Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

J E Z S Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(5): 1804-1806

Received: 10-07-2020
Accepted: 16-08-2020

Sheethal K.U
Department of Aquatic Environment Management, College of Fisheries Mangaluru, Karnataka, India

Telugu Chandra Mohan
Department of Aquatic Environment Management, College of Fisheries Mangaluru, Karnataka, India

Gangadhara Gowda
Department of Aquatic Environment Management, College of Fisheries Mangaluru, Karnataka, India

Harsha Nayak
Department of Aquatic Environment Management, College of Fisheries Mangaluru, Karnataka, India.

Sruthisree
Department of Aquatic Environment Management, College of Fisheries Mangaluru, Karnataka, India

Corresponding Author:
Telugu Chandra Mohan
Department of Aquatic Environment Management, College of Fisheries Mangaluru, Karnataka, India

Acute toxicology of Nickel to Nile tilapia, *Oreochromis niloticus* (Linnaeus, 1758)

Sheethal K. U, Telugu Chandra Mohan, Gangadhara Gowda, Harsha Nayak and Sruthisree

Abstract
Since ten years fresh water bodies influencing by different contaminants, among all heavy metals are considered as the most important pollutant. Nickel metal is used in as a raw material various industries. As it toxic and alter the physiological and haematological parameters of fish. In the present study, acute toxicity test was used for determination lethal toxicity of Nickel Chloride in the fingerlings of Nile tilapia, *Oreochromis niloticus* as the test organism. Toxicity test is most reliable for accessing effect of toxicants on aquatic life. The Static bioassay test was conducted to estimate acute toxicity of Nickel to the fresh water fingerlings of Nile tilapia *Oreochromis niloticus*. Fish were exposed to selected concentration of Nickel and the mortality data were determined after 96 hours with 6 hrs interval of mortality observation.

Keywords: Acute toxicity, nickel chloride, Nile tilapia, *Oreochromis niloticus*

Introduction
Since last few decades increase in population density, industrialization and agricultural activities have resulted in more and more wastes entering in fresh water resources. Contamination of fresh water with a wide range of pollutants has become a matter of concern over last few decades due to the damage caused to aquatic life especially fishes due to discharge of effluents from various industries, agriculture run off consisting heavy metals, insecticides, pesticides, fertilizers, chemicals [1]. Nickel metal is a ubiquitous trace metal and occurs in soil, water, air, and in the biosphere. It is nonessential and highly toxic which is distributed and released in the aquatic environment. Nickel is widely used in industry and is the dominant chemical species pollutant in natural waters [2]. It is released into the environment by both natural and anthropogenic sources [3]. Toxicity test is vital tool for accessing the action and fate of toxicant in aquatic ecosystems. Also it is necessary to derive the water quality standard for chemicals and to identify the suitable organisms as bio indicators [4]. Evaluating the heavy metals acute toxicity to fish will aid to design environmental monitoring strategies and ecosystem fortification measures. Hence the present study attempted to evaluate the acute toxic concentration of Nickel chloride in Nile tilapia (*Oreochromis niloticus*).

Statistical Analysis
The data collected were plotted statistically into regression lines (mortality in probit/concentration *i.e.*, probit kill/concentration) according to the method which allows the calculation of average lethal concentration (LC_{50}) for 24, 48 72 and 96 hrs [5].

Materials and Methods
Fresh water fish**,** *Oreochromis niloticus* fingerlings (Weight: 9.5-12g; Length 8.5-10 cm) were collected from the fish farm and acclimated to laboratory conditions for a period of 15 days in large FRP tough, previously washed with 1% potassium permanganate to free walls from microbial infection, if any. The fish were maintained in de-chlorinated tap water of the quality used in the test and whose physico-chemical characteristics were analyzed according to standard protocol [6] listed out in Table 1. Only healthy fishes were taken for experiment. Stock solution of Nickel chloride ($NiCl_2$ $6H_2O$) was prepared by dissolving appropriate amount of $NiCl_2$ $6H_2O$ as Ni salt in distilled water. An acute toxicity (LC_{50}**)** test by the static bioassay method was conducted to determine the toxicity of nickel in *Oreochromis niloticus.* Fishes were exposed to various concentrations of Nickel for 96 hrs.

Simultaneously, the control group was also maintained. After 96 h of exposure the data collected were plotted statistically into regression lines (mortality in probit/ Concentration i.e., probit kill/ Concentration) according to the methods of probit analysis which allows the calculation of lethal concentration (LC_{50}) for 96hrs.

Results

The concentration of Nickel for this study were selected based on the preliminary work where in which concentration of Nickel gave 10% to 100% mortality of tilapia fingerlings in 96h. The 96h LC_{50} value of nickel for fingerlings was found to be 46.98 ppm at 96h (Fig 1). However, the results in control group showed no death of test animals. Fish mortality increased with the concentration of nickel. Ten number of fishes in each tough were used.

Discussion

The present study indicated that the fingerlings of Nile tilapia (*O. niloticus)* proved very resistant to Nickel chloride with 96 hours and LC_{50} value was found to be 46.98 ppm. During the experimental period, fishes were observed to be reacting strongly even to slightest disturbance. Such behavioural abnormalities included rapid swimming accompanied by increased rate of opercular opening. The values obtained from the current study were clearly indicated that the LC_{50} of Nickel chloride is mainly influenced by size of fish [7].

The toxicity of Nickel sulphate to fresh water fish, *Channa gachua* found to show LC_{50} as 150 ppm. Further, their results indicated that Nickel sulphate poses toxic effect on fish, *Channa gachua* which is evident by the findings of present investigations and LC_{50} values.

It was opined that fish mortality may have resulted by absorption, bioaccumulation of Nickel sulphate in the fish. The LC_{50} values of Nickel was recorded to be 51.39 mg/L for 96 hrs in *Oreochromis mossambicus* [8]. Lethal studies with Nickel sulphate, Nickel chloride in *Labeo rohita* by different concentrations of nickel, and the lethal concentration values were 15.0 ppm and 40 mg/L respectively [9]. The LC_{50} in *Oreochromis mossambicus* was 37 ppm with Nickel chloride for 96 hours [10]. In addition to that the 96 h LC_{50} of nickel for five species such as rainbow trout (*Oncorhynchus mykiss*), three-spined stickleback (*Gasterosteus aculeatus*), perch (*Perca fluviatilis*), roach (*Rutilus rutilus*), dace (*Leuciscus leuciscus)* were found to be 19.3mg/L, 33.7mg/L, 48.1mg/L, 48.7mg/L, 61.2mg/L, respectively and also they concluded that lethal toxicity of Nickel varied with species, size and age of fish [11].

From the above it is well understood that liability of fishes to metals toxicity is to key factor in the lethal studies. Aquatic organisms are liable or non-liable to toxicity of one metal may be highly prone to toxicity to another metal at same concentration. In the same way metals showed their toxicity effect differently on organisms with same concentrations. The present investigation revealed that the mortality of fingerlings of Nile tilapia (*O. niloticus*) were dose and time dependent and might be due to bio concentration of nickel in tissues due to continuous exposure leading to the death of the fish. Fishes were highly sensitive to changes in their surrounding environment.

Assessing the acute toxicity of nickel to fingerlings of fish, *O. niloticus* will help to design environmental monitoring strategies and ecosystem conservation measures [12].

Conclusion

Anthropogenic activities are major source for contamination of aquatic ecosystem with heavy metals and among them nickel is the important. Hence toxicity of nickel metal to *O. niloticus* was determined using static bioassays following probit analysis.

Table 1: Chemical and physical characteristics of dilution water (All values are in mg/l, unless otherwise noted).

S. No.	Parameter	Values
1	Temperature	24±2°C
2	pH	7.6±0.2
3	Dissolved oxygen	8.5±0.8
4	Alkanity (as HCO_3)	284
5	Total Hardness	244±3.4 mg as $CaCO_3$/L

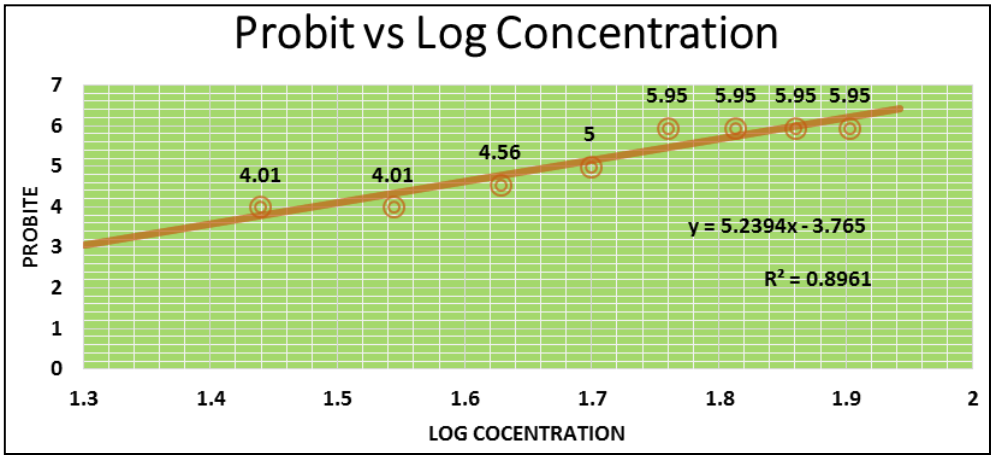

Fig 1: Graphical representation of 96 h LC_{50} of Nickel concentration in finger lings of Nile tilapia, *Oreochromis niloticus*

Acknowledgement

Authors are thankful to Dean (Fisheries) for their constant encouragement and valuable suggestion during my research tenure. I would like express my sincere gratitude to Dean, College of Fishery, Mangaluru, Karnataka Veterinary University, Bidar for supported by providing sufficient facilities during my study period.

References

1. Vutukuru SS. Acute effects of hexavalent chromium on survival, oxygen consumption, haematological parameters and some biochemical profiles of the Indian

major carp, *Labeo rohita*. Inter, J Environ. Res. Public Health. 2005; 2 (**3**):456-462.
2. Eisler R. Nickel hazards to fish, wildlife and invertebrates: a synoptic review. Biological Science Report USGS/BRD/BSR-1998-0001, Laurel, MD, 1998.
3. Karthikeyan S, Palaniappan P, Sabhanayakam S. Influence of pH and water hardness upon nickel accumulation in edible fish Cirrhinus mrigala. Jour.of Envir. Biol. 2007; 28 (2):489-92.
4. Sujata K. Toxicity of Nickel to fresh water fish, *Channa gachua* (Ham.). Cibtech Jour of Zool. 2016; 5:25-29.
5. Finney DJ. Probit analysis. 3rd (*ed*) London, Cambridge University Press, 1971, pp.333.
6. APHA. Standard Methods for the Examination of Water and Wastewater. 21st Edition, American Public Health Association/American Water Works Association/Water Environment Federation, 2005. Washington DC.
7. Allen, Heath G. Water pollution and fish physiology. Edition 2nd. Lewis publishers, 1995, pp: 6-7.
8. Dorey Benjamin AJ, Thatheyus. Acute Toxicity of Nickel and Cadmium to the Cichlid Fish, *Oreochromis mossambicus*. J zoolo. 2012; 2(4):19-22.
9. Bhatkar NV. Chromium, nickel and zinc induced histopathological alterations in the gill of Indian common carp *Labeo rohita* (Ham.). J of Appl and Natural Sci. 2010; 2(2):234-238.
10. Muthulingam M, Revathi SK, Ronald Ross P, Ravichandran S, Thenmozhi P. Effect of heavy metal, nickel chloride on protein and amino acid levels in gill, liver and kidney of freshwater fish, *Oreochromis mossambicus*. Indo Asia. J. of Multi Resea (IAJMR). 2015; 1:213-221.
11. Gintaras Svecevicius. Acute Toxicity of Nickel to Five Species of Freshwater Fish. Polish J. of Environ. Stud. 2010; 19(2):453-456.
12. Agarwal SK. Bioassay evaluation of acute toxicity levels of mercuric chloride to air breathing fish, *Channa punctatus* (Bloch.): Mortality and Behaviour study. J of Environ. Biol. 1991; 12(2):99-106.