ORIGINAL RESEARCH PAPER

Zoology

"EFFECT OF COPPER ACETATE ON ACUTE TOXICITY OF FISH CHANNA PUNCTATUS AT 24 HR BY STATISTICAL METHOD"

KEY WORDS: Pollution, copper acetate, Acute toxicity, channa punctatus.

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ABSTRACT

This study was carried out on fish channa punctatus to investigate the lethal concentration of copper acetate on fish channa punctatus at 24 hr. Experiment procedure was repeated five times at the selected copper acetate concentration, noting the number of fish killed. The mean value was taken. These values was taken to determine LC50 value for 24 hr.

INTRODUCTION :

The most common acute toxicity end point measured is mortality, which is expressed as the $LC_{50,}$ the lethal concentration of the toxicant which kill 50% test organisms in a given time (usually 48 or 96). This may be expressed as an Ec_{50}(effect concentration) if it is difficult to determined mortality. Direct chronic toxicity tests may be incorporate a wide variety of biological end point which may be functional (e.g mortality, feeding) or biochemical (e.g enzyme activity).

Functional end points are measured to be the most acceptable for chronic toxicity test (ANZECC/ ARMCANS 2000). End point for chronic toxicity test are often expressed in terms of the concentration to toxicants giving no observable effect on the test organism (NOEC) or the lowest concentration of toxicant at which an effect is observed (LOEC).

Toxicology has been developed into the quantitative study of the effects of chemicals on biological system. The word toxicity is a kind of expression commonly used in comparing one chemical with another and the toxicity of a substance could be defined as the capacity to cause injury to a living organism and it can not be defined without reference to the quantity of a substance administered or absorbed. The purpose of any toxicity test is primarily to determine how toxic the chemical Substances are that being against certain and likely to be used and likely to be used against certain specific test organisms.

MATERTAL AND METHOD :

For the determination of acute toxicity, the laboratory acclimatized, fishes were sorted into 8 batches of 10 each A constant ratio of fish biomass to water volume was maintained clean, aged and de-chlorinated water was used for experiments .

Water level in all the aquaria was maintained same. The test were also not fed during bioassay test to avoid any change in the toxicity. Stock solution of copper acetate were prepared. For bioassay tests, few concentrations from stock solution were prepared as per the dilution technique suggested by APHA (1998).

Preliminary experiments using different concentrations of copper acetate was conducted to find concentration that resulted in 0-100% mortality i. e. LC_{50} and $LC_{100.}$ After conducting such few initial test range finding experiments. i. e. pilot reading, suitable dilution of toxicant were prepared.

1) Statistical Method :-

The method makes use of probit analysis. The percent mortalities obtained were converted to probit kills by using regression equation according to finney (1971).

The regression equation
Y= a+b x.

RESULT :

In 24 hours exposure, the kills scored at 1.8, 2.0, 2.2, 2.4, 2.6, and 2.8 ppm. Of copper acetate were 10, 20, 40, 60, 80, and 100% respectively.

In bioassay test LC_{50} for copper acetate at 24 hr. of exposure were 2.279 ppm.

Table No. 1 Physico – chemical parameter of water used for Acute toxicity test.

Sr. No	Physico – Chemical Parameters	Range
1.	PH	7.2 + 7.4
2.	Temperature (C0)	24+ 4
3.	Do (mg/l)	8.0 + 3.0
4.	Hardness of CaCo3 (mg/l)	150 + 20
5.	Chlorides (mg/l)	172.5 + 0.8
6.	Salinity (g/l)	311.3+ 0.7

Table No : 02

Sr. No	Conc. In PPm.	Log conc. (X)	No.of Animal Exposed (N)	No.of mort-ality	% mort ality P = 100 r/n.	Emperical probit	Expec ted probit (y)	Weighing Coefficient (W)	Weight W = nw	Working probit (Y)	WX	WY	WX_2	W_{x2}	WXY.
1	1.8	0.2553	10	1	10	3.7184	3.7	0.33589	3.3589	3.719	0.8571	12.4917	0.2186	46.4566	3.1878
2	2.0	0.3010	10	2	20	4.1584	4.1	0.47144	4.7144	4.159	1.4190	19.6071	0.4271	81.5459	5.9017
3	2.2	0.3424	10	4	40	4.7467	4.7	0.61609	6.1609	4.747	2.1094	29.2457	0.722	138.8297	10.0137
4	2.4	0.3802	10	6	60	5.2533	5.2	0.62742	6.2742	5.251	2.3854	32.9520	0.9066	173.0643	12.5283
5	2.6	0.4150	10	8	80	5.8416	5.8	0.50260	5.0260	5.841	2.0852	29.3568	0.8649	171.4730	12.1801
6	2.8	0.4472	10	9	90	6.2816	6.2	0.37081	3.7081	6.281	1.6560	23.2591	0.7402	146.0906	10.4015
Total									29.2375		10.5121	146.9124	3.8794	757.4601	54.2131

Calculation of regression equation for LC_{50} of copper acetate to the Fresh water fish Channa Punctatus for 24 hours. (Probit analysis by Finney; D.J 1971).

Regression Equation :-
Y = Y + b (X - X)
Y = 5.0247 + 13.9252 (X – 0.3595)
Y = 5.0247 + 13.9252 X - 5.0061
Y = (13.9252) X + 0.0186
Y = 5, X = ?
5 = (13.9252) X + 0.0186
5 – 0.0186 = 13.9252
X = 4.9814
13.9252

Anti log of X = 0.3577
Lc50 For 72 hours = 2.279 PPm.

$$X = \frac{Swx}{Sw} = \frac{10.5121}{29.2375} = 0.3595$$

$$Y = \frac{Swy}{Sw} = \frac{146.9124}{29.2375} = 5.0247$$

$$b = \frac{Swxy - (X \times Swy)}{Swx2 - (X \times Swx)}$$

$$b = \frac{54.2131 - (0.3595 \times 146.9124)}{3.8794 - (0.3595 \times 10.5211)}$$

$$b = \frac{54.2131 - 52.8150}{3.8794 - 3.7790}$$

$$b = \frac{1.3981}{0.1004}$$

b = 13.9252

DISCUSSION:

Kazlauskiene and stasiunaite (1999) studied on the effects of heavy metal mixture of copper, zinc, chromium, nickel and iron on rainbow trout (Oncorhynchus mykiss) in its early stages of development and concluded that the partially and fully hatched larvae of fish were more sensitive to heavy metal mixture. The sensitivity of fish to heavy metal mixture varied with different stages of development which was dependent upon exposure duration.

Vosyliene and Jankaite (2006) studied the acute and long term toxicity of heavy metal model mixture of chromium, Zinc, nickel, manganese, lead and copper on rainbow trout. The 48 hr and 96 hr. LC_{50} values were recorded as 129.70% and 108.97% of heavy metal model mixture, water hardness had positive effects on the toxicity of metals in fish (Rathore and Khangarot, 2003).

The LC_{50} value of 96 hr. aluminium found to be 56.92 PPm. Brachydaniorerio (Anandhan and Hemalatha 2008) copper in water with higher hardness was generally less toxic to fish than water with lower hardness and reduce copper toxicity to rainbow trout reported by (Liepolt and weber 1958-Lloyd, 1961b) Father minoow (Nelson, et. al. 1986, picking) carp (perensand piham, 1991a) channel cat fish (straus and tucker , 1993) and chinook salmon (chapman and Mc crady 1977) increase calcium levels had the same effect in reducing copper toxicity to steelhead trout (cusimano ,et. al. 1986) and fathead minnows (nelson , et.al. 1986b) however hardness did not significantly effect survival of juvenile cat fish (Wurts and perschbacher, 1994). Increase alkality also reduces copper toxicity to channel cat fish (Straus and Tucker, 1993) and Chinook Salman (Chapman and Mc Crady, 1977). However, increase in alkalinity did not significantly affect copper toxicity to fathead minnows (Nelson, et. al 1986)

CONCLUSION :

The present investigation is aimed to an understand the toxicity of heavy metal copper acetate on fesh water fish channa punctatus. The test fish was selected for the toxic study because of its high commercial value easy availability and adaptability to laboratory condition.

LCso values decreased with increased in exposure period and with increase duration of exposure the heavy metals become toxic even at lower concentrations.

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