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TOXICITY OF CADMIUM, COPPER, LEAD AND ZINC TO THE JUVENILES OF *PERNA VIRIDIS*

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ABSTRACT

A study was conducted to evaluate the toxicity of cadmium, copper, lead and zinc to the juveniles of *Perna viridis* through acute toxicity in static renewal bioassay. The data revealed that the *P. viridis* was sensitive to copper followed by cadmium and lead. The juveniles were found to tolerate the concentrations of zinc.

Key words: Toxicity, Cadmium, Copper, Lead, Zinc, Juveniles, *Perna Viridis*.

INTRODUCTION

Protection and restoration of the aquatic environment has gained increased importance during the last two decades. In industrialised countries, environmental problems are less related to acute toxicity of environmental pollutants than to sublethal, synergistic and long-term effects which are difficult to detect and whose consequences for ecosystems are far from being understood[1]. The use of sensitive biomarkers have been developed and applied as biomonitoring tools to assess the risk for aquatic and terrestrial organisms in moderately contaminated environments[2]. Biological toxicity testing is a relatively simple laboratory bioassay that measures the biological response of marine organisms, particularly at their highly sensitive early life stages[3]. The overall toxicity of heavy metals is commonly assessed using laboratory bioassays where organisms are exposed to contaminants[4]. Invertebrates are routinely used as candidate organisms in such bioassays, and early life stages of invertebrates are often the most sensitive to contaminants[5].

EXPERIMENTAL

Juvenile specimens of *Perna viridis* (1.6 ± 0.4 cm in length and 0.12 ± 0.01 g),

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collected juveniles were immediately transported to the laboratory in air filled plastic bags and acclimatized in glass aquaria with aerated natural filtered seawater for a period of 8 days at 28 PSU salinity, temperature of 28 ± 2°C, dissolved oxygen of 5.6 mg/L and pH of 8.01. *P. viridis* was fed with mass culture of cyanobacteria (*Anabaena* sp.). Stock solutions of cadmium, copper, lead and zinc were freshly prepared by dissolving the proper metal salts of cadmium chloride hemi (pentahydrate), copper (II) chloride, lead (II) nitrate and zinc sulfate in deionized (doubly distilled) water. Fresh stock solutions were prepared daily. These solutions were serially diluted to get the experimental concentration for the toxicity test. The experimental method includes static renewal (24 hour renewal) test by following the method of USEPA[6]. Five concentrations in a geometric series including control were prepared for the test for 4 days in acute toxicity test (USEPA)[7]. Toxicant and seawater were replaced on daily basis. Test animals were not fed during acute test. Maximum-allowable control mortality was 10 percent for a 96 hour period of testing (USEPA)[8]. A computerized probit analysis program (USEPA probit analysis program version 1.5) (Probit Program version 1.5) was carried out for the calculations of LC_{50} values at the termination of each test and upper and lower 95 percent confidence levels were also calculated.

RESULTS AND DISCUSSION

Juveniles of *P.viridis* were highly susceptible to copper, 96 hour LC_{50} value was very low and was tolerant to zinc. The obtained LC_{50} values for *P.viridis* exposed to cadmium, copper, lead and zinc were 2.39 mg/L Cd, 0.44 mg/L Cu, 2.65 mg/L Pb and 3.63 mg/L Zn, respectively. The order of sensitivity was Cu > Cd > Pb > Zn. The juveniles of *P. viridis* exposed to heavy metals showed distinct behaviour in the test. The byssal thread formation was observed in the control, but not in treated test chambers. The present study results are consistent with Calabrese *et al.*[9] who reported LC_{50} values for American Oyster, *Crassostrea virginica* exposed to cadmium, copper, lead and zinc were, 2.45 mg/L Cd, 0.5 mg/L Cu, 3.80 mg/L Pb, and 0.103 mg/L Zn for LC_{50}. Copper was toxic than zinc followed by lead and cadmium, the order of sensitivity is as follows: Cu > Pb > Zn > Cd. Eisler and Raymond[10] reported the LC_{50} for cadmium and zinc to clam, *Mya arenaria* as 2.5 mg/L Cd and 7.7 mg/L Zn for clam. Blue mussel (juvenile), *Mytilus edulis* exposed to cadmium chloride showed and LC_{50} of 0.96 mg/L, Bay scallop (juvenile), *Argopecten irradians* showed and LC_{50} of 1.48 mg/L exposed to cadmium chloride, Pacific and eastern oyster, *Crassostera gigas* and *C. virginica* showed an LC_{50} of 0.61 and 3.8 mg/L exposed to cadmium. 0.85 mg/L was the LC_{50} for soft-shell clam, *M.arenaria* exposed to cadmium chloride (USEPA, 2001). Common clam, *D. faba* showed 0.2 mg/L as the 96 hour LC_{50}[11]. Concentrations of cadmium and copper used in our experiments are regarded to be high for *P.viridis*[12].

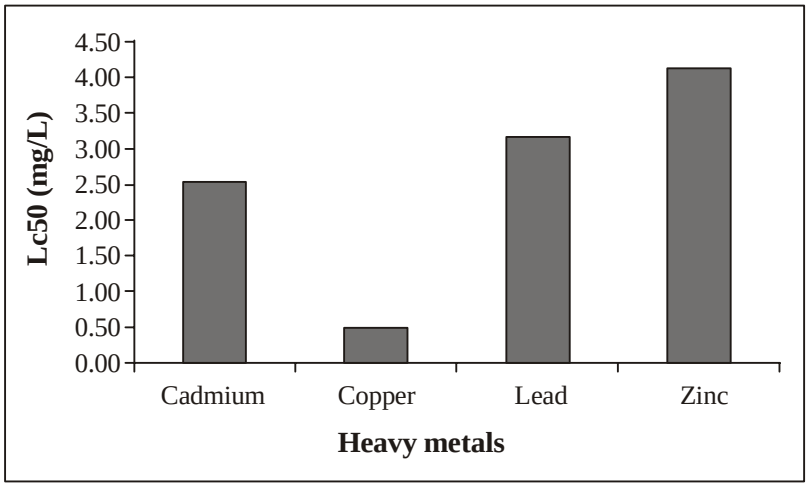

Fig. 1: *Perna viridis* Exposed to cadmium, copper, lead and zinc in acute toxicity test

Such concentrations do not occur permanently in surface waters. However, due to accidental industrial discharges of heavy metals into the aquatic environment, fish may have shorter or longer contact with such concentrations of heavy metals[2]. This may be dangerous for aquatic organisms, especially for larvae that are considered to be more vulnerable to intoxication caused by heavy metals than embryos or older individuals[13].

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