



Acute Toxicity and Behavioural Responses of Freshwater Crab *Barytelphusa Cunicularis* to Tributyltin Oxide (TBTO) Exposure

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Abstract

Organotin compounds used in various industries, contaminate aquatic reservoirs and adversely affect the non-target organisms. In the present study, acute toxicity of an antifouling agent, Tributyltin Oxide (TBTO), to a freshwater edible crab *Barytelphusa cunicularis* (west wood) was studied. The LC₅₀ values of TBTO on crab were 5.29 ppm, 4.26 ppm, 3.17 ppm, 2.44 ppm after 24, 48, 72 and 96 h, respectively. The exposed crab exhibited restlessness, escape behaviour, increased scaphognathite activity, topsy-turving responses has been found to increase with increasing toxicant concentration and exposure time.

KEY WORDS: LC₅₀, Tributyltin oxide, Crab, *Barytelphusa cunicularis*

Introduction

Industrialization has been instrumental in the economic development of the world. Shipping industries contributes economical support to nations. It also improves customer service and satisfaction. It reduces distribution and transportation cost and eliminates factors that cause inefficiency. This industry can help to boosting revenues and global expansion also facilitates new trading opportunities and growth. It connects sources of supply and demand for commodities including raw materials, manufacture goods and even livestock animals, passengers between ports and countries. From ancient time ships has been used for exploration, transportation and war. The harsh marine climate, with harsh salt and moisture makes ships prone to corrosion. Incrustation of ship hull notably the underside by algae, bacteria, aquatic organisms destroy paint, baring the metal to corrosion. There is need to use antifouling agents in paints to solve this problem. Tributyltin was first used as a biocide in antifouling paints from 1959 to 1961 and in the 1970s to prevent the build-up of barnacles and slime on boat hulls, ship hulls, marine platforms, and fishing nets because tributyltin is 10-100 times more effective than paints containing copper (Bryan et al., 1986; Wade et al., 1988). Organotin compounds are represented chemically by the type formulas RSnX₃, R₂SnX₂, R₃SnX, R₄Sn, in which R is any alkyl or aryl group and X is an anionic species, for example halide (TBTF, TBTCI), acetate (TBT-0Ac) and oxide (TBTO) (Smith, 1978; 1980; Pain and Cooney, 1998; Gadd, 2000). The TBT compounds are a sub-group of the trialkyl organotin family. The alkyl group tends to be more toxic than the aryls and the tri-organotins are more toxic than mono, di and tetra organotin. Among the contaminants,

organo-metals constitute one of the main dangerous groups, because they are toxic, persistent and not easily biodegradable.

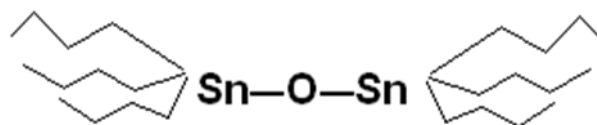
Materials And Methods

The medium size freshwater crab *Barytelphusa cunicularis*, 40 to 45 gm. body weight irrespective of sex were collected with the help of local fisherman from Godavari River at the Kaigaon village of Aurangabad district of Maharashtra. The crab was properly washed in tap water and treated with 0.01% KMNO solution to remove external infection of fungi, algae, etc. The normal healthy and non-infected crabs were selected for experiment. The crabs were acclimatized to laboratory conditions for 7 days before commencement of experiment. All the precautions laid down by APHA *et al.*, (1998) are followed, for maintaining the crab in laboratory. The animals were fed twice in daily with earth worm. The feeding was stopped 24hr. before experimentation.

Toxicity Evaluation:

The technical grade, organotin tributyltin oxide was used in present study. The tributyltin oxide was purchased from Spectrochem Pvt. Ltd. Mumbai.

The structural formula and Physico-Chemical properties of organotin tributyltin oxide is- (IUPAC Name : Bis-[Tri-n-butyltin]-oxide; molecular formula : $C_{24}H_{54}OSn_2$; Molecular weight : 596.07 ; Density : 1.17g/cc(20°C) ; Solubility in water: 0.002g/100ml ; Appearance : colourless to pale yellow]



The stock solution of tributyltin oxide (1-ppm) was prepared by dissolving a known quantity of solution in acetone and various concentrations were made from this stock solution for toxicity evaluation. Stock solution was prepared in acetone, Laughlin *et al.*, (1983). The Series of statistic bioassay were conducted under laboratory condition as described by Finney (1971). Acute toxicity tests were conducted over 96 hrs. The experimental troughs containing 5 litres dechlorinated water were used to keep the animals. For each experiment ten crabs *Barytelphusa cunicularis* of approximately similar size (40 to 45 g body weights) were exposed to different concentrations of tributyltin oxide. After every 12 hours the polluted water was changed by the fresh test solution of the same concentration. The mortality of the crabs was recorded before each change of water. The resulting mortality was noted in the range of 10 to 90% for each concentration for the duration of 24, 48, 72 and 96 hrs. Each experiment was repeated thrice to obtain constant results. The data collected was analysed statistically by means of probit method on transforming toxicity curve (% mortality vs. concentration), which allows the average median lethal concentration of LC_{50} to be calculated for 24, 48, 72 and 96 hrs.

Observations

Table 1.

LC50 values of fresh water crab *Barytelphusa cunicularis* exposed to tributyltin oxide for 24 hours

I	II	II I	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
Conc of TBTO in ppm	Log of conc. to base 10 'x'	No of animals exposed 'n'	Corrected % of Mortality	Empirical probit	Expected Probit Y	Weighting coefficient	Weight w=Wn	Working probit 'y'	Wx	wy	wx ²	wy ²	Wxy	Improvised expected probit 'Y'
5.21	0.7168	10	10%	3.7184	3.8	0.37031	3.7031	3.722	2.65438	13.78293	1.91237	51.5619	9.87961	4.1964
5.23	0.7185	10	30%	4.4756	4.2	0.50260	5.0260	4.504	3.61118	22.637104	2.59463	101.9575	16.26475	4.4015
5.25	0.7201	10	30%	4.4756	4.4	0.55788	5.5788	4.477	4.01729	24.976287	2.89285	111.8188	17.98542	4.5946
5.27	0.7218	10	40%	4.7467	4.6	0.60052	6.0052	4.750	4.33455	28.5247	3.12868	135.4923	20.58912	4.7998
5.29	0.7234	10	50%	5	4.8	0.62742	6.2742	5.003	4.53875	31.389822	3.28333	157.0428	22.70739	4.9929
5.31	0.7250	10	60%	5.2533	5	0.63662	6.3662	5.251	4.61549	35.1477	3.34623	175.5352	24.23596	5.1860
							$\sum W = 32.9535$		$\sum W = 23.7716$	$\sum WY = 156.4585$	$\sum WX^2 = 17.1580$	$\sum WY^2 = 733.406$	$\sum WXY = 11.6622$	

Table 2.

LC50 values of fresh water crab *Barytelphusa cunicularis* exposed to tributyltin oxide for 48 hours

I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
Conc. of TBTO in ppm	Log of conc. to base 10 X	Expos ed anima ls N	% morta lity	Empiri cal probit	Expec ted probi t Y	Weighi ng co- efficien t W	Weig ht w=Wn	Work ing probi t Y	Wx	Wy	wx ²	wy ²	Wxy	Impr oved expe cted prob it Y'
4.18	0.6211	10	20%	4.1584	4.0	0.43863	4.3863	4.171	2.59060	18.29525	1.692081	76.30951	10.80539	4.3194
4.20	0.6232	10	30%	4.4756	4.2	0.50260	5.0260	4.504	2.80689	22.63710	1.951989	101.9575	12.64223	4.5860
4.22	0.6253	10	40%	4.7467	4.6	0.60052	6.0052	4.750	3.75505	28.52470	2.348033	135.4923	17.83648	4.8526
4.24	0.6273	10	40%	4.7467	4.8	0.62742	6.2742	4.747	3.93580	29.78362	2.468930	141.3828	18.68324	5.1065
4.26	0.6294	10	50%	5	5.2	0.62742	6.2742	4.997	3.94898	31.35217	2.485488	156.6663	19.73305	5.3731
4.28	0.6314	10	60%	5.2533	5.4	0.60052	6.0052	5.250	3.79168	31.52730	2.394068	165.5183	19.90632	5.6144
							$\sum w = 32.6188$		$\sum wx = 20.3789$	$\sum wy = 156.0589$	$\sum wx^2 = 12.7324$	$\sum wy^2 = 754.8854$	$\sum wxy = 97.5667$	

Table 3.
LC50 values of fresh water crab *Barytelphusa cunicularis* exposed to tributyltin oxide for 72 hours

I	II	III	IV	V	VI	VII	VIII	IX	X	X I	XII	XII I	XI V	XV
Conc . Of TBT O in ppm	Log of conc. to base 10	No of anim als expos ed 'n'	Correct ed % of Morta lity	Empiri cal Probit	Expect ed Probit Y	Weigh ting coeffic ient W	Weight w=Wn	Work in g probit 'y'	W x	W y	wx ²	wy ²	W xy	Impro ved expect ed probit 'Y'
3.09	0.4899	10	20	4.1584	4.2	0.50260	5.0206	4.159	2.45959	20.88067	1.2049 5	86.84272	10.22943	4.1726
3.11	0.4927	10	30	4.4757	4.4	0.55788	5.5788	4.477	2.74867	24.97628	1.3542 7	111.8188	12.30579	4.3788
3.13	0.4955	10	30	4.4757	4.6	0.60052	6.0052	4.479	2.97557	26.89729	1.4743 9	120.4729	13.32757	4.5851
3.15	0.4983	10	40	4.7467	4.8	0.62742	6.2742	4.747	3.12643	29.78362	1.5579 0	141.3828	14.84116	4.7914
3.17	0.5010	10	50	5	5	0.63662	6.3662	5.000	3.18946	31.831	1.5979 2	159.155	15.9473	4.9902
3.19	0.5037	10	60	5.2533	5.4	0.60052	6.0052	5.250	3.02481	31.5273	1.5236 0	165.5183	15.88025	5.1891
							$\Sigma W =$ 35.2502		$\Sigma WX =$ 17.5245	$\Sigma WY =$ 165.8961	$\Sigma WX^2 =$ 8.71303	$\Sigma WY^2 =$ 785.1905	ΣWXY = 82.5314	

Table 4.
LC50 values of fresh water crab *Barytelphusa cunicularis* exposed to tributyltin oxide for 96 hours

I	II	III	IV	V	VI	VII	VIII	IX	X	X I	XII	XII I	XI V	XV
Conc . Of TBT O in ppm	Log of conc. to base 10	No of anim als expo sed 'n'	Correct ed % of Morta lity	Empiri cal Probit	Expect ed Probit Y	Weigh ting coeffic ient W	Weight w=Wn	Work in g probi t 'y'	Wx	Wy	wx ²	wy ²	W xy	Impro ved expect ed probit 'Y'
2.40	0.3802	10	30	4.4756	4.6	0.50260	5.0260	4.504	1.91088	22.63710	0.72651	101.9575	8.6066	4.8107
2.42	0.3838	10	40	4.7464	4.8	0.60052	6.0052	4.750	2.30479	28.5247	0.88458	135.4923	10.9477	4.9104
2.44	0.3873	10	50	5	5	0.63662	6.3662	5.000	2.46562	31.831	0.95493	159.155	12.3281	5.0073
2.46	0.3909	10	60	5.2533	5.1	0.62742	6.2742	5.253	2.45258	32.95837	0.95871	173.1303	12.8834	5.1070
2.48	0.3944	10	60	5.2533	5.2	0.60052	6.0052	5.250	2.36845	31.5273	0.93411	165.5183	12.4343	5.2039
2.50	0.3979	10	70	5.5244	5.4	0.55788	5.5788	5.523	2.21980	30.81171	0.88356	170.1730	12.2599	5.3008
							$\Sigma W=35.2556$		$\Sigma WX=13.72212$	$\Sigma WY=178.29018$	$\Sigma WX^2=5.3424$	$\Sigma WY^2=905.4264$	$\Sigma WXY=69.46$	

Table. 5
Relative toxicity of tributyltin oxide against the fresh water crab, *Barytelphusa cunicularis*

Sr. no.	Time of exposure (hrs)	LC50 Value (ppm)	Standard Error S.E.= $\sqrt{v}$	LC10 Value (ppm)	Variance 'v'	Chi Square value	Fiducial limits		Lethal dose (ppm)	Safe Conc. (ppm)
							M1	M2		
1	24	5.2893	0.0014507	0.7128	2.1×10^{-6}	0.1598	0.7205	0.7262	126.943	0.5503
2	48	4.2570	0.0013926	0.6187	1.9×10^{-6}	0.2702	0.6266	0.6321	204.192	
3	72	3.1702	0.0023039	0.4766	5.3×10^{-6}	0.2302	0.4964	0.5055	228.254	
4	96	2.4378	0.0061064	0.3407	3.7×10^{-5}	1.3628	0.3753	0.3992	234.028	

Fig.1: Probit regression line showing relation between log of concentration of tributyltin oxide probit kill for graphical derivation of LC_{50} for *Barytelphusa cunicularis* at 24hrs.

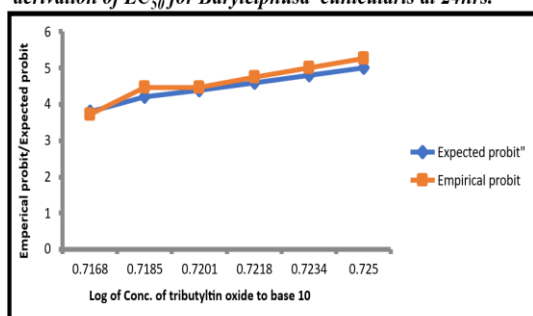


Fig.2: Probit regression line showing relation between log of concentration of tributyltin oxide probit kill for graphical derivation of LC_{50} for *Barytelphusa cunicularis* at 48hrs.

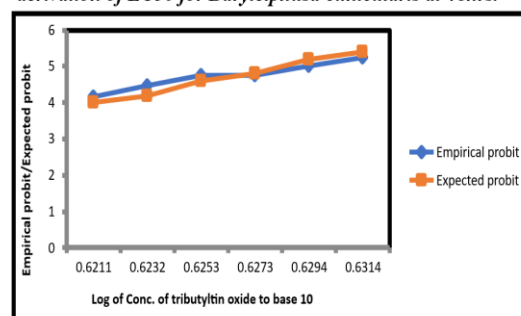


Fig.3: Probit regression line showing relation between log of concentration of tributyltin oxide probit kill for graphical derivation of LC_{50} for *Barytelphusa cunicularis* at 72hrs.

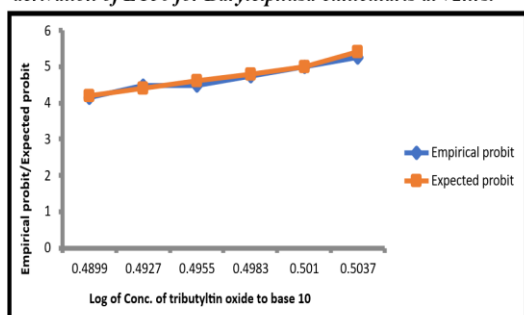
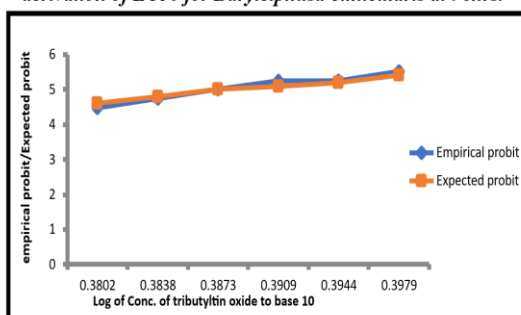


Fig.4: Probit regression line showing relation between log of concentration of tributyltin oxide probit kill for graphical derivation of LC_{50} for *Barytelphusa cunicularis* at 96hrs.



Results

In the present investigation, freshwater crab *Barytelphusa cunicularis* were exposed to different concentrations of tributyltin oxide, revealed behavioural changes. The control crab behaved in a natural manner, they were active and show well-coordinated movements such as crawling movements were normal and showed no signs of stress. Excretion was normal. Eye movements and body posture were normal. They lived gregariously with each other with no signs of any aggression. They were alert to the slightest disturbance and there were no detectable behavioural changes or deaths observed till the end of experiment. The experimental crab, *B. cunicularis* showed aggressive behaviour. Rapid movement of chelate legs was observed. Crawling upon each other trying to attack each other and some animals also showed very little or no feeding at all. Excitation and increase in rate of movements. Irregular, erratic, colour change, over secretion of mucous was seen. Crabs were more sensitive and preferred comparatively dark areas.

In 24hrs LC_{50} exposure of tributyltin oxide, *Barytelphusa cunicularis* showed slight increase in feeding quantity for first few hours. Crab exposed to 48hrs LC_{50} there was an increase in the activity. The feeding also increased from moderate to higher compare to previous group. There was slight increase in excretion than 24hrs exposure. When crab treated with tributyltin oxide for 72hrs and 96hrs lethal concentration of organotin compound demonstrates abnormal behaviour that the animals looked quite restless. Movements increased initially then became dull gradually. They show normal eye movements and excreta found sticky. Along with most of the animals showed aggressive behaviour with Rapid movement of chelate legs and crawling upon each other. They attack each other. Some crabs showed very little or no feeding at all. The increase in activity and aggressive behavioural was shows the increased metabolic rate, which could be to overcome the induced stress of tributyltin oxide concentration. It was recorded for *Barytelphusa cunicularis*.

For the experimentation and before each change of water animal behaviour was recorded. The LC_{50} values were calculated for 24 h, 48 h, 72 h and 96 hrs by Finney's method (1971). The LC_{50} values obtained for tributyltin oxide exposed for 24 h, 48 h, 72 h and 96 hrs exposures were 5.29ppm, 4.26ppm, 3.17ppm and 2.44ppm respectively. In the present investigation, LC_{50} values up to 96 hours exposure period indicated high toxicity.

The variance 'V' of LC₅₀ for 24 h, 48 h, 72 h and 96 hrs were recorded 2.1×10^{-6} and 1.9×10^{-6} , 5.3×10^{-6} , 3.7×10^{-5} ppm respectively. The calculated minimum fiducial limits of tributyltin oxide for 24 h, 48 h, 72 h and 96 h were 0.7205, 0.6266, 0.4964, and 0.3753 ppm to 0.7262, 0.6321, 0.5055 and 0.3992 ppm respectively and The Chi-square values were calculated, 0.1598, 0.2702, 0.2302 and 1.3628 these values were used to test homogeneity of data. Lethal dose obtained for tributyltin oxide of 24, 48, 72, and 96 hrs were 126.943, 204.192, 228.254, and 234.028 ppm respectively. The safe concentration of tributyltin oxide 0.5503 ppm was recorded (Table 5).

The graphical representation of log of concentration of TBTO with empirical Probit and expected Probit for crab at 24, 48, 72 and 96hr showed in (fig. 1-4) respectively. The results obtained for toxicity evaluation of tributyltin oxide on *Barytelphusa cunicularis* indicated that tributyltin oxide found to be toxic as exposure period increases.

Discussion

The evaluation of LC₅₀ concentration of tributyltin oxide is an important factor for carrying out further studies on physiological and biological changes in *Barytelphusa cunicularis*. In the present investigation the freshwater crab *Barytelphusa cunicularis* exposed to tributyltin oxide for the study of acute toxicity. It was expressed in terms of LC₅₀ values. Mortality of *Barytelphusa cunicularis* is a more sensitive measure of toxicant. The lethal toxicity of tributyltin oxide and other xenobiotic compound for crab and other aquatic organisms like shrimps, fishes varies with species and concentration. It might be due to change in chemical structure and way of intake of the contaminant used in the present investigation. The route of uptake for dissolved contaminant is mainly fishes, crabs through the gills, but intake via food is also significant (Part, 1989; Holm *et al.*, 1991; Triebkorn *et al.*, 1994).

The measurement of mortality in the crab depends upon the amount of toxicants. The current research work reveals about toxicity of tributyltin oxide to model organism *Barytelphusa cunicularis*. The percentage survival of the crab's decreases along with increasing concentration of organotin compound. In existing probe, acute toxicity test indicates a link between the concentration of organotin and length of exposure period. The LC₅₀ values of the crab reduce gradually as the exposure period goes on increasing. This is because of acute toxicity causes damage to the organism by fastest acting mechanism. The exposure of pesticide like coragen on *Barytelphusa cunicularis* shows similar results observed by others (Mirajkar, 1984, Manikumar 1985, Sharma 1989, and Yadav 1991).

The research conducted by Shejule *et al.*, (2006) states that the LC₅₀ values for freshwater prawn; *Macrobrachium* exposed to the organotin tributyltin chloride for 24, 48, 72 and 96 hrs and found LC₅₀ values as 0.33, 0.26, 0.17 and 0.09 ppm correspondingly. The percentage mortality of crabs increased progressively up to 96 hrs. In all the concentrations of the pesticide coragen, the LC₅₀ values decreased with increasing exposure period. In the mature crabs, the LC₅₀ values of coragen were found to be 0.2612, 0.2280, 0.1650 and 0.1448 ppm after 24, 48, 72, and 96 hrs exposures respectively. From the above results it was observed that the LC₅₀ values of 96 hrs were found lowest among all the exposure periods (Kapadnis and Yadav, 2011). Li *et al.*, (2006), reported LC₅₀ value for chlorpyrifos for adult Chinese crab *Eriocheir sinensis* was 460.9 µg/L for 24 hours, which decreased with exposure time (96 h LC₅₀ value 143.0 µg/L). Comparison of toxicity to different life stages revealed sensitivity of chlorpyrifos in the order: Juvenile I > embryos > Juvenile II > Adult. Data on toxicity of chlorpyrifos to crab *Oziotelphusa senex* revealed its sensitivity in the same magnitude (Radhakrishnaiah & Renukadevi, 1990; Senthil Kumar *et al.*, 2007) reported LC₅₀ of chlorpyrifos to *Sirialothelphusa hydrodroma* which revealed that crabs show high tolerance to it than the fishes (Rao *et al.*, 2005) possibly due to the hard chitinous exoskeleton in crabs.

Living animals are constantly faced with various environmental stresses that challenge their daily lives. Cu is an essential metal that participates in normal physiological process of crustaceans, but several

studies have shown that crustaceans are adversely affected when exposed to high concentrations of Cu. LC₅₀ value represents a common point at lethal physiological response to toxicity, which has been well-documented in many crustaceans. For example, the 96-h LC₅₀ value for shrimps of *Exopalaemon carinicauda*, *Echinogammarus olivii*, *Sphaeroma serratum*, and *Palaemon elegans* was 0.712 mg Cu/L, 0.25 mg Cu/L, 1.98 mg Cu/L, and 2.52 mg Cu/L, respectively (Bat *et al.*, 1999 and Zhang *et al.*, 2014). In addition, for paddy field crab *Paratelphusa hydrodromus* and freshwater crab, *Barytelphusa cunicularis*, the 96-h LC₅₀ values recorded were 15.70 mg Cu/L and 215 mg Cu/L, respectively Vardhanan and Radhakrishnan, (2002). Likewise, in freshwater crayfish, *Procambarus clarkia*, the 96-h LC₅₀ value reached 162 mg Cu/L (Bini and Chelazzi, 2006).

The *C. dauricus* had higher concentration-dependent accumulation ability of copper *Barytelphusa cunicularis* (Westwood) to copper sulphate (Jie *et al.*, 2020). They treated crabs with fatal concentrations (282, 258, 238 and 215 ppm) of copper sulphate. After exposure to copper sulphate, the crabs exhibited many histological changes during 1 to 4 day of exposure. They observed that gills exhibited vacuolization in the gill stem, gill lamellae were ruptured, connective tissue cells in the stem were broken, and blockage of haemocytes in the gill lamellae were observed (Kulkarni, 2013). Verma and Sharma (2024) also investigated that cypermethrin is a very strong insecticide to promote structural and physiological disturbances in roughly all fish species.

The Physiological processes are mostly coordinated by hormones and changes in hormone levels are expected to occur soon after exposure to environmental stress, such as pollutant, eventually acting as endocrine disruptors (Newell, 1973). In the investigation done by Patil, Kadam and Raut, (2014), it is found that, Malathion with concentration of 5.5 ppm found to be LC₅₀ concentration for fresh water crab, *Paratelphusa (Barytelphusa) jacquemontii*. When exposed to various chlorpyrifos concentrations, crabs displayed altered behavioural responses such as hyperactivity, escape actions, scaphognathite racing to psyturving reflex, and increased oxygen consumption. They displayed increased scaphognathite activity during the first several hours of exposure, as well as the generation of air bubbles and coughing, at low concentrations. According to Dyer and Uglow, (1978) and Shibu Vardhanan and Radhakrishnan, (2002) scaphognathite activity has also been used as an index to determine the hazardous potential metals to crabs. In vivo, ammonia is mostly produced from amino acids. In order to respond to external stress, crustaceans have the capacity to control the content of intracellular free amino acids (Greenaway *et al.*, 1991). In the investigation, AER revealed a diminishing tendency with increasing exposure concentration and time to Cu, whether it was acute or sub chronic Cu exposure. Maximum reductions in AER of 79.4% and 70.06%, in compared to the control, were seen following exposure to 16.48 mg/L for 96 hours and 2.06 mg/L for 14 days, respectively (Jie *et al.*, 2020). Similar to this, after 30 days of Pb exposure, Chinni *et al.*, (2002) observed a substantial decline in AER in post-larval *P. indicus*. It was hypothesised that such a decline might be brought on by a slowing of the metabolic rate or by a heavy metal's involvement with the ammonia-N synthesis pathways. Other crustaceans, on the other hand, were shown to excrete more ammonia after being exposed to heavy metals. For instance, after exposure to Zn and Hg, a rise in AER was observed in juvenile *E. carinicauda* (Zhang, C., *et al.*, 2014) and in *F. paulensis* following Cd and Zn exposure (Barbieri, 2009). In present investigation the freshwater crab *Barytelphusa cunicularis* showed behavioural alterations when exposed to various amounts of tributyltin oxide. Behavioural alterations were observed throughout the initial phases. The control crab acted naturally as compare to exposed crab the acute toxicity test responsible for increased metabolic rate is evident in the increased activity and aggressive attitude, which may be an attempt to combat the stress that the elevated tributyltin oxide content has caused. *Barytelphusa cunicularis* was the subject of the report. The sub-lethal concentrations of 96 hrs LC₅₀ further can be used to study chronic toxicity studies.

Conclusion

Toxicity of compound was calculated using static renewal bioassay for 96 hrs exposure. To determine the LC₅₀ value for *Barytelphusa cunicularis* after exposure period 24, 48, 72 and 96 hrs. In static

renewal system was 5.29ppm, 4.26ppm, 3.17 ppm, 2.44ppm respectively. In the current experimental work revealed that the rate of mortality increases with respect to the increase in concentration of toxicant, which gave a dose response curves, the LC_{50} values were calculated by Finney's probit analysis method. From the toxicological studies it was clearly indicated that tributyltin oxide is toxic to the test crab *Barytelphusa cunicularis*. When exposed to lethal concentrations of tributyltin oxide, abnormal behavioural responses such as increase in aggressive behaviour with rapid movement of chelate legs and also crawling upon each other and trying to attack each other. Some animals showed very minute quantity or no feeding at all. Excitation and increase in rate of movements with irregular, erratic, over secretion of mucous were observed as compared with control crabs. However, the behavioural responses were not much obvious at sub-lethal concentration.

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