



BEHAVIORAL CHANGES OF COMMON CARP EXPOSED TO ZINC OXIDE NANOPARTICLES

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ABSTRACT

The present study deals with the behavioral change of fresh water fish common carp *Cyprinus carpio var. communis* exposed to zinc oxide nanoparticles in. Zinc nanoparticles were synthesized using precipitation method. *Cyprinus carpio* was exposed to different concentration (250mg, 500mg, 1000mg, 1500mg and 2000mg) of ZnO nanoparticles for a period of 14 days. Behavioural changes were observed from day 1 of exposure of fish to ZnO nanoparticles till 14th day. The activities like Circular motion, jerk moment, aggressive behavior, surface respiration and bottom resting were affected due to the exposure of ZnO nanoparticles.

KEYWORDS

Behavioral changes, zinc oxide, nanoparticles, Common carp.

INTRODUCTION

In recent decades, nanoparticles have been increasingly manufactured and used in daily consumer products, such as textiles, pharmaceuticals and cosmetics, as well as in pollution treatment and remediation process (Masciangioli *et al.*, 2003 & Nohynek *et al.*, 2007). Widely used nanoparticles, will most likely to enter the ecosystem and may produce a physiological response in many animals, possibly altering their fitness and many materials might ultimately change their densities or community populations. Aquatic organisms have been linked to decrease in survival and reduction of reproductive ability (Pelgrom *et al.*, 1995, Liao *et al.*, 2003). Among nanoparticles, ZnO nanoparticles are widely used. Fishes are vulnerable to ZnO nanoparticles because it can induce gill injury and acute lethality. The work related to the synthesis and behavioral changes of common carp *Cyprinus carpio var. communis* exposed to ZnO nanoparticles is totally wanting. Hence the present study was carried out.

MATERIALS AND METHODS

Zinc Sulphate and Sodium hydroxide was purchased from Loba chemicals, India. All the reagents used for the synthesis ZnO were analytical grade and used without further purification. All the glass wares were washed thrice with deionized water and dried before use.

Synthesis of Zinc Oxide Nanoparticles

The Precipitation method was adopted for synthesis of zinc oxide nanoparticles. 0.03 mole of 14.377g ZnSO₄ were dissolved into 500mL of distilled water and stirred vigorously using magnetic stirrer for 20 minutes. Precipitation was achieved by adding 50ml of 1 M NaOH solution in drop wise under vigorous stirring. The initial pH was observed as 3 and it was increased to pH 12 using 1M NaOH. Then precipitating process was continued until white color precipitate obtained. Then the ZnO precipitate was taken into centrifuge tube and centrifuged at 2000 rpm for 15 minutes. The centrifuged process continued with water and two times with ethanol. Then the precipitate was dried and then subjected for calcination at 500°C for 3 hrs. Finally, Zinc oxide nanoparticles (ZnO) formed.

Healthy fingerlings of *Cyprinus carpio* were procured from SGC fish farm, E. Pudthupatti, Theni and acclimatized to laboratory conditions for about 10 days before the commencement of the experiment. During acclimatization, fish were fed with rice bran and ground nut oil cake once a day. Feeding was given at least one hour prior to replacement of water. Water (one-third) was

changed frequently to remove the excretory wastes. Feeding was withheld for 24 h before the commencement of the experiment to keep the experimental animals more or less in the same metabolic state. During acclimatization, the fish stock was maintained at natural photoperiod and ambient temperature. This ensures sufficient oxygen for the fish and the environment is devoid of any accumulated metabolic wastes.

For behavioral studies, different concentrations of the ZnO nanoparticles (i.e. 100, 600, 1000, 1500, 2000mg/10L) were taken in 10 litre plastic troughs. A control was maintained with tap water and without ZnO nanoparticles. Ten healthy fish, with an average length of 15 cm and average weight of 12.6 g were selected and introduced into each trough. The behavior of fish was observed in each concentration for fourteen days.

RESULTS AND DISCUSSION

Synthesized Zinc oxide nanoparticles by precipitation method is presented in Fig.1.

FIGURE 1: SYNTHESIS OF ZnO NANOPARTICLES



The behavioral changes of Common carp exposed to different concentrations of ZnO nanoparticles are presented in Table 1.

TABLE 1: BASIC OBSERVATION OF FISH

S. No	Activity	Yes	No
1	Circular swimming	✓	-
2	Jerk movement	✓	-
3	Bottom resting	✓	-
4	Surface respiration	-	-
5	Aggressive movement	-	✓
6	Excess of mucous secretion	-	✓
7	Mortality observation	-	✓
8	Behavior observation	Good	
9	Breathing movement	Good	

The behavioral changes of the fish were observed daily and control group showed normal behavior during the experimental period.

Circular swimming, Jerk movement, Bottom resting and Surface respiration were noticed among the fishes. Keerthika et al (2016) reported similar behavioral changes in fresh water fish *Labeo rohita* exposed to iron oxide nanoparticles. Chen et al(2011) also reported behavioral effects of titanium dioxide nanoparticles on larval Zebra fish.

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