumulation of heavy metals in the tissues of fishes may cause various physiological defects and mortality (Torres *et al.*, 1987). The pattern of bioaccumulation of metals in animals differs from metal to metal and organ to organ during their functional status. Most of the investigations pertaining to heavy metals contaminants in aquatic systems are dealt either with toxicity or with accumulation (Rushforth *et al.*, 1981; Khadiga *et al.*, 2002). Heavy metals have been shown to be concentrated in the liver of various fishes (Sorensen, 1991; Rao *et al.* 1998). In the present study, the bioaccumulation of Lead in the different tissues is evaluated in the fish, *Channa punctatus* exposed to sub-lethal concentration of lead for
30 days.

MATERIALS AND METHODS

Sexually immature healthy specimens of freshwater teleost *Channa punctatus* having length between 14-18 cm and weight of about 40-55 g were selected for lead exposure. The fishes were treated with 0.05% KMnO4 solution for 2 minutes to avoid any dermal infection before left for acclimatization for 7 days in the laboratory in glass aquarium containing 41litre non-chlorinated tap water. Proper aeration was done during the period and the fishes were fed with Spirulina special fish food. Feeding was stopped 24 hour prior the commencement of the experiment. The water of the aquarium was changed after every 48 hour leaving no faecal matter, unconsumed food or dead fish if any. The water quality parameters of aquarium and a 12h photoperiod were maintained.

The acclimatized fishes were separated into two groups consisting of 8 fishes in each aquarium .One group served as the controlled group and the other as the experimental group. The experimental group of fishes was exposed to a sub lethal concentration of 5ppm lead acetate for a period of 30 days in the aquarium tank filled with 41 litres of water.

C.punctatus were sacrificed after the exposure period and the tissues like liver, kidney, gills and muscle were dissected out from the experimental and control groups and samples were prepared to determine the accumulated lead by atomic absorption spectrophotometer.

The tissue samples were prepared by taking about 0.2g of each sample which is digested with 3:1 ratio of nitric acid and perchloric acid. The samples are then heated up to 60˚C for about 1hour until a pale yellow colour solution is appeared which is then cooled to room temperature and the final volume is made up to 50ml by distilled water.

The concentration of the accumulated lead in the tissues samples is then determined by measuring in Atomic absorption spectrophotometer. Values were expressed as mg / g wet wt.

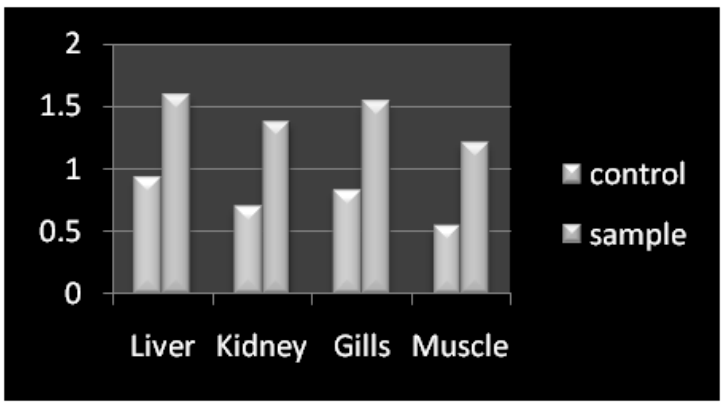
RESULTS AND DISCUSSION

The levels of lead accumulation in the different tissues such as liver, kidney, gills and muscle of *Channa punctatus* exposed to sub-lethal concentration of lead acetate for a period of 30 days are shown in Table 1.A comparison of the tissues of the experimental group with the controlled group are shown in Fig 1. In the present investigation the highest accumulation of Lead was found on the liver (1.585±0.265) followed by Gills, kidney and muscles. Muscles accumulating the lowest level (1.205±0.255). The same was reported for arsenic in *Labeo rohita* (K. Pazhanisamy *et al.*, 2007; Swati *et al.*, 2012) and for lead in *Labeo rohita* (Pandi prabha *et al.,)* . This will lead to liver damage.

Sexually immature healthy specimens of freshwater teleost *Channa*

Table1. Comparison of accumulation of lead in different tissues of controlled group and experimental group of *Channa punctatus*

Fish tissues	Controlled group(mg/g)	Experimental group(mg/g)
LIVER	0.93±0.010	1.585±0.265
KIDNEY	0.70±0.005	1.38 ±0.25
GILLS	0.82±0.007	1.535±0.245
MUSCLE	0.54±0.004	1.205±0.255



Tissues of *Channa punctatus*

Figure 1. comparision of concentration of lead in different tissues of controlled and lead exposed *Channa punctatus*

The reason behind the liver damage was due to decrease in the level of protein, lipids, glycogen and metabolic enzymes (Zodape, 2010).The liver of fish was important organ for ecotoxiocological study and it was the prime site for accumulation of lead (Ahmed and Bibi, 2010; Vinodhini and Narayanan, 2008; Lal Shah and Ahmed Altindau, 2005).Accumulation of lead in Gill comes next in the order due to its large surface area's contact with the water. Since, Kidney is the doorway for heavy metal detoxification in the body, accountable amount of lead accumulation was observed. Heavy metals were uniformly spread over the body muscles. Hence, the muscles are known to have less accumulation of lead than other. The heavy metals were uniformly spread over the body muscles. Hence, the observed values were relatively lower than the other potential organs. The presence of higher amounts of heavy metals in any parts of the body will definitely induce changes in biochemical metabolisms and other induced stresses (Vinodhini and Narayanan, 2008).

CONCLUSION

Studies on the accumulation of heavy metals in various organs of the fresh water fish exposed to sublethal concentrations were very much important. The information can be used to evaluate the biochemical changes in the fish metabolism

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