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ACUTE TOXICITY OF FIVE HEAVY METALS TO THE PRAWN, *PENAEUS INDICUS* (H. MILNE EDWARDS) IN BRACKISHWATER MEDIUM

Rapid industrialisation and urbanisation are resulting in pollution of the estuaties and coastal areas of India[1-6]. Heavy metals are among the pollutants which are potentially harmful to most aquatic organisms when exposed above a critical threshold. Acute toxicity tests are usually employed in assessing the chemical hazard to aquatic biota. Hence bioassay studies were made on a commercially important species of prawn, *P. indicus* to test the relative toxicity potential of Cr, Cu, Zn, Cd and Hg and the relative sensitivity of prawns of variable sizes to these metals.

Static bioassay tests were conducted following the recommended methods[7]. The test animals, *P. indicus* of 2 size groups (35-45 mm and 50-70 mm) were collected from the Pulicat lake and acclimatized to laboratory conditions in brackishwater (salinity 25.0±0.2 ppt) recirculatory system for one week prior to the experiment. Prawns were fed with boiled egg pieces during acclimatization to avoid cannibalism. Feeding by natural plankton and other food was suspended two days before the experiments. Acclimatized prawns were carefully examined and only the healthy ones were kept in cylindrical glass jars of 10 l capacity for experiments.

The brackishwater, needed for the experiment, was collected from pollution-free Pulicat estuary. The metal concentrations of the water samples were : Zn 0.018 $\mu g.ml^{-1}$ and Cu 0.004 $\mu g.ml^{-1}$ while Cd, Cr and Hg were below detection limit. Metal stock solutions were prepared by dissolving analytical grade $HgCl_2$, $CuSO_4.5H_2O$, $ZnSO_4.7H_2O$, $CdSO_4$ and $K_2Cr_2O_7$ in double distilled water. A range of test concentrations ($\mu g.ml^{-1}$) as indicated by preliminary toxicity tests were prepared (0.01, 0.02, 0.04, 0.06, 0.08, 0.10 for Hg ; 0.25, 0.5, 1, 2, 3, 4 for Cu ; 0.25, 0.5, 1, 2, 3, 4 for Zn ; 2, 4, 6, 8, 10, 12 for Cd and 5., 7, 9, 11, 13, 15 for Cr). The prawns were exposed to these concentrations for 48 and 96 hours. Duplicates were run for each metal.

The physico-chemical characteristics of water during the experimentations were : water temperature 28.3 ± 0.3°C, pH 8.05 ± 0.15, dissolved oxygen 7.9 ± 0.7 $mg.l^{-1}$, salinity 25.0 ± 0.2 ppt and total alkalinity 168 ± 2.0 $mg.l^{-1}$ as $CaCO_3$.

Ten prawns were used in each jar with a separate set of controls. The prawn mortality was observed at 8 h intervals upto 96 h of experimentation. A prawn was considered dead when with a slight prod by rod, it failed to respond. Such a prawn was taken out of the jar and preserved in formalin for measurements. The 48 h and 96 h LC_{50} values were calculated for all the metals tested according to Finney[8].

The results of the experiments are given in Table 1. The 48 h LC_{50} values calculated for Cr, Cu, Zn, Cd and Hg are 12.2, 2.3, 1.66, 7.67 and 0.05 $\mu g.ml^{-1}$ and 96 h LC_{50} values are 7.12, 0.90, 0.70, 4.22 and 0.02 $\mu g.ml^{-1}$ respectively to prawns of small size group (35-45 mm) while for the bigger size group (50-70 mm) the 48 h LC_{50} values are 13.1, 2.5, 2.24, 9.8 and 0.06 $\mu g.ml^{-1}$ and 8.4, 1.3, 1.2, 5.1 and 0.05 $\mu g.ml^{-1}$ respectively.

Table 1. Median lethal concentrations (LC_{50}) of five heavy metals to prawn, *P. indicus*

Heavy Metals	Prawn size 35-45 mm		Prawn size 50-70 mm	
	LC_{50} ($\mu g.ml^{-1}$)		LC_{50} ($\mu g.ml^{-1}$)	
	48 hr.	96 hr.	48 hr.	96 hr.
Hg	0.05	0.02	0.06	0.05
Cr	12.20	7.12	13.10	8.40
Cd	7.67	4.22	9.80	5.10
Cu	2.30	0.90	2.50	1.30
Zn	1.66	0.70	2.24	1.20

The results of static bioassay tests for acute toxicity of metals to prawns showed that the order of toxicity for *P. indicus* was found to be $Hg \gg Zn \geqslant Cu > Cd > Cr$.

It is reported[9, 10] that among Hg, Cu and Zn tested with marine invertebrates, Hg has the highest toxic potential followed by Cu and Zn. In the present study, Zn was slightly more toxic than Cu. It is pointed out that the order and degree of metal toxicity vary not only with such parameters as salinity and metal salt form, but also with life stages and the type of species[9].

In the present study it is observed that prawns of small size group are more sensitive to all the five metals tested than bigger size group. This may be because of the higher exposure and accumulation of metals by the younger animals as their surface to volume ratio is greater than that of bigger ones.

Since the above toxic metals are found as common pollutants in the estuarine and coastal waters of India[1-6], the above data will be of practical importance in the culture of commercially important penaeid prawns in brackishwater systems.

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Central Institute of Brackishwater Aquaculture
141, Marshalls Road, Egmore,
Madras-600 008

K. O. JOSEPH
J. P. SRIVASTAVA*
P. M. A. KADIR

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*Post Graduate Department of Chemtstry, Magadh University, Bodh-Gaya-824 234

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