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REGULAR ARTICLE

EFFECT OF ORGANOTIN TRIBUTYLTIN CHLORIDE ON OXYGEN CONSUMPTION OF *MACROBRACHIUM KISTNENSIS*

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SUMMARY

Aquatic animal's responses to chemical pollutants in the aquatic environment are usually understood, through determining their rate of survival and changes in the levels of various physiological phenomenon's. In the present study effect of LC50 for 48 hrs of Organotin tributyltin chloride on the rate of oxygen consumption of freshwater prawn, *Macrobrachium kistnensis* has been determined. The prawns were exposed to lethal concentration of 0.26 ppm of organotin tributyltin chloride and oxygen consumption rate was measured after 1, 2, 4, 8, 12 and 24 hrs of exposed period. The obtained data showed that there was an increase in the rate of oxygen consumption in *Macrobrachium kistnensis*, when exposed for 1 and 2 hrs to 0.26 ppm of TBTCl, where as the rate of oxygen consumption decreased significantly ($P<0.05$) after exposed for 4 to 24 hrs at 0.26 ppm as compared to control values. The increases in oxygen consumption in 1 and 2 hrs indicated immediate response to the toxic environment and initial elevation in the rate of oxygen consumption showed a compensatory phase to enhance the physiological activity, but the steady decrease may be due to the failure of respiratory metabolism in *Macrobrachium kistnensis*.

Keywords: *Macrobrachium kistnensis*, Organotin tributyltin chloride, Oxygen consumption, LC50.

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1. Introduction

Organotin compounds are among the most hazardous pollutant known so far in aquatic ecosystems. Tributyltin (TBT) is of particular importance because of its widespread use as moth-proofing agents, bactericides, fungicides, as heat stabilizer in PVC industries, Paper and Pulp industries and biocidal agent in wood preservation and as an antifouling agent in paint on ships and boats. Since the late 1970's considerable quantities of TBT were introduced into the aquatic environment and as a result, widespread pollution of marine and freshwater harbors and adjacent areas resulted. Organotin pollution in the aquatic environment is of global concern. Due to the extreme toxicity and the ecotoxicological hazards associated with TBT in antifouling paints, restrictions on its use have been implemented in many countries in the mid

to end 1990. TBT accumulates in aquatic environment for a long period of time and as a consequence, high levels of TBT have been found in freshwater and coastal sediments, with concentrations up to several mg/kg.

Organotins are extremely toxic to aquatic biota as demonstrated for a variety of different organisms in vivo and in vitro, Fent (1996). Many ecotoxicological studies on organisms of different evolutionary level have been reported, Alzieu and H´eral (1984); Bryan et al., (1989); Fent and Muller (1991); Fioramonti et al., (1997) Alzieu, (2000).

However, the long-term ecotoxicological effects of organotins on the structure and function of aquatic ecosystems are still not well understood, particularly with respect to its mode of action in different physiological and biochemical systems, Guruge et al., (1996); Jak et al., (1998).

Studies on the oxygen consumption form a useful tool in assessment of toxicant stress on the aquatic organism and give an index of energy expanditive mechanism for environmental variation, Sultana and Devi (1995). Oxygen consumption is a very sensitive physiological process and changes in the respiratory activity has been used as an indicator of stress animal exposed to toxicant, Shivakumar and David (2007).

Very few literatures are available on the effect of antifouling agent like TBT on oxygen consumption in arthropod and especially in crustacean. Hence, in present investigation attempt has been made to determine the possible effect of organotin tributyltin chloride on the rate of oxygen consumption of fresh water prawn, *Macrobrachium kistnensis* exposed to tributyltin chloride.

2. Material and Methods:

The fresh water prawns *Macrobrachium kistnensis* were collected from Kham river near Aurangabad, Maharashtra. The prawns were maintained in plastic trough containing aerated tap water. They were acclimatized for a week to laboratory condition. Prawns were fed with green algae at alternative days. 1ppm stock solution was prepared in acetone (Laughlin et al., 1983). Matured healthy female prawns were selected for experiment. For each experiment 20 animals of approximately similar size (2.5±1cm in length) were exposed to 0.26 ppm (48 hrs LC_{50}) of tributyltin chloride.

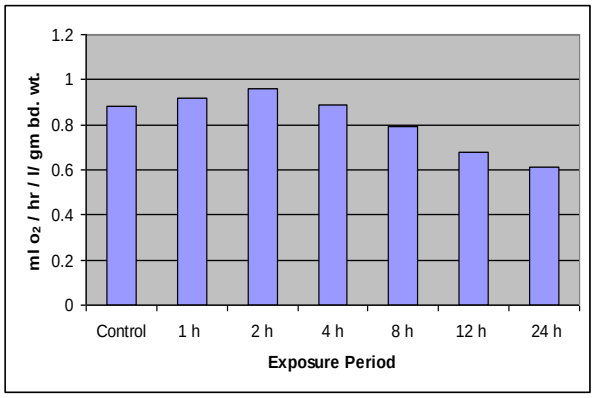
The oxygen consumption for lethal exposure was measured after 1, 2,4, 8, 12 and 24 hr. Estimation of oxygen consumption was made by Winkler's method as modified by Strickland and Parsons. The rate of respiratory metabolism is expressed as ml /O_2 /g /l. simultaneously control group was also maintained in tap water with experimental animal group.

3. Results

On exposure to tributyltin chloride the respiratory metabolism of prawn, *Macrobrachium kistnensis* has been found to be directly altered. The obtained data clearly showed that there was an increase in the rate of oxygen consumption of prawn, *Macrobrachium kistnensis* after exposing for 1 and 2 hrs. to 0.26 ppm of tributyltin chloride. Whereas the rate of oxygen consumption decreased significantly ($p< 0.05$) after exposing for 4 to 24 hrs. as compared to control groups. It was also observed that at acute exposure, the prawns showed sudden decrease in oxygen consumption followed by an initial increase and then steady decrease as shown in Fig. 1. The decrease in the oxygen consumption can be immediate response to the toxic environment. The initial elevation in the rate of oxygen consumption showed a compensatory phase to enhance the physiological activity but the

continuous decrease may be due to the failure of respiratory metabolism.

Fig. 1. Rate of oxygen consumption of freshwater prawn, *Macrobrachium kistnensis* exposed to 0.26 ppm 48 hr LC50 of tributyltin chloride



3. Discussion

In the present study, oxygen consumption of fresh water prawn, *Macrobrachium kistnensis* was normal and after exposure to contaminated area has been quantified. There was continues increase in rate of oxygen consumption of fresh water prawn, *Macrobrachium kistnensis* up to 4 hrs when prawn were exposed to TBTCl. As the period of exposure increased, this uptake gradually but constantly decreased with a sever fall after 8 hrs. and continued even after 24 hrs of exposure. These results clearly indicate that the tributyltin chloride must be acting on the organized enzyme sites of the cells slowly in the concentration initially. This is speculated because there was an obvious decrease in the rate of oxygen consumption of fresh water prawn, *Macrobrachium kistnensis* after 4 to 24 hrs. exposures as compared to first 4 hrs exposure to tributyltin chloride.

Tributyltin compounds are known to cause a variety of effects on mitochondrial, which correlates with increase in oxygen consumption. (Wulf and Byington, 1975, Aldrich, 1976). Furthermore, tributyltin compounds are known to inhibit ions translocating ATPase (Selvin et al. 1970, Selvin 1976) Indira B. (1989) displays oxygen consumption rate by *Caradina weberi* shows alteration like increase and decrease oxygen uptake when exposed to different concentration of copper sulphate and TBTO.

Initial elevation and subsequent decrease in the rate of oxygen uptake in freshwater prawn *Macrobrachium kistnensis* exposed to lethal concentration of 0.26 ppm for 48 hrs of TBTCl suggests that the increase in rate of oxygen consumption in different contaminated media might be the reflection of a augmented physiological activity like osmosis at the cellular level in eliminating and/or counteracting the pollutant stress perhaps when exposed to the different sublethal concentration. In conclusion, the response of an organism to the toxic environment is quite evident from the variation in respiratory metabolism and that can also effect several parameters like the growth rates in prawns or exhausts the biochemical reserve.

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