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ORIGINAL RESEARCH ARTICLE

Electroplating Industry Effluent Induced Modulation Of Aminotransferase Activity In The Freshwater teleost Fish *Mystus punctata*

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ABSTRACT

Electroplating industry effluent exposure (1%) for 48 hr increased the AlAT and AAT contents in the brain, gill, liver and muscle of *Mystus punctata*. Both protein and carbohydrate metabolism was affected. Alanine aminotransferase (AAT E.C. 2.6.1.2) and aspartate aminotransferase (AAT E.C. 2.6.1.1) play a crucial role in transamination reactions and can be used as potential biomarkers to indicate hepatotoxicity and cellular damage.

Key Words: *Mystus punctata*, ALAT, AAT

INTRODUCTION

In India extensive work has been done on the effect of waste water from major industries on the water quality of the ponds and rivers; however, literature on the characteristics and treatment of waste water of electroplating industry and its impact on freshwater fishes is almost nil. Electroplating industry waste water is one of the most important sources of ground water pollution in Avarampalyam, Ganapathy and Peelamedu areas of Coimbatore town. In an earlier report (Palanisamy and Natarajan 2003). We presented evidence for the contamination of groundwater at Avarampalayam by Cyanide, Zinc, Nickel and Chromium generated from the waste water discharged indiscriminately by the electroplating industries. Since aspartate (AAT) and alanine (AIAT) aminotransferases are known to play a key role in mobilizing L – amino acids for gluconeogenesis and also function as links between carbohydrates and protein metabolism, the present investigation was undertaken to understand the modulation of these enzymes by the electroplating industry waste water in the freshwater catfish, *Mystus punctata*.

MATERIALS AND METHODS

Healthy living specimens of *M. punctata* (21 + 2 cm) were collected and acclimated to the laboratory conditions for one week; water used in the test had a temperature of 28 ± 0.5 C, pH 7.3, hardness of 155 ppm (as $CaCO_3$), alkalinity of 85 ppm (as $CaCO_3$) and dissolved oxygen concentration of 7.6 ppm. Fishes were fed with boil egg on alternative days and water in the aquaria renewed daily. The approximate sublethal concentration of electroplating waste water (1%) was used to experimental fishes for 48 hr of exposure. The LC_{50} value was determined by method of Finney (1971). Liver, brain, gill and muscle samples were collected from control and waste water exposed fish. Alanine aminotranferase (ALAT E.C. 2.6.1.2) and aspertate aminotransferase (AAT E.C. 2.6.1.1) activities were assayed by colorimetric method of Reitman and Frankel (1957) as described by Bergmeyer (1965). Protein content was determined by the method of Lowery *et al.* (1951). The enzyme activity was expressed as µ mole of pyruvate formed / mg protein per hour. Statistical significance of difference between control and waste water treated groups of exposure period were tested by using‘t’ test [Zar] (1984).

RESULTS AND DISCUSSION

The electroplating industry waste water contains chemicals like chromium, nickel, zink, cyanide,

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cadmium etc. The discharge of this water affects various physiological processes in freshwater fishes. This is evident for the present study. From the (**Table.1**) it is apparent that the electroplating industry waste water increases the ALAT and AAT activities in all the vital organs of *M. punctata*. The increase was significant except the brain AAT accumulated heavily ($P<0.05$) in all the organs except brain (+6.34%). However, ALAT accumulated significantly ($P<0.05$) in the liver (+104.42%), muscle (+91.49%) brain (+ 86.95%) and gill (+21.43%). Any changes in the biochemical activity of the freshwater fish generally reflect the changes attained in the physiological structure and function of the organs in its body. Both the alanine and aspartate transaminase are important in the diagnosis of liver damage caused due to the exposure to industrial chemicals (Lehninger, 1982). The increase may be due to the excess stress caused by waste water which indicates activities feeding of ketoacids into the pathway of carbohydrate metabolism. The increased activities of these transaminases may also due to the occurrence of tissue damage and increased synthesis of aminotransferase. During waste water exposure, the tissues brain, gill, liver and muscle show remarkable high activity of ALAT compared to that AAT activities which may indicate that at conditions of stress, the three incline towards AlAT over AAT activity. The increased trend in both AAT and ALAT activities indicates that there is more conversion of aminoacids into ketoacids than that utilized for energy synthesis (Siva Prasada Rao and Ramana Rao, 1984; Malla Reddy *et al.*, 1991; Tilak *et al.*, 2003). Industrial waste water and effluents affected the plasma cortisol, glucose and lactate content in *Anguilla* (Teles *et al.*, 2004). Mining effluents contain sulphate, nitrate, lithium, potassium and heavy metals and damage respiratory organs in the Perca (*Perca fluviatilis* L) and roach (*Rutilus rutilus*) Tkatcheva *et al.*, 2004. The discharge of the waste water without any treatment into the nearby streams and sewers may disrupt the ecosystem particularly the freshwater fishes. This is very much more evident from the present study.

Table 1. Changes in the activities of ALAT and AAT (μ moles of pyruvate formed / mg protein /hr) in the tissues of fish *M. punctata* exposed to sublethal concentration of waste water.

Tissues	**ALAT**		**AAT**	
Tissues	**Control**	**Experimental**	**Control**	**Experimental**
Brain	4.51 ± 0.62	8.02 ± 0.71	1.90 ± 0.10	2.02 ± 0.14
	+86.93		+6.32*	
Gill	1.40 ± 0.18	1.70 ± 0.23	1.51 ± 0.46	1.96 ± 0.21
	+21.43		+29.80	
Liver	4.52 ± 0.82	9.24 ± 0.91	1.46 ± 0.12	1.98 ± 0.17
	+104.42		+35.62	
Muscle	1.88 ± 0.20	3.60 ± 0.31	1.60 ± 0.24	2.41 ± 0.16
	+91.49		+50.63	

Each value is the mean of 6 individual observations ± indicate S.D.
To signs + or – indicate percent increase or decrease over control
Values are significant at $P<0.05$, *P = N.S.

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