

CYPERMETHRIN INDUCED ALTERATIONS IN ELECTROLYTES IN THE BLOOD AND TISSUES OF *CYPRINUS CARPIO*

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Abstract— Fresh water fishes *C. carpio* and synthetic pyrethroid cypermethrin were used in the present study. After the determination of LC₅₀ 96 hr value of the pesticide (2.0 ppm) to the fishes, a group of fishes were exposed to the sublethal concentration of the pesticide (0.2 ppm). The impact of the pesticide on various electrolytes namely K⁺, Na⁺, Cl⁻ and HCO₃⁻ ions in the serum and tissues like gills, liver, kidney and muscle was determined during various exposure periods (days 4, 7, 14, 21 and 28). Cypermethrin was found to bring an overall reduction of Na⁺, Cl⁻ and HCO₃⁻ ions where as the K⁺ ions were increased. The obtained results were discussed.

Index terms- Electrolytes, cypermethrin, *Cyprinus carpio*, blood and tissues.

I. INTRODUCTION

Fishes are the simple and reliable biomarkers of pollution in aquatic environment. The fishes respond to alteration has been given to find the toxicity of a variety of pollutants on fishes⁽¹⁾. Cypermethrin is a widely used major synthetic pyrethroid pesticide which is found to be extremely toxic to fishes and other aquatic organisms⁽²⁾. In general, the pollution may bring alterations in growth rate, development, reproduction, histopathology, physiology and behaviour of fishes⁽³⁾. The toxic substances are mostly found to affect the metabolic process of organisms. Therefore it is of most relevant to understand the significance of these variations in the tissues of the affected individuals.

Electrolytes maintain ionic balance which is essential for normal functioning of cells. Na⁺ and K⁺ ions are the major cations of the extra cellular fluids and are essential for the transport of ATP. Cl⁻ and HCO₃⁻ ions are the main extracellular anions which play prominent role to maintain osmotic pressure in organisms in combination with Na⁺ ions. The concentration of blood and electrolytes are regulated by the absorption of electrolytes from the

medium through active sites like gills, kidneys and skin⁽⁴⁾.

In the present investigation, it is planned to study the effects of cypermethrin on certain electrolytes in the blood and tissues of the freshwater fish *Cyprinus carpio*.

II. MATERIALS AND METHODS

The fishes with the average body weight of 18 – 20 gms and average length of 13cm procured from the Tamilnadu state fisheries department Aliyar, Tamilnadu, India and cypermethrin (wetttable powder with analar grade) procured from Gharda chemicals, Mumbai, India) were used in the present work.

Active toxicity tests were carried out to determine 96hr LC₅₀ value of cypermethrin to the fishes. A set up 10 fishes were exposed to different concentrations of cypermethrin (12, 1.6, 2.0, 2.4 and 2.8 ppm) along with appropriate controls. The test solutions were changed every 24 hrs and feeding was stopped during the static bioassays. Then the fishes were exposed to sublethal concentration for 4 weeks of cypermethrin and the sampling were done on days 4, 7, 14, 21 and 28. At the expiry of each experimental period, the blood and tissues like gills, liver kidney and the muscle were collected and processed for the estimations.

The concentrations of Na⁺, K⁺, Cl⁻ and HCO₃⁻ were determined in the serum and tissues using the automatic analyser COBAS MIRA (Hoffma, Laroche, Co, Switzerland) and using optimized tests of Boehringer Mannheim GMBH by means of spectrophotometer (Vavian DMS 200). The concentration of the electrolytes was expressed as mEq/L.

III. RESULTS AND DISCUSSION

The LC₅₀ 96 hr value of the pesticide to the fishes was found to be 2.0 ppm (Table.1) then a group of 10 fishes were exposed to 0.2 ppm which

was 1/10 of LC₅₀ 96 hr value to evaluate chronic toxicity of the pesticide on *C. carpio*. The ranges of percent changes in the level of various electrolytes in the serum and tissues of control and pesticide-treated fishes are presented in Table 2. The cypermethrin was found to cause an overall reduction of Na⁺ ions in both blood and tissues where as the K⁺ ions were found to increase under sublethal concentrations of the pesticide as the duration of exposure increased. As in the case of sodium ions, Cl⁻ ions as well as HCO₃⁻ ions were also decreased in the serum and in various tissues of fishes on different days of exposure. It is recorded that the regulation of cations and anions

are greatly affected in aquatic animals an exposure to toxicants with the resultant ionic imbalance due to failure of osmoregulation and cell damage⁽⁵⁾.

In general, the toxicants alter the cell membrane permeability by causing ionic changes due to ionic imbalance associated with increased muscular activity of animals. In the present study, the enhanced K⁺ level can be accounted for the osmotic distress in fishes resulting in haemolysis, tissue damage, kidney failure, failure of osmotic regulating function, disturbed condition of nerve impulses an irregular heartbeats as also observed^(6,7,8). The decreased quantity of Na⁺ ions would bring tissue damage followed by malfunctioning of cells and neurotoxic damage in the present experimental animals also⁽⁹⁾.

A significant reduction of Na⁺ and Cl⁻ ions in the tissues of the test fishes also suggests the prevalence of dehydration process due to disturbed uptake of these ions from the water through the gills. Moreover, a low bicarbonate level in the tissue of *C. carpio* is indicative of metabolic acidosis and respiratory alkalosis caused by cypermethrin.

REFERENCES

- [1]K. Sajda, Suganthi, S. Sridhar, and J. Helan Chandra, Histological and behaviour c hanges of freshwater fishes *Clarius batrachus* exposed to letahal concentration of rogorin. Int. Journal of Applied Engi Research, 2014,9 (3): 311- 316.
- [2].USDA, United states department of agriculture research services. ARS pesticide properties. Wizard arsude. Dgov/ rsml/ textiles/ cypermethrin- Areview.1995.
- [3].F.,Aziz, Y.Akhtar, B.Bilal, and N. Parveen, Effect of fluoride exposure an key enzymes activity of protein – carbohydrate metabolism in gills of freshwater fish Tilapia mossambica, Keenjihar lake, Thatta, Sindh, Pakistan.Int.Res.J.Environ.Sci,2014, 2 (8): 24 -27.
- [4].O.Firat, H.Y.Cogan, T.A. Yuzereroglu,, G.Gok, O.Firat, F. Kargin, and Y. Kotemoen A Comparative study on the effects of a pesticide (Cypermethrin) and two metals (copper, lead) to serum biochemistry of Nile, Tilapia, *Oreochromis niloticus*. Fish physiol.Biochem, 2011,37 (3): 657 – 666.
- [5].Ibrahim El-Elairy,Mohamed Falthy Ferag Beyong, Asmaa Galal- Khallat, Khaled Mahamed – geba,G,Martinez – Rodriguez, J.M.Maneera, Decelopment of sensitive molecular markers for detecting the genotoxicity induced by two and permethrin. Journal of Applied Pharmaceutical Science, 2014, 4(02):034-042.
- [6].U.U. Gabriel, F.G. Obomanu, and O.S. Edori, Haematology, plasma enzymes and organs indices of *Clarias gariepinus* after intra muscular injection with aqueous leaves extracts of *Lepidagathis alopeuriodes*. African J.Biochem. Res, 2009, 3(9): 312 -316.
- [7].T. Asano, P.C. Wang, and A.Iwaski, Septrophotometric detection of labile zinc(11) released from metallothionein; a sample method to evaluate heavy metal toxicity, J.Biosci. Bio eng, 2010,109(6): 638 – 644.
- [8].R.A.Maniyar, R. Nazeer Ahmed, and , M. David,. Heamatological responses of *Cyprinus carpio* (L) exposed to sublethal concentrations of monocrotophos. elixir aquaculture, 2012, 43: 6946 – 6951.
- [9].O.B. Adediji, Acute effects of diazinon on blood plasma biochemistry in the African cat fish (*Clarius gariepinus*).J.Chin.Med.Res, 2010,2(1):1- 6.

TABLE 1. Acute toxicity of cypermethrin to *C. carpio* after 96 hr exposure.

Concentration (ppm)	No. of tested fishes	No. of dead fishes	Percentage (%) of mortality	LC ₅₀ 96hr value
1.2	10	0	0	
1.6	10	2	20	
2.0	10	5	50	2.0 ppm
2.4	10	8	80	
2.8	10	10	100	

Table 2. Ranges of percent changes in electrolytes levels in the tissues of *C. carpio* on exposure to cypermethrin during various periods.

Tissues	Electrolytes			
	Na ⁺	K ⁺	Cl ⁻	HCO ₃ ⁻
Serum	-3.73 to -22.57	+2.31 to 18.59	-4.68 to -20.17	-9.89 to -41.51
Gills	-5.16 to 20.44	+8.35 to 26.43	-3.82 to -25.72	-11.41 to -43.17
Muscle	-5.88 to -23.16	+4.42 to +16.08	-3.44 to -27.80	-3.44 to -30.11
Liver	-5.85 to -21.27	+4.12 to +18.49	-6.66 to -17.37	-10.98 to -26.81
Kidney	-9.60 to -29.17	+3.57 to +24.53	-6.36 to -30.14	-9.41 to -34.24

-represent percent decrease from control

-represent percent increase over control