

# Lethality of Chlorpyrifos for A Fresh Water Fish *Channa Punctatus*

## Abstract

Chlorpyrifos (CPF) is common pesticide. It reaches to water bodies through surface runoff and affecting the aquatic biota. The objective of the present study was to observe seasonal variation in acute toxicity of CPF with behavioural and morphological changes in fresh water *Channa punctatus*.  $LC_{50}$  was determined by standard method which was very low and indicate its highly toxic nature for fishes.

**Keywords:**  $LC_{50}$ , *Channa Punctatus*, Chlorpyrifos.

## Introduction

Aquatic contamination of pesticides causes acute and chronic poisoning in fish and other organisms directly or indirectly via food chain. The responses of fish towards the toxic chemicals are broad-ranged depending on the toxicant, exposure duration, water quality and the species (Onyedineke et al., 2010). Toxicity tests are an important component in assessing the impact of chemicals on aquatic ecosystems because they indicate toxic effects of chemicals in organism by manipulating their morphology and behavior at first and survival rate at last. The organophosphorus pesticide, chlorpyrifos (CPF) is a widely used and most preferred broad spectrum chlorinated organophosphate pesticide. It is frequently used on crops and in the warehouses, for the eradication of a wide range of insect-pests. This reaches to the aquatic ecosystem through rain and affecting aquatic organism (Misha et al., 2012). The pesticides enter the food chain and their subsequent bioaccumulation and biotransformation at different trophic levels have disastrous effect to the ecosystem. Chlorpyrifos chemical also used in the agricultural field for control of pests. Oxidative stress and role of reactive oxygen species (ROS) in disease and toxicity have been studied on two major issues in biomedical science in recently times (Devi and Misha, 2013).

For the control of pests, the pesticides are used since about 1850. Now-a-days due to advancement of technologies and requirement of huge amount of grains, the use of pesticides increased on large scale. Both types of pesticides are used by the farmers, natural as well as chemical. The natural pesticides are easily used, safe and more biodegradable. But the synthetic pesticides like pyrethroids, polycyclic chlorinated hydrocarbon are less degradable and more dangerous to the environment. These chemicals when enters in food chain then they create most dangerous effects to human beings as well as other animals like fishes, reptiles and aves etc. Oxidative stress and role of reactive oxygen species (ROS) in disease and toxicity have been studied on two major issues in biomedical science in recent times. These aspect have also been studies in the aquatic animals (Kaushal and Misha. 2013).

Recently a great deals of attention has been paid to evaluate hazardous effect of pyrethroids compound on physiology of many non – target organisms particularly fish. The symptoms of pyrethroids compound toxicity generally involve respiratory distress, increase glycolytic rate, decreased oxidative metabolism protein and RNA synthesis. (Padmanabha et al., 2015) though a lot of work has been done on the pollutional characters and determinate effect of the pyrethroid compound, their indiscriminate use has increased the pollutional hazards, posing much danger to fish and other aquatic life. A pyrethroid is a synthetic chemical compound similar to the natural chemical pyrethrins produced by the flowers of pyrethrums (*Chrysanthemum cinerariaefolium* and *C. coccineum*). Pyrethroids are common in commercial products such as household insecticides and insect repellents. They are usually broken apart by sunlight and the atmosphere in one or two days, and do not significantly affect groundwater quality (Johal et al., 2007).



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Pyrethroids are axonic poisons that work by keeping open the sodium channels in the neuronal membranes of insects. The sodium channel is a small hole through which sodium ions are permitted to enter the axon and cause excitation. When left open, nerves cells will produce repetitive discharges and eventually cause paralysis. Pyrethroids are usually combined with piperonyl butoxide, a known inhibitor of key liver enzymes. This prevents the liver enzymes from clearing the pyrethroid from the body of the insect, and assures the pyrethroid will be lethal and not merely a paralyzing agent. Combined, pyrethroids are toxic to most beneficial insects like bees or dragonflies. The pyrethroid chrysanthemic acid is produced industrially in a cyclopropanation reaction of a diene as a mixture of cis- and trans isomers followed by hydrolysis of the ester. *Channa punctatus* is selected for present study due to easily availability and handling. The fish *Channa punctatus* is the most sensitive of all aquatic animals towards such pollutant while passing through the river receiving wastes from adjoining human settlement and industries. The fish easily gets its tissues, damage due to water pollutants. The number of workers have been studied on several aspects of toxicity of pollutants on the metabolism (glucose, urea and creatinine) of fishes (Agrahari et al., 2006) but studies on the effect of Chlorpyrifos toxicity of metabolism of *Channa punctatus* is so meager. So therefore this study is needed.

#### Materials and Methods

*Channa punctatus*, a catfish belongs to the family Channidae. It is commonly known as snakeheaded fish. It is found in India, Pakistan, Nepal, Srilanka, Thailand and Myanmar. Juvenile live fishes were purchased from the local fish market during September to April when the room temperature ranges from 25 to 36 °C and water temperature from 20 to 25 °C. The fish averaging 6-10cm standard length and average body weight of 60-70gm were used for the study. After examining carefully for any injury they were kept in one percent solution of potassium permagnate for few minutes to get rid of any dermal infection. After acclimatization for 15days they were reared in large glass aquaria measuring 75 cm X 37.5 X 37.5 cm and fed on boiled egg yolk and fish food. Chlorpyrifos has been selected for present study. Chlorpyrifos products are among some of the most popular and widely used insecticides in the world and has become very popular with pest control operators and individuals in the United States in the past five years. This material is a member of one of the safest classes of pesticides: synthetic pyrethroids.

There are many uses for Chlorpyrifos, ranging from agricultural uses to home pest control. Chlorpyrifos has been instrumental in preventing the spread of diseases carried by tick-infested prairie dogs, rodents and other burrowing animals. It is helpful in eliminating and preventing a wide variety of household pests, especially spiders, fleas, ticks, carpenter ants, carpenter bees and cockroaches. For LC<sub>50</sub> determination, the *Channa punctatus* were divided into four groups (A, B, C and D). Each group consisting of six individuals. The mortality and survival

number of fish was recorded for each concentration after 96 hours. The statistical analysis of data was done by log dose/probit regression line method (Finney, 1971).

#### Results and Discussion

The LC<sub>50</sub> value in the present study for Chlorpyrifos has been calculated as 0.024mg/l and the toxicity is dose dependent (Table-1). In *Channa punctatus* the toxicity of Chlorpyrifos results in reduced activity with enormous extrusion of mucous which practically covers the body before death. This may be due to the fact that mucous hinders the exchange of the gases resulting in the deficiency of oxygen in the blood, which in turn affects the general physiology of the body resulting into death. These results gain support by the findings of Venkateswara et al., 2004 in *Channa punctatus* in response to the toxicity of carbamate pesticide. Chlorpyrifos is extremely toxic to fish *Channa punctatus* which were followed by observable behavioural changes and disruption in glycogen metabolism was considered as cause of death. However, in some cases Padmanabha et al., 2015 have suggested behaviour of fish in different test concentration of insecticide has been observed and it was found that each set of fish exhibits certain physical reactions fish swim rapidly with pronounced excitation followed by jerky movement of the body and made jumped frequently. Fish was also observed striking their head against the walls of experimental aquarium. Gul (2005) and Hussein et al. (2006) supported the present findings.

#### References

- Agrahari S, Gopaland K, Pandey KC. Biomarkers of monocrotophos in a fresh water fish *Channa punctatus* (Bloch), *Journal of Environmental Biology*. 2006; 27:453-457.
- Devi Y, Misha A. Study of behavioural and morphological anomalies of fry fish of fresh water teleost, *Channa punctatus* under chlorpyrifos intoxication, *International Journal of Pharmacology and Biosciences*. 2013; 4(1B):865-874.
- Finney, D.J.. *Probit analysis* Cambridge University Press, London, 1971 pp. 333.
- Gul A. Investigation of acute toxicity of chlorpyrifosmethyl on Nile tilapia (*Oreochromis niloticus* L.) larvae *Chemosphere* 2005; 59:163-166.
- Hussein MA, Obuid-Allah AH, Mohammad AH, Scott-Fordsmann JJ, Abd El-Wakeil KF. Seasonal variation in heavy metal accumulation in subtropical population of the terrestrial isopod, *Porcellio laevis*. *Ecotoxicology and Environmental Safety* 2006; 63(1):168-74.
- Johal MS, Sharma ML, Ravneet. Impact of low dose of organophosphate monocrotophos on the epithelial cells of gills of *Cyprinus carpio communis* Linn- SEM study, *Journal of Environmental Biology*. 2007; 28:663-667.
- Kaushal BT, Misha A. Investigation of acute toxicity of cadmium on snakehead fish *Channa punctatus*- A comparative toxicity analysis on median lethal concentration, *International*

*Journal of Advanced Biological Research.* 2013; 3(2):289-294.

Misha A, Kaushal BT, Singh K. A toxicity study of heavy metal toxicant cadmium sulphate on behavioral and morphological changes of the fresh water fish *Channa punctatus* (Bloch), *International Journal of Pharmaceutical Science Invention.* 2012; 2(8):8-19.

Onyedineke NE, Odukoyaand AO, Ofoegbu PU. Acute toxicity tests of cassava and rubber effluents on the Ostracoda *Strandesiaprava Klie*, 1935 (Crustacea, Ostracoda), *Research Journal of Environmental Sciences.* 2010; 4:166-172.

Padmanabha A, Reddy HV, Khavi M, Prabhudeva KN, Rajanna KB, Chethan N. Acute effects of chlorpyrifos on oxygen consumption and food consumption of freshwater fish, *Oreochromis mossambicus* (Peters), *International Journal of Recent Scientific Research.* 2015; 6(4):3380- 3384.

Venkateswara RJ, Parvathi K, Kavitha P, NM Jakkaand R Pallela. Effect of chlorpyrifos and monocrotophos on locomotor behaviour and acetylcholinesterase activity of subterranean termites, *Odontoter mesobesus* *Pest Management Science* 2004; 61(4):417-421.

**Table-1**  
**Toxicity evaluation of Chlorpyrifos to *Channa punctatus* specifying fiducial limits**

Experimental fish	Compound	Regression equation	LC <sub>50</sub> (in mg/l)	Variance	Fiducial limits
<i>Channa punctatus</i>	Chlorpyrifos	Y = 5.24+5.44 (X-2.10)	0.024	0.002	m <sub>1</sub> = (+) 2.665 m <sub>2</sub> = (-) 2.632

**Fig. 1: regression line for LC<sub>50</sub> determination of Chlorpyrifos for *Channa punctatus***

