International Journal of Engineering and Technology Studies
Vol.1, No.1, pp.31-36, March 2014
Published by British Research Institute UK (www.gbjournals.org)

BIO-ASSAY OF SELECTED ENDOCRINE DISRUPTIVE CHEMICALS ON OREOCHROMIS MOSSAMBICUS

Dr.P.S.Navaraj
Associate Professor in Zoology

J.Yasmin
Yadava College, Madurai, India

ABSTRACT: *The toxicity of endocrine disruptive chemicals is a major concern today (Navaraj and Yasmin, 2012). Understanding the toxic range of the most confirmed endocrine disruptive chemical sources is a must. In line of this objective, a static renewal bioassay test conducted to determine the toxicity of Paper mill effluent, Cypermethrin and Zinc sulphate on the fresh water fish, Oreochromis mossambicus. Fish were exposed to various concentrations of Paper mill effluent, Cypermethrin, Zinc sulphate for 96 hours and the percent mortality was recorded. The 96h LC_{50} values 6.5%, 0.001ppm, 10.6 ppm of Paper mill effluent, Cypermethrin and Zinc sulphate respectively analysed for Oreochromis mossambicus. The fish is more sensitive to pesticide, Cypermethrin than effluent or zinc metal.*

KEYWORDS: Paper mill effluent, Cypermethrin, Zinc, Bio-assay, Oreochromis mossambicus.

INTRODUCTION

Bioassay is a test to assess the toxic range of the chemicals. This will expose the real toxicity of the chemical as well as the concentration at which the animal can be kept for probing. Earlier studies reported that Paper and pulp mill effluent has endocrine disruptive activity on fish (Hewitt *et al.,* 2000; Karels *et al.,* 2001). The Paper mill effluents are toxic because of low bio-degrability of tannins, lignins, resins, long chain fatty acids, terpenes and chlorophenolic compounds (Buzzini *et al.,* 2007). The toxic range assay of this effluent analyzed by Pathen *et al.,* (2009) in *Rasbora daniconius*. A lot of works indicated that Paper mill effluent has endocrine disruptive function (Navaraj and Yasmin, 2012). As there is no bioassay conducted on *Oreochromis mossambicus* with Paper mill effluent, hence this study.

Cypermethrin (pyrethroid) used to control many pests of cotton, cereals, vegetables, fruits, food storage and animal husbandry is proved to be toxic for aquatic organism (Gowland *et al.,* 2002). The lipophilicity of pyrethroids indicates that these chemicals will be readily absorbed by fish even in low concentrations (Doharty *et al.,* 1987). The LC_{50} value of cypermethrin on fresh water fish identified by different authors; Gupta *et al., (*1984) in *Channa striatus*, Devi *et al.,* (1981) in *Channa punctatus*, Arora and Kulshrestha in *Channa punctatus*, Basha mohideen *et al.,* (1989) in *Catla catla*, Kumar (1988) in *Lepidocephalichthys thermalis,* Rao and Murthy (1980) *in Anabus testudinus*, Ural and Saolam (2005) in *Rainbow trout*, Philips *et al.,* (2002) in *Labeo rohita*. Cypermethrin is an endocrine disrupting chemical (Moore and Waring, 2001; Alia Jaensson, *et al.,* 2007) and hence tested against the fish.

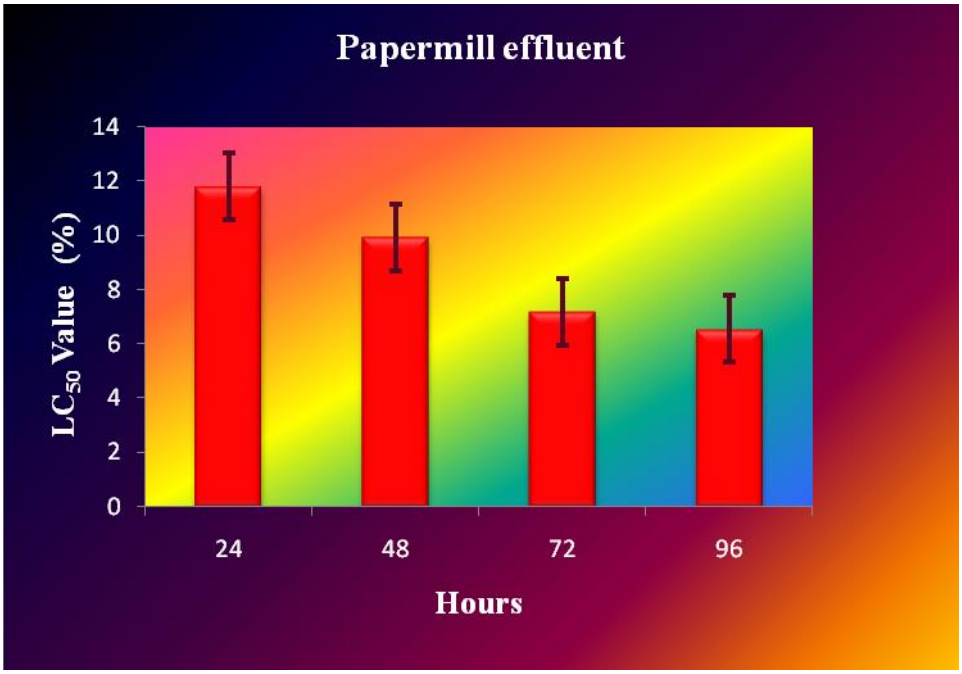
Heavy metal pollution in aquatic ecosystem poses a serious environmental hazard because of their persistence and toxicity. It is the vital source causing lethal effect on ecological balance of recipient environment and diversity of aquatic organism (Farombi *et. al., 2007*). Particularly, this heavy metal pollution poses a great threat to fish (Hoo *et al.,* 2004). The fish constitutes a valuable commodity from the stand point of human consumption and so heavy metal contamination on aquatic biota becomes a serious concern. Many authors found out zinc toxicity in fish, via disturbances in acid-base (Everall *et al.*, 1989) and iono-regulation, disruption of gill tissue (Hogstrand *et al.,* 1994). Zinc is a potential endocrine disruptive toxicant available in Paper mill effluent and therefore the impact of zinc metal on fish is probed in this study. The objective of the work is to assay the toxic range of chosen endocrine disruptive chemicals (Paper mill effluent, Cypermethrin and Zinc sulphate) individually against *Oreochromis mossambicus.*

MATERIALS AND METHODS:

The adult tilapia, *Oreochromis mossambicus*, used for the experiment collected from a local farm and transferred to glass aquaria (30 L) for acclimatization in laboratory condition for two weeks at a water temperature of 28 ± 10^0C. Feeding stopped 24 h prior to experiment. The effluent collected from the local Paper mill industry, Cypermethrin from local market and Zinc sulphate from local scientific company used in this experiment. The LC_{50} values analysed by the probit analysis method (Finney, 1982). The pollutants renewed daily. Preliminary screening was carried out to determine the appropriate lethal concentration range of the toxicants as described by Solbe (1995). Three sets of experiments conducted. In each set, ten acclimated fish kept in each aquarium containing different concentrations such as 1%, 4%, 7%, 10% of Paper mill effluent, 0.0001ppm, 0.0002ppm, 0.0003ppm of Cypermethrin and 8ppm, 16ppm and 24ppm of Zinc sulphate used for 96h toxicity assay. Feeding stopped during the bio-assay period and fish responded to each concentration noted for every 24h up to 96h. The LC50 value of each toxicant then calculated and tabulated.

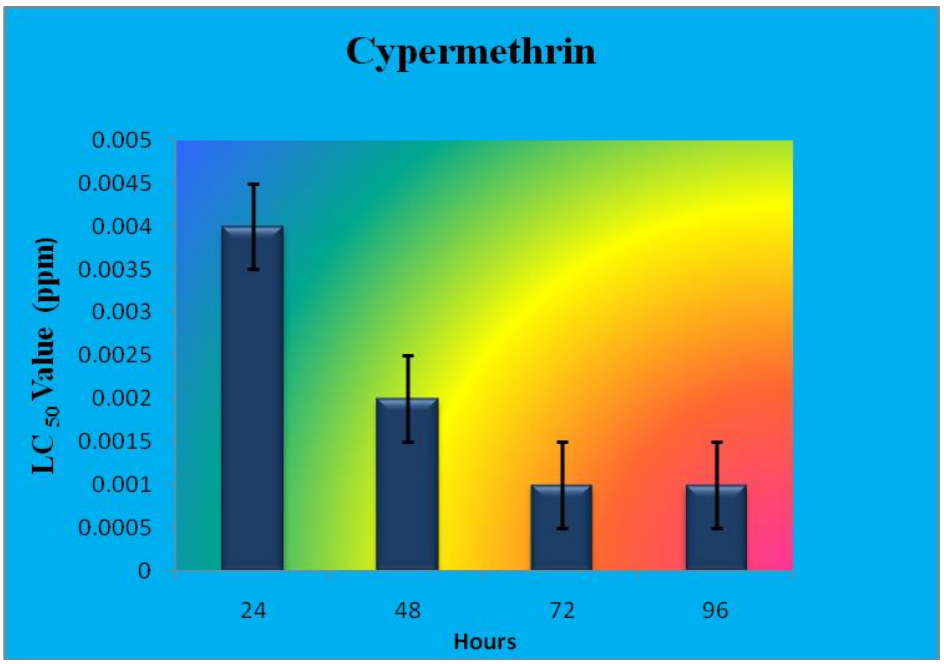
RESULTS AND DISCUSSION

The present study showed that 96h LC_{50} value of Paper mill effluent, 6.5% that was dose and duration dependent. The death may be caused by severe physiological stress at cellular level, that may be responsible for the death of fish. Pathen *et al.*, (2009) reported LC_{50} value of paper mill effluent, 9,5%, against *Rasbora daniconius*. Similarly, LC50 values via., 3.09, 8.35 and 11.28 % for *Anabus testudineus, Channa punctatus and Clarias batrachus* respectively (Nanda *et al.,* 2002).



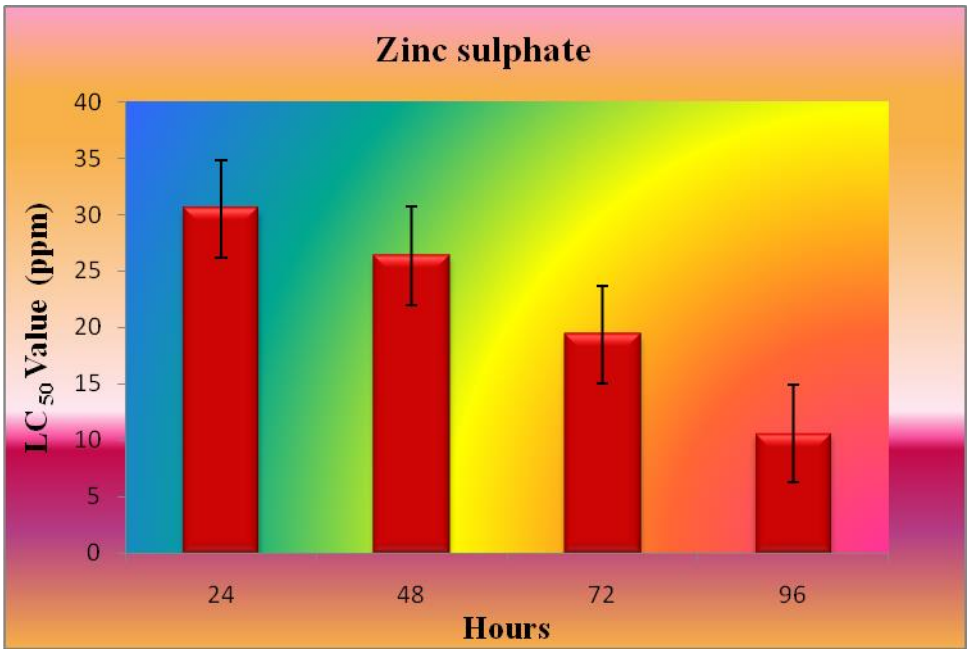
LC_{50} value of Cypermethrin

The 96h LC_{50} value of pesticide, Cypermethrin against *O.mossambicus* found out as 0.001ppm. Similarly, LC_{50} values of Cypermethrin for different fish has been found out ; 4.8 ppm for *Channa punctatus* (Devi *et al.*,1989), 0.346-0.424ppm for *Catla catla* (Bashamodhideen *et al.*, 1981), 1.2-3.0 ppm for *Anabus testudinus* (Rao and Murthy, 1980) and 0.67ppm for *H.fossilis* (Saha, 2003). Here the results indicate that *Oreochromis mossambicus* is more sensitive to Cypermethrin.



LC $_{50}$ value of zinc sulphate:

The 96h LC_{50} value of zinc sulphate against of *O.mossambicus* has been found out as 10.588ppm. The LC_{50} values of zinc sulphate against different fish has been projected; 63.984mg/l for *Nile tilapia* (Arora *et al.*,1985) 48.68mg/l for *Channa punctatus* (Senthil murugan *et al.*, 2008), 17.22mg/l for *Clarias batrachus* (Prasanna, 2011) and 30.826mg/l for *Poecilia reticulate* (AliGul *et al.*, 2009). Therefore, *Oreochromis mossambicus* is found to be more sensitive to Zinc sulphate.



SUMMARY

Oreochromis mossambicus is found to be more sensitive to the endocrne disurptive chamicals via., Paper and pulp effluent, Cypermethrin and Zinc metal individually.

REFERENCE:

Alia Jaensson , Alexander P. Scott , Andrew Moorec, Henrik Kylin and Hakan Olsen, K. (2009). Effects of a pyrethroid pesticide on endocrine responses to female odours and reproductive behaviour in male parr of brown trout (*Salmo trutta* L.). Aquatic Toxicology 81 (2007) 1–9

Arora, N. and Kulshrestha, S. K. (1985). Effects of chronic exposure to sublethal doses of two pesticides on alkaline and acid phosphatases activities in the intestine of a freshwater teleost, *Channa striatus*. Acta Hydrochim. Hydrobiol. 13: 619-624.

Bashamohideen, M., Sunetha, N., and Reddy, P. M. (1989). Comparative toxicity of endosulfan and methyl parathion to the fish *Catla catla*. Environ. Ecol. 7: 1006-1008.

Buzzini, A.P., Patrizzi, L.J., Motheo, A.J., Pires, E.C. (2007). Preliminary evaluation of the electrochemical and chemical coagulation process in the post-treatment of effluent from an upflow anaerobic sludge blanket (UASB) reactor. J Environ Manag. 85:847-857.

Devi, A. P., Rao, D. M. R., Tilak, K. S., and Murty, A. S. (1981). Relative toxicity of the technical grade materials isomers and formulations of endosulfan to the fish, *Channa punctatus*. Bull. Environ. Contam. Toxicol. 27: 239-243.

Doharty, J. D., Nishimura, K., Kurihare, N., Fujita, T. (1987). Promotion of norepinephrine release and inhibition of calcium uptake by pyrethroids in brain synoptosomes. Pestic. Biochem. Physiol. 29: 187-196.

Everall, N.C., MacFarlane, N.A.A. and Sedgwick, R.W. (1989). The interactions of water hardness and pH with the acute toxicity of zinc to the brown trout, *Salmo trutta* L. J. Fish. Biol., 35: 27−36.

Farombi, E. O., Adelowo and Arioso. (2007). Biomarkers of oxidative stress and heavy metal levels as indicator of environmental pollution in African (*Clarias gariepinus*) from Nigeria Ogun River. International Journal of Environmental Research and Public Health. 4: 158-165.

Gowland, B.T.G., Moffat, C.F., Stagg R.M., Hovlihon, D.F. and Davies, I.M. (2002). Cypermethrin induces glutathione S-transferase activity in the shore crab.Carcinus maenas, Marine Environ Res, 54 :169-177.

Gupta, P. K., Mujumdar, V. S., and Rao, P. S. (1984). Studies on the toxicity of some insecticides to a freshwater teleost, *Lebilstes reticulates* (Peter). Acta Hydrochim. Hydrobiol. 12, 629-636.

Hill, J. R. (1989). Aquatic organisms and pyrethroids. Pestic. Sci. 27: 429-465.

Hogstrand, C., Wilson, R.W., Polgar, D. and Wood, C.M. (1994). Effects of zinc on the kinetics of branchial calcium uptake in freshwater rainbow trout during adaptation to waterborne zinc. J. Exp. Biol., 186: 55−73.

Hoo L. S., Samat A. and Othman M. R. (2004):.The level of selected heavy metals (Cd, Cu, Fe, Mn, Pb and Zn) at residential area nearby Labs river system riverbank, Malaysia. Res. J.chem.Environ. 8: 24-29.

Hewitt, L. M., Smyth, S. A. M., Dube, M. G., Gilman, C., MacLatchy D. L., 2002. Environ. Toxicol. Chem. 21, 1359–1367.

Kumar, S. A. (1988). Effect of endosulfan on oxygen consumption of *Epidocephalicthys thermalis* blecker. *Comp. Physiol. Ecol*. 13, 191-194.

Karels, A., Markkula, E., Oikari, A., (2001). Environ. Toxicol. Chem. 20, 1517–1527.

Malla Reddy, P. and Bashamohideen, M. (1989). Fenvalarate and Cypermethrin induced changes in the haematological parameters of Cyprinus carpio. Acta. Hydrochim. Hydrobiol., 17 (1): 101-107.

Moore, A., Waring, C.P., 2001. The effects of a synthetic pyrethroid pesticide on some aspects of reproduction in Atlantic salmon (*Salmo salar* L.). Aquat. Toxicol. 52, 1–12.

Nanda, P., S. Panigrahi, B. Nanda and B.K. Behera, 2002. Toxicity of paper mill effluent to fishes. Env. Eco., 20(2): 496-498.

Pathen, T.S., Sonawane, D.L., and Khillare, Y.K., (2009). Toxicity and behavioural changes in freshwater fish Rasbora daniconius exposed to papermill effluent. Botany Research International 2(4): 263-266.

Philip, G.H., Reddy, P.M. and Sridevi, G. (1995). Cypermethrin induced in vivo alterations in the carbohydrate metabolism of freshwater fish, *Labeorohita*. Ecotoxicol. Environ. Saf., 31: 173-178.

Prasanna Subhash Joshi, (2011). Impact Of Zinc Sulphate On Behavioural Responses In The Freshwater Fish Clarias Batrachus (Linn.). Online International Interdisciplinary Research Journal, ISSN2249-9598, Vol.I:II.

Rao, D.M. and Murthy,A.S. (1980). Toxicity, biotransfortmation and elimination of endosulfan to the Indian major carp, *Catla catla* with special reference to some biochemical changes induced by the pesticide. Pestic. Biochem. Physiol. 33: 220-229.

Saha, S. and Kaviraj, A. (2003). Acute toxicity of synthetic pyrethroid cypermethrin to freshwater catfish *Heteropneustes fossilis* (Bloch). Int. J. Toxicol., 22(4):325.

Senthil Murugan. S., Karuppasamy, R., Poongodi1, K., Puvaneswari1, S., 2008. Bioaccumulation Pattern of Zinc in Freshwater Fish *Channa punctatus* (Bloch.) After Chronic Exposure Turkish Journal of Fisheries and Aquatic Sciences 8: 55-59.

Ural, M.P.and Saolam, N.2005. A study on the acute toxicity of pyrethroid deltamethrin on the fry rainbow trout (*Oncorhynchus mykiss Walbaum*, 1792). Pestic Biochem Physiol. 83(2-3):124-131.