

Studies on some physiological aspects in fresh water fish *Ophiocephalus striatus* (Channa) in relation to heavy metal cadmium (Cd) toxicity

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(Received: August 13, 2008; Accepted: October 04, 2008)

ABSTRACT

Metal are integral part of all ecosystems occurring in both elemental as well as locked from. Some of them are vital components of living system known as essential metal ions. Heavy metals like cadmium (cd), Arsenic (As) which is present in industrial wastes create a serious water pollution problem. Cadmium is widely distributed mineral deposit and found in shale and igneous rocks, coals, sand stone, lime stone, lake and marine sediment soil etc. Its commercial production has been done from mines. Nickel cadmium batteries are the major source of cadmium. These batteries used in all two wheeler four wheeler and inverter also. After the use of batteries it throws out in waste. These wastage batteries can leak the Nickel Cadmium oxides in to the soil and in rainy season this should be reaches up to fresh water bodies which are extremely adverse effects on fish as well as all aquatic ecosystems. The heavy metal contaminated food fish may causes cancers in humans.

Key words: Fresh water, Fish Lethal Concentration, Cd, Metal etc.

INTRODUCTION

Metals are the natural components of earth's crust and humans have come in contact with many of them from the early phases of civilization. For the majority of heavy metals, it is certain that their present rate of exploration, direct or indirect use and concentration in the environment is extremely high in comparison of previous centuries. The environmental concern regarding heavy metal is complex. While trace amount of some of them are essential for plant and animal life. The oldest toxins recognized by our species were probably derived from food from the was recognized after the working of metals become more than an occasional event. Metals were the first industrial toxins.

Heavy metals like cadmium (cd), mercury (Hg), Lead (Pb) which are present in industrial waste create serious water pollution problem. It was

detected that cadmium (Cd) content in tissues of fish living in Minamata Bay in Japan is very high (Thomas - 2006). The hazards of eating these cadmium contaminated fish in Japan come to public attention in 1956 when 121 people are died due to eating contaminated fish. The symptoms of lack of contaminated fish. The symptoms of lack of coordination paralysis, difficulty, swallowing, convulsions and brain damage became known as Minamata disease (Thomas Gale 2006).

Environmental pollution by heavy metals is very prominent in areas of mining and old mines sites and pollution reduces with increasing distance away from mining sites (Peplow, 1999). These metals are leached out and in sloppy areas are carried by acid water downstream of run-off to the sea. Through mining activities water bodies are mostly polluted (Garba 1995) through rivers and streams, the metals are transported as either dissolved species in water or as an integral part os

suspended sediments. They may then be stored in river bed sediments or seep into the underground sources partial harmful wells and the extent of contamination will depend on the nearness of the well to the mining sites.

Due to the natural, geochemical and anthropogenic factor, the infiltration of toxic heavy metals into aquatic ecosystem is on the increase. These toxic heavy metals in aquatic ecosystem are carried via the food chain to the upper trophic level and create a serious ecological problem. (Bedi Cicik 2003).

Methodology

Selection and identification of fish

We select the fish *Ophiocephalus striatus* which is widely distributed cosmopolitan fresh water, and important food fish through out the world. It is a hardy fish which are characteristics feature is presence of air breathing organs. That's why this fish is highly tolerable to reduced oxygen level in water. It is commonly called as channa and its locally known as "Murrel" or "Dokla". It is popularly known as snake headed murrel. It is found in fresh water reservoirs dam, ponds, river and muddy shallow

water bodies also. Genus ophiocephalus has three species namely *Ophiocephalus marulius*, *Ophiocephalus punctatus* and *Ophiocephalus striatus*.

Lethal concentration (LC50)

Selection and maintenance of test animals in laboratory

The fish are used in this experiment are collected from their breeding places brought to the laboratory environment and acclimatized for 2 weeks to laboratory conditions in glass hambers (Aquaria) measuring 40cm width × 120 cm. in length & 40cm. in height. The initial mean weight & length of fish were 100 ± gm & 25-30 cm. respectively. There was no significant different ($P > 5$) between the mean weights & length of the fish used in the experiments. Because the metabolic activity changes with size & affects the parameters to be measured, individuals of similar size & weight were used in this experiment. The room temperatures during the experiments were 32-35°C. Five aquaria, 1st of which was designates as a control, were used to conduct experiments. Other four aquaria are used as a experimental to find out the LC 50 values at 72hrs duration.

Table 1.

S. No.	Quantity of water	conc. of toxicant (Heavy metal) cdcls2 Mg/lit	No. of Animal faced (approx. 100 gm each)	Period (duration) hrs	No. of animals dead	% mortality	% porbit kill
1	20lit	0.5	10	24	1	-	-
				48	3		
				72	4		
				96	6		
2	20 lit	0.6	10	24	2	50%	5.00
				48	4		
				72	5		
				96	8		
3.	20 lit	0.7	10	24	3	50%	
				48	5		
				72	6		
				96	9		
4.	20 lit	0.8	10	24	5	50%	-
				48	7		
				72	8		
				96	10		

MATERIAL AND METHODS

Five aquaria are used those experiments of which 1st was used as a control & other four used as a experimental. All aquaria filled with 20 lit of tap water. The four aquaria were added to make the 0.5, 0.6, 0.7 & 0.8 mg/lit cadmium chloride. Ten fish were added to all five aquaria & observe the fishes during 72 hrs. period for 50% mortality. Every day water of aquarium was replenished to make the metal concentration constant. All the control and experimental fishes were fed once daily during the experimental period. From data analysis we

observed the 0.6 mg/lit CdCl₂ conc. indicate the 50% mortality during 72hrs. (Table 1 and Fig 1).

RESULTS AND DISCUSSION

The acclimatization of fish to heavy metals has been proved in Rainbow trout was exposed 0.15 & 0.30 mg/lit for 96 hrs it shows 50% mortality (LC 50) (Gintras 1999) & the solution of two different kinds of heavy metals with conc. 0.16 mg/lit & 0.19 mg/lit of 96 hrs it shows LC 50 value. (Gintras 1999). The probit kill % value calculated from conversion table of % mortality to % probit kill which is given by

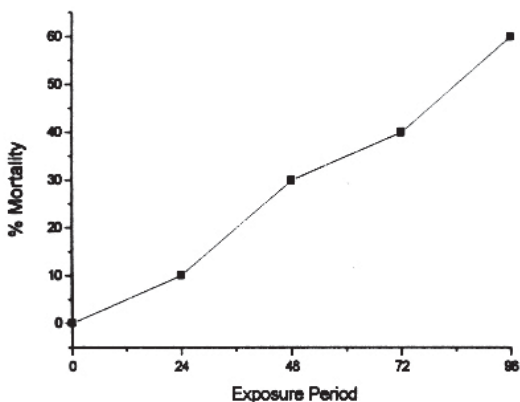


Fig. 1(a): 0.5 mg/lit CdCl₂ exposure to ophioccephalus striatus

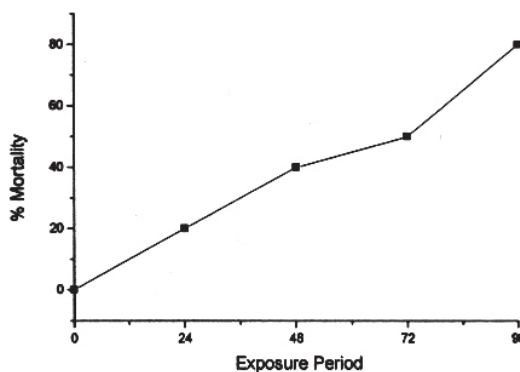


Fig. 1(b): 0.6 mg/lit CdCl₂ exposure shows 50% mortality in 72 hours to ophioccephalus striatus

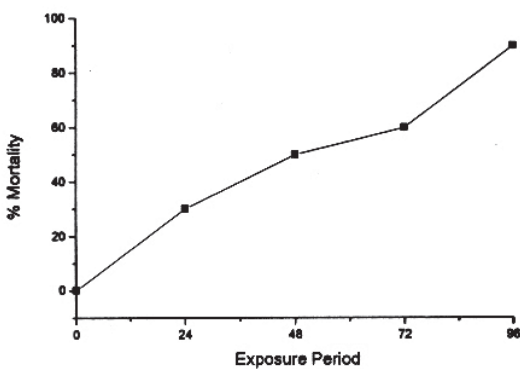


Fig. 1(c): 0.7 mg/lit CdCl₂ exposure to ophioccephalus striatus

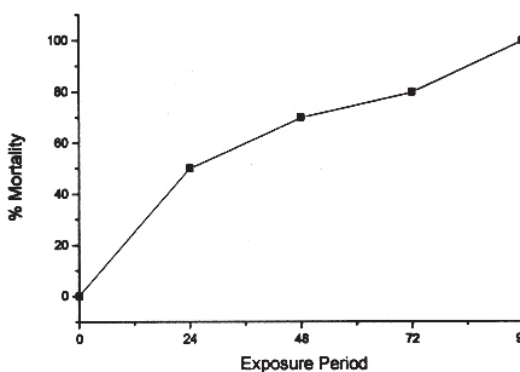


Fig. 1(d): 0.8 mg/lit CdCl₂ exposure shows to ophioccephalus striatus

Finny (1964). The LC 50 value is more closer with respect to the hardness of water particularly in fresh water carps in heavy metal toxicity of 0.5 mg/lit CdCl₂ of 96 hr. LC 50 (Alicia, 2005). Heavy metal toxicity indicate in following order Hg²⁺>cd>cu (Bedii cicik 2003). Many researcher has work on the toxicity of CdCl₂ on fish some of them are states that LC 50 value indicates that no general rule for exactly 50% mortality, this value is associated with so many factors viz, nature of chemical or metals,

physiological condition of organism, size, weight, physico-chemical properties of water, temp, avoidane capacity of animals etc. (Bedii cicik 2003).

The Green mussel are more tolerable than the fresh water fishes to heavy metal toxicity (C.V. Mohan 1996). The Hg is more toxic than CdCl₂ in fresh water carps, the LC 50 or 96 hrs of Hg is 0.10 mg/lit where as CdCl₂ is 0.5 mg/lit (C.V. Mohan 1986).

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