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Effect of Cadmium Nitrate on Acute Toxicity of Fish Channa Punctatus at 24 Hr. by Dragstedt and Behren's Method

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ABSTRACT: This study was carried out on fish channa punctatus to investigate the lethal concentration of cadmium nitrate on fish channa punctatus at 24 hr.

Experiment procedure was repeated five times at the selected cadmium nitrate concentrations, noting the number of fish killed. The mean value was taken. These values were taken to determine LC_{50} value for 24 hr.

Toxicity of heavy metals it may be depends upon the dose and time of exposure period.

KEY WORDS: Acute toxicity, Cadmium nitrate, Channa punctatus, Pollution.

INTRODUCTION

In aquatic system, cadmium is most readily absorbed by organisms directly from the water in its free ionic form cd/AMAP 1988/. cadmium is not an essential element but may be accumulated via pathway for calcium up take (wright, 1995) bioaccumulation of cadmium from solution is correlated with the free divalent concentration, cd (Sunda, et al 1978) may also be influenced by abiotic factors such as salinity, temperature (mubina and Blust, 2007) and calcium concentration (wring and Frain, 1981, De Lisle and Rober, 1994) as with copper, cadmium may also be caccumulated via uptake from contaminated food (Khalil, et al 1995) cadmium may cause toxic effect by binding sulfydryl, sulphate and carbonyl sites on proteins and DNA (Furst, et.al 1998) inhibiting their function cadmium may also interfere with calcium uptake and calcium channel via competition for binding sites (Furst, et.al 1998, Strydom et.al 1998, strydom, et.al 2006).

In addition cadmium may cause lipid peroxidation (stohs and Bagchi,1995) and inhibit DNA repair (Frust, et.al.1998). so, in the present investigation cadmium nitrate is selected as heavy metal.

Aquatic toxicity may be considered in terms of either acute or chronic effects on the species present in a given ecosystem. Acute toxicity involve harmful effects to an organism through short term exposure chronic toxicity is the ability of a substance to cause harmful effects over an extended period, usually on repeated or continuous exposure lasting a substantial portion of the life of exposed organism.

MATERIAL AND METHOD

For the determination of acute toxicity, the laboratory acclimatized, fishes were sorted into 8 batches of 10 each and kept in aquarium with measured quantitiy of water. Since an increase in fish density (Number) is known to increase toxicity (Holden, 1973) a constant ratio of fish biomass to water volume was maintained by providing 1 liter of water per 1g weight biomass. Clear, aged and de-chlorinated water was used for experiments. One day prior to the commencement of experiment, feeding was stopped. Water level in all the aquaria was maintained same. The test fish ware also not fed during bioassay test.

Stock solution of heavy metal, cadmium nitrate were prepared. For bioassay tests, few concentration from stock solution were prepared as per the dilution technique suggested by APHA (1998).

Preliminary experiments using different concentration of cadmium nitrate 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. The range of concentration for cadmium nitrate at 24 hr. was set.

DRAGSTEDT AND BEHREN'S METHOD

The log application was made in Dragstedt and Behren's method (1975). In theis method, cumulative mortality was determined at different concentrations of heavy metals and percent mortalities were calculated from the cumulative mortality values. Lc_{50} values were calculated by adopting the following formula:-

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$$\text{Log } Lc_{50} = \text{Log A} + \frac{50-a}{b-a} \times \text{Log}_2$$

Where,
A= Concentration of the heavy metals having the percentage of mortality below 50 %
a= percentage of mortality immediately below 50 %
b = Percentage of mortality immediately above 50 %
Lc_{50} = Antilong of log Lc_{50} Value.

RESULT

Based on preliminary observations, a total of 10 test concentrations of the cadmium nitrate were chosen for this experiment. In 24 hrs. exposure, the kills scored at 0.6, 0.7, 0.8, 0.9, 1.0, 1.2 and 1.4 ppm of the cadmium nitrate were 10, 20,30, 50, 60, 70 and 100 % respectively. While mortality was absent in the control.

By Dragstedt and Behren's method Lc_{50} value at 24 hr. is 0.9924 ppm.

Table No. 1. Physico – Chemical parameters of water used for Acute toxicity test.

Sr. No	Physico – Chemical Parameters	Range
1.	PH	7.2 ± 7.4
2.	Temperature (C^0)	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. 2. Showing Absolute and cumulative mortalities at 24 hr of fish channa punctatus exposed to copper acetate (Dragstedt and Behren's method (1975)

S.r No	Con. (im P.Pm)	Log Conc.	Fish Exposed	Absolute mortality		Cumulative mortality		%kill	Probit Kill
1	0.2	0.3010	10	Live	Dead	Live	Dead	00	00
				10	00	76	00		
2	0.3	0.4771	10	10	00	66	00	00	00
3	0.4	0.6021	10	10	00	56	00	00	00
4	0.5	0.6990	10	10	00	46	00	00	00
5	0.6	0.7782	10	09	01	36	01	2.70	3.72
6	0.7	0.8451	10	08	02	27	03	10.00	4.16
7	0.8	0.9031	10	07	03	19	06	24.00	4.48
8	0.9	0.9542	10	05	05	12	11	47.82	5.00
9	1.0	1.0000	10	04	06	07	17	70.83	5.52
10	1.1	1.0414	10	03	07	03	24	88.88	5.52
11	1.2	1.0792	10	00	10	00	34	100.00	8.09

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$$\text{Log} = \log a + \frac{50 - a}{b - a} \times \text{Log}_2$$

$$= 0.9 + \frac{50-47.82}{70.83-47.82} \times 0.3010$$

$$= 0.9542 + \frac{2.18}{23.01} \times 0.3010$$

$$0.9542 + 0.0947 \times 0.3010$$

$$= 0.9542 + 0.0285$$

Anti log of = 0.9827

LC_{50} = 0.9924 PPm.

DISCUSSION

According to mckian and Benoitra (1971),Chapman(1978) early life stage of brook trout and Chinook salmon were more susceptible to copper than older life stages. They also reported, the effect of toxicity on fish size. Smaller fish were more sensitive to copper than older size fish of following species.

Cutthroat trout (chakoumakos, et.al. 1979) rainbow trout (Howarth and Sprague, 1978), Pumpkinseeds (Anderson and spear, 1980) and guppies (spear and Anderson 1975) (Anderson and weber, 1975)

From the above references it is conformed that copper and cadmium are highly toxicant and influenced on fish size. Therefore in present investigation, have chosen heavy metal cadmium nitrate and observd their toxic effect on fish channa punctatus.

Channa punctatus exposed to camium nitrte for 24, hrs. at PH ragnes from 7.2. temperature ranges from 24^0C, Dissolved oxygen 8.0 mg/l, of $Caco_3$ 50 mg/l, chlorides 220 mg/l. and salinity 530 mg/l.

Ebrahimpour, et.al (2010) studied on the influence of water hardness on acute toxicity of copper on capoeta fusca, a teleost fish and observed that the 96 hrs. Lc_{50} were 7.5 mg/lit. that is almost similar to the 96 hrs. Lc_{50} of 7.11 mg/lit. reported for C. Juvenile and young fish had similar Lc_{50} values of 0.804 mg/l. zn and 0.815 mg/L zn respectively, while larvae had an Lc_{50} value of 0.685 mg/l zn. The 24 hr. Lc_{50} of eggs was the lowest, at 0.313 mg/L zn and concluded that these results indicate that eggs are the most sensitive to zinc.

CONCLUSION

The test fish was selected for the toxic study because of its high commercial value easy avalilability and adaptability to laboratory condition.

The Lc_{50} value 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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