

Research Article

THE INFLUENCE OF TANNERY EFFLUENT ON BIOCHEMICAL CONSTITUENTS IN THE BLOOD OF THE FISH *Oreochromis mossambicus* (BLOCH)

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ABSTRACT

Tannery effluent was found to increase the concentration of free aminoacids in the blood of *Oreochromis mossambicus*. But, it reduced total proteins, glycogen content, total free sugars and total lipids. The increased proteolysis might be the cause for the raise of total free aminoacids and for the decrement of total proteins. The reduction in the concentration of glycogen, sugars and lipids could be due the utilization of these biochemical constituents to meet the excessive energy demand under emergency during the stress caused by the effluent.

Key words: Tannery effluent, blood, biochemical constituents, *O. mossambicus*.

INTRODUCTION

In India, the increase in number of small and large scale industries has led to the production of enormous volume of complex wastes. Various industrial effluents that affect the quality of water bodies have been characterized by investigators like Varadaraj and Subramanian (1991), Baruah *et al.*, (1996) and Reddy and Subba Rao (2001). The tannery industries are one of the water based industries as they use large quantity of water and chemicals in processing the leather. Of all the industrial wastes, the tannery effluent is shown to be a dangerous pollutant (Arora,1981). Literatures are made available to show the adverse effect of tannery effluent on aquatic organisms (Jayachandran and Chokalingam 1987; Subramanian and Varadaraj, 1993; Thorat, 2001; Parithabhanu *et al.*, 2003). In general, the industrial effluents including the tannery wastes are shown to affect respiration, food utilization, enzyme activity, haematology and biochemistry of fishes.

The freshwater fishes constitute an important link in the food chain as top consumers in aquatic ecosystem and as the prey to the predators in terrestrial ecosystem. Moreover most of the

freshwater fishes also form protein-rich food for human beings. But unfortunately, majority of xenobiotic substances enter into the body of fishes as the water bodies are mostly contaminated by a number of industrial effluents. Nemesok *et al.* (1987) have reported that the fishes are sensitive to the contamination of water so that the pollutants significantly damage their physiological and biochemical processes.

In the recent past, the adverse effects of heavy metals, pesticides and paper and pulp mill effluent have been elucidated with reference to hematological alterations in a number of fishes (Joshi *et al.* 2002; Singh *et al.* 2002). As studies pertaining to the toxicity of tannery effluent on the biochemical constituents in the blood of fishes are scanty, the present work has been carried out to assess the toxic impact of tannery effluent on some biochemical parameters in the blood of *Oreochromis mossambicus*.

MATERIALS AND METHODS

Bioassays were carried out by using tannery effluent collected from one of the local tanneries were characterized by having high suspended and dissolved solids BOD, COD, chlorides,

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sulphides, sodium chromium tannin & lignin and locally collected fishes of known weight and size. By adopting the method given by Sprague (1973) the LC₅₀ 96hr value of the effluent to the fishes was found to be 10% (table 1). Then a group of ten fishes were reared in different sublethal concentrations along with appropriate control for 30 days. The blood from the fishes was collected from the supraorbital vein by using

18 gauge needle and syringe. Various biochemical parameters such as total free amino acids, total proteins, glycogen content, total sugars and total lipids were estimated in the blood using the methods of Yemm and Cocking (1957, Gornall *et al.* (1947), Roe (1955) and Kemp and Kits (1973) respectively. The results were statistically analyzed and tabulated.

Table 1. Mortality of *Oreochromis mossambicus* in different concentrations of tannery effluent after 96 hr exposure period.

Concentration of the effluent (%)	No. of fishes exposed	No. of fishes died	% Kill	Probit kill (%)	LC ₅₀
Control	10	0	0	0	
5	10	3	30	4.48	
10	10	5	50	5.00	10%
15	10	6	60	5.25	
20	10	9	90	6.28	
25	10	10	100	8.09	

RESULTS AND DISCUSSION

In the present study, the sublethal doses of tannery effluent are found to cause significant increase in total free amino acids in the blood of *O. massambicus*, whereas total proteins, total free sugars, glycogen content and total lipids were found to decrease (Table 2). The level of enhanced free amino acids in the blood of effluent-treated fishes indicates the intensive

proteolysis due to effluent stress. The depletion of proteins suggests the contribution of the same for the increase of free amino acids in the blood as also recorded by Joyce Shoba Rani and Janaiah (1991) in pesticide-treated *O. mossambicus*. The free amino acids are shown to serve as supplementary source of energy during chronic stress condition (Nagabushanam *et al.*, 1983).

Table 2. Levels of biochemical parameters in the blood of control and tannery effluent treated *Oreochromis mossambicus*.

Effluent Concentration (%)	Biochemical Constituents (mg/100 ml)				
	Total free amino acids	Total proteins	Glycogen	Total free sugars	Total lipids
Control	309.23 ± 21.36	61.00 ± 4.12	15.12 ± 1.01	183.00 ± 14.88	269.17 ± 21.95
0.50	370.08 ± 19.78 * (+ 19.91; r = 0.92)	54.90 ± 3.88 NS (-10.00; r = 0.78)	14.00 ± 0.94* (-17.40; r = 0.78)	158.75 ± 19.55 NS (-13.25; r = 0.78)	239.41 ± 22.83 NS (-11.05; r = 0.68)
1.00	358.44 ± 24.21 NS (+15.91; r = 0.76)	42.70 ± 3.89 * (-30.00; r = 0.84)	12.80 ± 1.08 NS (-15.34; r = 0.92)	133.59 ± 10.84* (-27.00; r = 0.92)	220.58 ± 19.88* (-18.05; r = 0.84)
1.50	389.34 ± 23.74* (+25.90; r = 0.88)	38.13 ± 2.99 * (-37.49; r = 0.68)	11.20 ± 0.89* (-25.92; r = 0.82)	122.61 ± 11.55* (-33.00; r = 0.77)	204.44 ± 20.67* (-24.04; r = 0.88)
2.00	395.52 ± 20.71* (+27.90; r = 0.96)	33.55 ± 3.09 * (-45.00; r = 0.96)	10.30 ± 0.91* (-31.87; r = 0.99)	107.97 ± 10.71* (-41.00; r = 0.71)	180.23 ± 14.56* (-33.04; r = 0.96)
2.50	407.88 ± 27.10* (+31.90; r = 0.97)	36.25 ± 2.87 * (-40.57; r = 0.95)	7.03 ± 0.66* (-53.50; r = 0.94)	99.81 ± 8.24* (-45.45; r = 0.87)	166.78 ± 12.89* (-38.03; r = 0.91)

Each value is the mean ± SD of 5 observations.

+ indicates increase over control.

- indicates decrease over control.

* indicates significant at P>0.05.

NS indicates non-significant.

Under excessive energy demand due to stress caused by the effluent, the glycogen reserve in the blood of the present species might have used for glycogenolysis to provide the required energy with resultant depletion of glycogen content. Similar observations have also been made in pesticide-treated fishes (Natarajan, 1999). In turn, glycogenolysis could increase the utilization of carbohydrates under hypoxic conditions. This could be the possible reason for the reduction of total free sugars in the blood of the experimental fishes. This corroborates the results obtained by Mary Chandravathy and Reddy (1996) in fishes treated with heavy metals.

Insecticides are found to reduce the concentration of lipids in the tissues of fishes. (Jebakumar *et al.*, 1993; Govindan *et al.*, 1994). The endogenous fat in animal is found to be the only source of energy during prolonged stress. Thus, the reduced level of total lipids in the blood of the species under study is the indicative of the utilization of the same to meet the energy demand during the stress caused by the tannery effluent.

CONCLUSION

The discharge of tannery effluent with present condition into water bodies will definitely affect the fish population.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest associated with this article.

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