

Toxic Effect of Zinc Sulphate on Some Freshwater Fishes

Lalit Choudhary¹, Tanay Vyas², Pritha Pandya³, Teena Sharma⁴ and Seema Bharadwaj*⁵

^{1,2,3,4}Department of Zoology, Leo College, Banswara (Rajasthan) India

⁵Department of Zoology, HDJ Govt. Girls College, Banswara (Rajasthan) India

Abstract : *The effects of toxicity on the aquatic organism are attracting wide attention. The high toxicity of industrial pollutants and their hazardous nature on the aquatic environment has been a matter of concern because a large number of deaths of fishes and other aquatic organisms occurred in different aquatic bodies due to a load of heavy metals and other pollutants. The 240 hours LC₅₀ values for zinc sulphate were found to be 51.08 mg/l for *Danio devario*, 38.15 mg/l for *Puntius ticto* and 46.42 mg/l for *Puntius conchoni*. Opercular beats also increased in high concentrations. Feeble opercular beat with struggling for breathing activities was noticed in fishes of different constructions of heavy metals. Metal has its toxic effect on the skin of fishes because the loss of scales was observed in treated fishes. Abnormal and uncoordinated swimming behavior and irregular gill movements were clearly visible in high concentrations.*

Keywords—*Anthropogenic, Heavy Metal, Pollutants, Toxicity.*

Introduction

The danger of aquatic life infiltration of heavy metals is because of the discharge of effluents from various industries which is a prominent cause of water pollution. Zinc pollute the water and disturb the whole aquatic ecosystem, hence this needs exploration of different aspects of fish biology. Zinc is a common metal found in many discharges. Heavy metals are common environmental pollutants because of industrial, agricultural and other anthropogenic activities [1]. Industrial development and chemical

contamination are very dangerous for fishes [2]. Factors influencing the toxicity of zinc compound and their mode of action on fish and on other aquatic animal have been reviewed and discussed by [3]. [4] measured the acute toxicity of zinc to different fishes. [5] observed the acute toxicity of zinc polluted stream on four species of salmonids. [6] noticed the toxicity of zinc sulphate to rainbow trout. Furthermore, the main physicochemical factors (pH, temperature, solubility and hardness) were studied in relation with acute toxicity of zinc on selected freshwater fishes. [7], [8], [6], [9], [10], [11] and [12]. The toxicity effects of zinc, copper and cadmium (Zn, Cu and Cd) on common carp were studied by [13].

Heavy metal pollution possesses a great threat to fishes. When fishes are exposed to the elevated level of heavy metal in the polluted aquatic ecosystem then they take these metals direct from their environment [14]. Heavy metal contamination of aquatic ecosystem is a serious ecological issue which has lethal effects on the ecological balance of aquatic environment and biodiversity [9]. Erosion is the main cause of natural emission of Zn to aquatic habitats and forest fires are a common source for natural inputs of Zn to air [11]. [15] noticed the effect of metals on fish gills. The present study was the evaluation of 240 hours toxic level to *Danio devario*, *Puntius ticto*, and *Puntius conchoni* with zinc sulphate and also evaluation of the effect of zinc metals on physicochemical parameters. [16] observed the effect of zinc on bone metabolism of *Cyprinus carpio*.

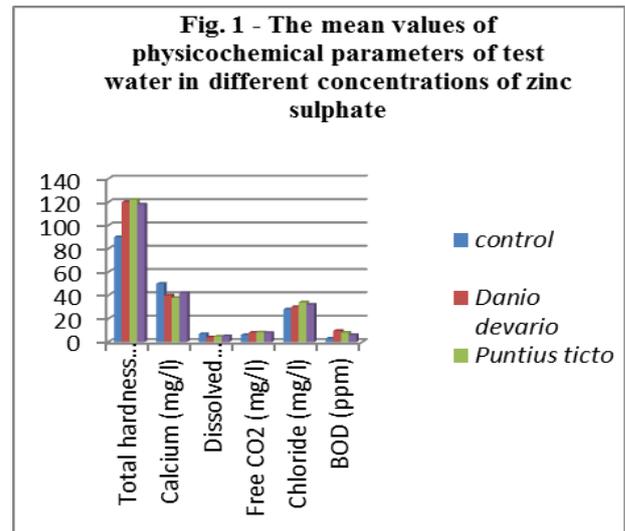
Material and Method

Zinc as zinc sulphate was chosen for the present work because it is a very common heavy metal and has definite toxic effects on aquatic life. Fish *Danio devario*, *Puntius ticto* and *Puntius conchonius* were selected for this study because it is easily available in the locality. These fishes are sensitive species and can be well experimented in laboratory aquaria. A stock solution of used chemical was prepared then different experimental concentrations were prepared with this stock solution. The control fishes were maintained under similar conditions without the addition of used metal. The water of aquaria was changed twice a week to maintain the constant concentration of heavy metal.

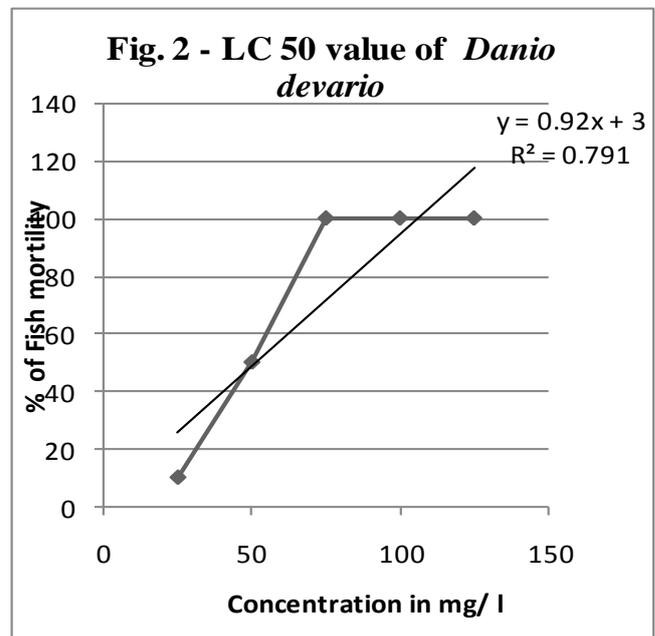
The living specimens of fishes were obtained from local fishermen and then they held in the aquarium and fed 1% of body weight per day with dry shrimp's powder. The fishes were acclimatized to well water conditions for a period of one week. Static bio-assays were performed by exposing various concentrations of ferrous sulphate and zinc sulphate. In each aquarium 30 litres of water was used with the renewal of test solutions to every 24 hours, the range of weight and range of length were noted before keeping in different concentrations of ferrous sulphate and zinc sulphate. The well water was used as test water. The physicochemical analysis of test water was done according to the procedures described in APHA, AWWA and WPCFC [17].

Results

The mean values of physicochemical parameters of test water in different concentrations of zinc sulphate have been shown in fig. 1.

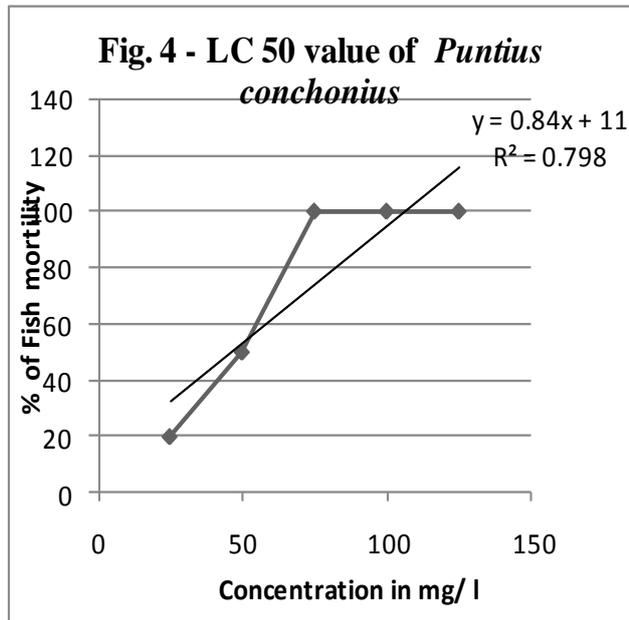
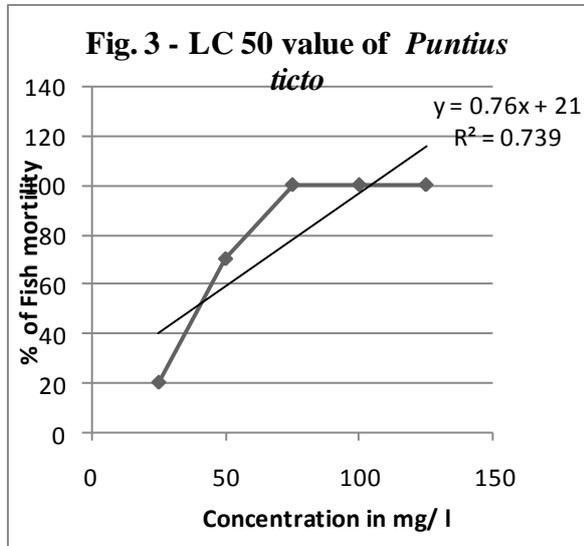


The 240 hours LC50 values for zinc sulphate were found to be 51.08 mg/l for *Danio devario*, 38.15 mg/l for *Puntius ticto*, and 46.42 mg/l for *Puntius conchonius* (Fig. 2, 3 & 4).



Opercular beats also increased in high concentrations. Feeble opercular beat with struggling for breathing activities was noticed in fishes of different constructions of heavy metals. Metal has its toxic effect on the skin of fishes because the loss of scales was observed in treated fishes. Abnormal and uncoordinated swimming behaviour and irregular gill movements were clearly visible in high concentrations. All these changes were not

recorded in control sections from the above results and discussion, it can be concluded that used zinc sulphate has various toxic effects on fish *Danio devario*, *Puntius ticto* and *Puntius conchoniuis*.



Discussion

The results of the present study were in supporting range as reported for bluegill, sunfish, golden fish and fathered *Minnows* and *Nemachilus barbatulus* by [8] and [18].

In the present study, the deposition of white precipitate along with a slight increase in pH and hardness was recorded. This has also been

confirmed by [8] and further, they observed that in case of bluegill, sunfish treated with zinc sulphate, only soluble zinc ions were responsible for the death of the fish. [19] and [20] reported the effect of total hardness and pH on the acute toxicity of zinc to selected freshwater fishes. The investigations made by [21] with acute toxicity of zinc to rainbow trout and brook trout were due to increase in the pH with increasing hardness and alkalinity similar observations were also made in the present study in respect of zinc sulphate.

[22] observed a number of fishes death of shiners and carps in 4 to 24 hours in 2.9 ppm in distilled water. [14] reported that *Minnows* and *Lauciscus phoximus* were killed in about 3 hours in 315 ppm in distilled water. [14] also noted that goldfish *Caressius suratus* was killed in 2 to 10 hours in 1000 ppm in hard water while 100 ppm in pond water was apparently not harmful to goldfish in a 96-hour exposure.

[23] [24] observed LC50 values of zinc 96h on *Mtynnis fasciatus* and *Modiolus philippinarum* while [12] reported the LC50 values of zinc for the at 24 h, 48 h, 72 h and 96 h on *Percocypris pingi*. [25] worked on the accumulation of zinc in carp. Results of opercular beat and swimming behaviour of present study show similarities with the finding of [26][27].

Conclusion

From the above results, it can be concluded that the heavy metal pollutants zinc sulphate causes toxic effects on fishes. With the current results it is clear that $ZnSO_4$ has toxic effect on biotic and abiotic components of aquatic habitat including fish and physicochemical parameters. The present study indicated that *Danio devario*, *Puntius ticto* and *Puntius conchoniuis* were very sensitive to zinc sulphate.

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