

Short term effect of zinc chloride LC-50 on physicochemical parameters of water after exposure on *Ophiocephalus punctatus*.

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Abstract:

Zinc is an essential element and cause deleterious effect at high concentration to both the animals and plants. In the present study, we observed that the zinc chloride at lethal concentration fifty alters the behavior of fish which also change the physico-chemical properties of water. It was observed that the zinc chloride steadily increased the pH, conductivity, free CO₂ and total alkalinity of water from 24 to 96 hrs., whereas the dissolved oxygen concentrations in water was gradually decrease. It is concluded that the increasing pH, conductivity, free CO₂ and total alkalinity of water and decrease in oxygen could be due to increase in the metabolic process of *Ophiocephalus punctatus* upon exposures to zinc chloride at lethal concentration 44.25 mg/lit.

Keywords: Zinc, Physico-chemical parameter, *Ophiocephalus punctatus*, etc

Introduction:

The *Ophiocephalus punctatus* (*Channa punctatus*) is fresh water murrel. It is known as spotted snakehead. It is usually present at the bottom of water bodies and in India, it occurs in most of the fresh water ecosystem.

Zinc is an essential trace element for all living organisms. As a constituent of more than 200 metalloenzymes and other metabolic compounds, zinc assures stability of biological molecules such as DNA and of biological structures such as membranes and ribosomes (Vallee 1959; National Academy of Sciences [NAS] 1979; Casey and Hambidge 1980; Mason *et al.* 1988; Llobet *et al.* 1988b; Leonard and Gerber 1989). Clinical manifestations of zinc deficiency in animals include growth retardation, testicular atrophy, skin changes, and poor appetite (Prasad 1979). Zinc poisoning has been documented in some mammals and fishes, usually as a result of ingesting galvanized metal objects, certain paints and fertilizers, zinc-containing coins, and skin and sun block preparations containing zinc oxide (Wentink *et al.* 1985; Ogden *et al.* 1988; Lu and Combs 1988a; Binnerts 1989; Robinette 1990). Aquatic populations are frequently decimated in zinc-polluted waters (Solbe and Flook 1975; Everall *et al.*, 1989b). Zinc in the aquatic environment is of particular importance because the gills of fish are physically damaged by high concentrations of zinc (NAS, 1979).

Zinc concentrations in fish and other aquatic vertebrates are modified by diet, age of the organism, reproductive state, and other variables. In fish, diet is the major route of zinc uptake. In juveniles, accumulation of zinc from the aquatic medium takes place more rapidly than in embryos or larvae (Cutshall *et al.*, 1977; Eisler

1981). A reduction in the level of zinc in serum during egg formation in a flatfish (*Pleuronectes platessa*) may represent a transfer of zinc to eggs (Overnell *et al.*, 1987b). High zinc concentrations in eggs of Atlantic salmon are sometimes associated with increasing mortality, although low concentrations seem to have no adverse effect on survival (Craik and Harvey 1988).

Material and Methods:

Healthy fingerling of *b punctatus* measuring the size 15-20 cm were purchased from local fish market. It was carried to the laboratory in hygienic condition and acclimatize for 15 days. During this period of acclimatization fish were feed with boil egg and rice bran. Zinc LC-50 for 96 hrs was carried out thrice to confirm exact dose of LC-50. Then the fish were divided into six groups. Each group was contained 20 fish each. Later all the fish were exposed to lethal concentration of zinc for 24, 48, 72 and 96 hrs. the estimation of water was carried out at the interval of 24 hrs after real start time.

The parameters like atmospheric temperature, water temperature, pH and conductivity were analyzed with the help of thermometer and water analysis kit developed by Labtronic, India. And rest of the chemical parameters such as dissolved oxygen, free carbon dioxide and total alkalinity as CaCO_3 were analysed with the help of the procedures given in APHA (1985), Khanna and Bhutani, (2004), Bhalerao (1998) and Kodarkar (1992).

Observation:

Zinc is the essential elements require for the physiological process in the living organism but when its concentration increases it disturbs the physiological process. In the present study the attempt was made to explore its effect on the physic-chemical characteristics of water after exposure to fish. It was observed that the zinc at its different concentration variably affects the physico-chemical parameters of the water such as temperature, pH, conductivity, dissolved oxygen, free carbon dioxide and alkalinity as CaCO_3 .

Temperature: The average temperature of water in controlled aquarium was estimated 22.8 ± 0.394 °C. In an experimental aquarium the temperature exhibited no consistency (Table-1). The maximum (23.85 ± 0.150 °C) temperature was noted on the 2nd day and minimum (22.88 ± 0.515 °C) on the first day of exposure.

pH: The negative logarithmic hydrogen ion concentration was found consistently increased from 1st to 4th day of exposure (Table-1). The maximum (6.838 ± 1.020) pH was observed on the 4th day and minimum (6.385 ± 0.010) on the day 1st of exposure. The average pH in the water was observed 6.385 ± 0.010 throughout the period of exposure.

Conductivity: In the controlled aquarium the average conductivity was measure 0.258 ± 0.011 mmhoscm⁻¹. The conductivity was consistently increased from the 1st day 4th day of exposure (Table-1). The minimum (0.392 ± 0.003 mmhoscm⁻¹) conductivity was noticed on the 1st day and maximum (0.532 ± 0.005 mmhoscm⁻¹) on the 4th day of exposure.

Dissolved Oxygen: The dissolved oxygen content in the water of controlled aquarium was found 0.375 ± 0.025 mg/l. On the first it got decreased to 0.325 ± 0.025 mg/l. Later it was observed consistently increased up to 3rd day and then it got decreased (0.400 ± 0.041 mg/l) on the 4th day. The maximum (1.525 ± 0.063 mg/l) dissolved oxygen was noticed on the 3rd day and minimum (0.325 ± 0.025 mg/l) on the 1st day (Table-1).

Free Carbon dioxide: The average free carbon dioxide observed in the controlled aquarium was 25.30 ± 2.144 mg/l. On the first day of exposure it was observed to increase. From the day 1st till 4th day of exposure, there was no consistency in free carbon dioxide content occurred (Table-1). The maximum (27.72 ± 122 mg/ml) increase was estimated on the 2nd day and minimum (24.68 ± 3.288 mg/l) on the 4th day of exposure.

Alkalinity as CaCO₃: The average alkalinity of water in the controlled aquarium was estimated 23.25 ± 0.025 mg/l. It was observed that the alkalinity was increase consistently from the 1st day to 4th day of exposure (Table-1). In the course of exposure, the minimum (24.35 ± 0.236 mg/l) alkalinity was observed on the 1st and maximum (26.25 ± 0.479 mg/l) on the 4th day.

Result and Discussion:

In the present study, Zn toxicity was noticed by fish mortality. Shetty *et al.* (2007) reported that the determination of acute toxicity is usually an initial screening step in the assessment and evaluation of the toxic characteristics of all compounds. Likewise, De Schamphelaere and Janssen (2004) reported that fish mortality might be a more sensitive endpoint for assessing effect of Zn exposure. The LC-50 (96 hrs) of zinc chloride for *O. punctatus* was found 44.25 mg/l of tap water. It is observed that the toxicity of any chemical is determined by supporting factors like pH, temperature and alkalinity, otherwise the little amount of xenobiotic substance alone exert the effect lately. Thus, this factor helps the toxic substance to accelerate the effect on target organ or tissue or animal as a whole.

Bengeri and Patil (1986) have suggested that, 65.0 mg/l of zinc causes the 50% mortality of *Labeo rohita* upto 96 hrs of exposure. Hilmy *et al.* (1987) were reported 13.0 and 26.0 mg/l of zinc for *Tilapia zillii* and *Clarias lazera*. The variation in LC-50 values among the different studies may be due to the variations in kinetic variables of water and environment that may play a role in explaining these differences. Weatherley *et al.*, (1980) and Wood (2001) stated that zinc bioavailability and toxicity to aquatic organisms are affected by pH, alkalinity, dissolved oxygen, and temperatures. Alabaster and Lloyd (1982) and Everall *et al.*, (1989) stated that zinc toxicity to fish can be greatly influenced by the pH. Hilmy *et al.* (1987) found that 96 hrs LC-50 for both fishes increased with the decrease in water temperature. Eisler (1993) reported that the acute 96 hrs LC-50 values for fish were between 66 and 40,900 µg zinc/l depending on many factors including pH, alkalinity, dissolved oxygen, and temperatures.

Table:1 : Effect of zinc chloride(LC-50) on physico-chemical parameters of water for short term exposure.

Sr. No	Parameters	Control	24 hrs	48 hrs	72 hrs	96 hrs
1	Temperature °C	22.8 ± 0.394	22.88 ± 0.515	23.85 ± 0.150	23.65 ± 0.655	22.93 ± 0.319
2	pH	6.263 ± 0.075	6.385 ± 0.010	6.478 ± 0.039	6.675 ± 0.015	6.838 ± 1.020
3	Conductivity	0.258 ± 0.011	0.392 ± 0.003	0.454 ± 0.004	0.485 ± 0.008	0.532 ± 0.005
4	Dissolved oxygen	0.375 ± 0.025	0.325 ± 0.025	1.350 ± 0.065	1.525 ± 0.063	0.400 ± 0.041
5	Free CO ₂	25.30 ± 2.144	27.11 ± 1.319	27.72 ± 2.122	24.93 ± 4.735	24.68 ± 3.288
6	Alkalinity as CaCO ₃	23.25 ± 0.025	24.35 ± 0.236	25.00 ± 0.408	25.75 ± 0.250	26.25 ± 0.479

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