Adv. Pharmacol. Toxicol. 19 (1) 2018, 1-4
ISSN - 0973 - 2381

Evalution of Acute Toxicity of Heavy Metal Copper Chloride and Copper Sulphate to a Freshwater Bivalve *Lamellidens Corrianus (Lea)*

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Abstract

Acute toxicity testing on freshwater Bivalve *Lamellidens Corrianus (Lea)* to $CuCl_2$ than $Cuso_4$ was carried out. The Median Lethal Concentration (LC_{50}) of CuC_{l2} and CuS_{o4} for 24, 48 , 72 and 96 hrs were 1.9496,1.8487, 1.6871 and 1.3956, 1.9822, 1.9544, 1.9214, and 1.6666 ppm respectively. Anylysis of results indicates that L.corrianus is highly sensitive to $CuCl_2$ than Cuso4 . The Toxicants can be arranged in order of their toxicants as $CuCl_2 > CuSo_4$.

Key Words: Copper Chloride, Copper Sulphate, Acute Toxicity, Lamellidens corrianus (LEA).

INTRODUCTION

Indiscriminate use of heavy metal compounds for various purposes and effluents arisen due to production in water pollution thereby created serious threat to life on the earth. Aquatic pollution is of great concern as every kind of life depends on water.

Heavy metal that reach the aquatic bodies deteriorate the qulity of life sustaining water and cause damage to both flora and fauna . (Kotsanis and Georgudaki, 1999; Zyadah and Abdel Bakey, 2000; Georgudaki and Kotsanis , 2001; Sharma and Agrawal, 2005). Accumulation of toxic metals to hazardous level in the aquatic ecosystem has become a serious problem over the last few decades and it become a threat to public water supplies as well as damage cause to the aquatic life (Manahann, 1994). The problem increase many folds due to their long half life Period and non-biodegradable property , bioaccumulation and biomagnifications .

Copper Chloride is a non biodegradable metal with unknown biological function but reported to be a major contaminant of aquatic ecosystems through diverse sources including both natural and anthropogenic activities. The major sources of contamination includes electroplating, battery, mining and smoldering units and many other modern industries. Copper Sulphate is used in preparations of alloys, electroplating, metal spraying, wrappings (Merck, 1989)

Review of literature on water pollution mainly on the river system , includes the use of test animals mainly fish from vertebrates and freshwater mussels from invertebrates.

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Individual and combined toxicity of Mercury and Cadmium to tropical green mussel Perna viridis have been reported (Mohan et al., 1986). Comparative toxicity of CuCl2 and CuSo4 to the juvenile water snail Filopaludina martensi (Piyatiratitivorakkul and Boonchamol,2008) and remedial effect of CuCl2 and CuSo4 induced alteration in protein and phosphatase activities in gill and mantle of freshwater bivalve Lamellidens marginalis have been reported (Injal and Raut, 2009). The mussels act as a food chain component of the ecosystem and play role in biological control by removing a number of bacterial population and toxic substances from water. The concentration of heavy metals in bivalves changes with respect to the environmental pollution. It has been well established that the study of bio-accumulation of heavy metals in different molluscs facilitates the assessment of water quality as well as the selection of suitable bio-indicator of heavy metal pollution (Chaudhary and Hazara, 2001).

Copper Chloride and its compound is highly toxic metal but their hazardous nature as pollutant of aquatic environment became a matter of grave concern only after Minamata disaster in Japan . Thus, studies reveals that there is no information on toxicity of Copper Chloride and Copper Sulphate Lamellidens Corrianus, a common bivalve inhabiting in river Girna Dam Jamda (Chalisgaon) Jalgaon District (MS) . Hence, present studies were aimed to evaluate comparative toxicity of heavy metal Copper Chloride and Copper Sulphate to Lamellidens Corrianus .

MATERIALS AND METHODS

Mussels L. corrianus were collected from the river Girna Dam, Jamada (Chalisgaon), brought to the laboratory and acclimatized in aged tap water for a period of three days. During acclimatization they were fed with crushed green algae. Pilot experiments were carried out so as to select the final concentrations of heavy metals. Healthy active animals of L. CORRIANUS approximately same size and weight were selected for toxicity testing irrespective of their sex. Two heavy metals CuCl2 and CuSo4 were used for toxicity testing. The stock solutions (1%) of each toxicant were prepared in distilled water and from which 8-10 concentrations were prepared by diluting the stock solutions so as to set them in the final experiments. Physico-chemical analysis of aged tap water was carried out as per standard methods of APHA (1981). Ten animals were exposed to each concentrations containing five liter toxicant along with control maintained in aged tap water. Three replicates were run for each concentration.

Static bioassays were carried out for a period of 96 hours standard methods of APHA (1981). The experimental concentrations were renewed after every 24 hours using aged tap water as diluent medium. During bio-testing, feeding was discontinued. Mortality was recorded after every 24 hrs and data was analyzed so as to compute 24, 48, 72 and 96 hrs LC50 values for two heavy metals by probit analysis

(Finney, 1971).

Results

The physico-chemical analysis of aged tap water showed the temperature 28±2°C, pH 9.8±0.4; total hardness 57±4 ppm as Cucl2 total alkalinity 8.5 -+0.3ppm as Cucl2 and dissolved oxygen 8.5-+0.3mg/lit The LC50 value for different heavy metal pollutants to L. corrianus for 24, 48, 72, and 96 hrs were calculated . The relative toxicity of heavy metal pollutants , Probit regression equation , LC 50 fudicial limits are summarized in Table 1. It is evident from the results (Tab. 1) that the mussel L. corrianus was found to be highly sensitive to CuCl2 and CuSo4 . The heay metal can be arranged in order of their toxicities as CuCl2 > CuSo4.

During the bio-testing, the bivalve showed response to heavy metal treatment .At higher concentration, the test solutions became turbid due to copius secretion of mucus. Another notable effect observed was loss of ability to retract the foot even after mechanical stimulation .

Discussion

Toxicity studies measures a response of an organism to a biologically active substance (Alderdice, 1966) an are useful in determining water qulity . From the result (Tab. 1), it is quite clear that the mussel L. corrianus is highly sensitive to CuCl2 than CuSo4. Similar observations have also been reported by various workers using different heavy metals on different test animals (Wandkhede and Dhande, 1999: Shrivastava and shrivastava, 2002; Bhamre et al. ,2004: KSHERWANI et al., 2009). The wide variation in sensitivity of different species to different heavy metals depends on various factors like age, sex, weight physical stage of the animal and presence or absence of enzymes system that can degrade the pollutants (Nagratnamma and Ramamurti, 1981; piansiri et al ., 2008). Similar findings were also reported. In the aquatic animals Gills are important organs of respiration. Damage to the Gills by different heavy metals and pesticides has been reported by number of workers (Pawar and Katdare , 1983; Nilkant and Sawant 1993). It Seems therefore anoxia may be an important factor causing death of organisms exposed pollutants. Another contributing factor causing death may be toxic effect of pollutant on the osmoregulatory mechanism of the animal. It is well known that fish and crustacean gills are involved in ionic regulation (Hughes and Morgan, 1973) and hence impairment of gil function may affect osmoregulation.

Results of present studies (Tab. 1) clearly indicate that the rate of mortality for any fixed time increases with increase in concentration and for a particular concentration with increase in exposure time and a regular mode of action of toxicant, due to accumulation up to dangerous level leading to death.

The lethal effects of heavy metals CuCl2 and CuSo4 have been described to

coagulation of mucus on gill surface , damage done to gill tissues and consecuently result to the respiratory failure (Dandroff and Katz, 1953).

Thus from the present studies it can be concluded that the toxicity of tested heavy metals to L. corrianus affect respiratory and nervous system of the animal resulting into death.The present investigations also confirm a high sensitivity of mollusk to Copper Chloride as compaired to Copper Sulphate.

Table 1 . Regression equations of probit mortality (y) against x, the logarithm of the metal concentrations, and LC50 values for L. corrianus exposed to CuCl2 and $CuSo^4$ ..

Table 1 . Regression equations of probit mortality (y) against x, the logarithm of the metal concentrations, and LC_{50} values for *L. corrianus* exposed to $CuCl_2$ and $CuSo_4$ ..

SN Pollutant	Exposure period in Hrs	Probit Regression equation ly = a + b (x – m)l	LC_{50} in pp	Fiducial limits M1	M2
$CuCl_2$	24	y = 0.39 + 2.3273 (x – 0.2805)	1.9496	0.1440	0.4110
	48	y = 0.90+ 2.1664 (x – 0.2584)	1.8487	0.1478	0.3686
	72	y = 1.88 + 1.7378(x – 0.2190)	1.6871	0.1290	0.3076
	96	y = 2.02 + 1.7604(x – 0.1370)	1.3956	0.0090	0.2739
$CuSo_4$.	24	y = 0.93 + 3.1656(x – 0.2870)	1.9822	0.1772	0.3968
	48	y = 1.12 + 1.6978(x - 0.2816)	1.9544	0.1045	0.9577
	72	y = 1.98 + 1.3016(x - 0.2745)	1.9214	0.0576	0.4914
	96	y = 1.08 + 1. 9661(x – 02709)	1.6666	0.1315	0.3165

ACKNOWLEDGEMENT

The authers are thankful to the Principal, Dr. L. P. Deshmukh for encouragement and providing laboratoryfacilities.

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