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# THE INFLUENCE OF TANNERY EFFLUENT ON BIOCHEMICAL CONSTITUENTS IN THE TISSUES OF *OREOCHROMIS MOSSAMBICUS*

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## ABSTRACT

Bioassays were carried out to find out $LC_{50}$ 96 hr value of the tannery effluent on the freshwater teleost fish *O.mossambicus* and it was found to be 15%. The effluent was found to bring alterations in various biochemical constituents in tissues like gills, liver and intestine of the fishes. There was a significant increase in the concentrations of the total free amino acids in all the tissues of *0.mossambicus*, whereas overall decrease in the total protein, free sugars and total proteins in gills, liver and intestine. The decrement of proteins, free sugars and lipids could be due to utilization of these as an energy source under the condition of emergency during prolonged stress. Thus the tannery effluent caused alterations in the fundamental biochemical mechanism in the present experimental animal leading to mortality in them.

**KEYWORDS:** **Bioassay, *Oreochromis mossambicus,* total protein, free sugar, lipid, concentration.**

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# INTRODUCTION

By a tremendous increase in human population with varying degree of pollution of the biosphere, the living organisms knowingly or unknowingly absorb toxicants significantly to produce chronic and non specific symptoms. 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 the investigator[1]. 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[2]. Literature are available to show the adverse effect of tannery effluent on aquatic organisms[3,4,5]. In general, the industrial effluents including the tannery wastes are shown to affect respiration, food utilization, engyme activity, haematology and biochemistry of fishes. The freshwater fishes constitute an important link in the food chain as top consumers in aquatic ecosystem and they are available as prey to the predators in terrestrial ecosystem. Moreover most of the freshwater fishes also form protein rich food for human beings. But unfortunately, the majority of xenobiotic substances enter into the body of fishes as the water bodies are mostly contaminated by number of industrial effluents. The fishes are sensitive to the contamination of water so that the pollutants significantly damage their physiological and biochemical processes[6].

In the recent past, the adverse effects of heavy metals, pesticide and paper and pulp mill effluent have been elucidated with reference to histological changes in fishes [7,8,9]. As studies pertaining to the toxicity of tannery effluent on the biochemical constituents in the tissues 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 and locally collected fishes of known weight and size were used in the present study. The $LC_{50}$ 96 hrs value of the effluent to the fishes was found[10]. Then a group of ten fish were reared in different sublethal concentrations along with appropriate control for 30 days. 100mg of liver, intestine and gills were taken out and was homogenated in an electrically operated homogenizer and the homogenates were used for analyses. Various biochemical parameters such as total free aminoacids, total proteins, total free sugar and total lipids were estimated.[11,12,13,14.] The results were statistically analyzed and tabulated.

**Table 1**

***The concentration of total free amino acids (mg/100mg) in different tissues of control and tannery effluent treated fish O.mossambicus (Each value is the mean ± SD of 5 observations).***

| Concentration of the effluent (%) | Total free amino acids (mg/100mg) | | |
|---|---|---|---|
| | Gill | Liver | Intestine |
| Control | 18.64 ± 0.13 | 34.49 ± 1.30 | 20.63 ± 0.40 |
| 0.5 | 18.61 ± 0.19* +2.56% | 38.24 ± 1.24NS +7.37% | 12.49 ± 0.31* +11.85% |
| 1.0 | 18.96 ± 0.18* +2.87% | 42.45 ± 1.68* +18.25% | 13.18 ± 0.52* +18.23% |
| 1.5 | 19.20 ± 0.15* +2.94% | 45.63 ± 1.94* +30.53% | 15.46 ± 0.60* +25.06% |
| 2.0 | 19.43± 0.11* +5.94% | 49.91± 1.03* +36.78% | 16.87± 0.54* +33.06% |
| 2.5 | 20.85 ± 0.11* +8.23% | 52.68 ± 1.11* +43.55% | 19.63 ± 0.43* +39.46% |

*+ indicates increase over control*
*-indicates decrease over control*
** indicates significant (t value)*
*NS indicates non-significant*

**Table 2**

***The concentration of total protein (mg / 100 mg) in different tissues of control and tannery effluent treated fish O.mossambicus (Each value is the mean ± SD of 5 observations)***

| Concentration of the effluent (%) | Total Protein (mg/100mg) | | |
|---|---|---|---|
| | Gill | Liver | Intestine |
| Control | 34.66 ± 0.88 | 48.34 ± 1.21 | 37.33 ± 1.03 |
| 0.5 | 32.91 ± -0.64<br>-55.05% | 46.49 ± 1.97NS<br>-43.83% | 35.43 ± 1.60*<br>-25.09% |
| 1.0 | 29.30 ± -1.03*<br>+42.29% | 41.93 ± 2.23*<br>-33.26% | 31.84 ± 1.84*<br>-14.71% |
| 1.5 | 27.19 ± -1.16*<br>-31.16% | 38.86 ± 1.73*<br>-29.61% | 28.83 ± 1.93*<br>-12.77% |
| 2.0 | 25.09 ± -1.24*<br>-23.38% | 33.08 ± 2.05*<br>-21.57% | 24.14 ± 1.69*<br>-10.33% |
| 2.5 | 22.41 ± -0.94*<br>-19.25% | 30.10 ± 1.04*<br>-17.73% | 21.92 ± 1.12<br>-8.49% |

***+ indicates increase over control*** **** indicates significant (t value)***
***-indicates decrease over control*** ***NS indicates non-significant***

**Table 3**

***The concentration of total free sugars (mg / 100 mg) in different tissues of control and tannery effluent treated fish O.mossambicus (Each value is the mean ± SD of 5 observations)***

| Concentration of the effluent (%) | Total free sugars (mg/100mg) | | |
|---|---|---|---|
| | Gill | Liver | Intestine |
| Control | 71.50 ± 1.87 | 73.33 ± 1.87 | 62.53 ± 1.60 |
| 0.5 | 68.63 ± 1.31<br>-76.64% | 71.48 ± 1.90NS<br>-12.52% | 61.84 ± 1.84*<br>-4.30% |
| 1.0 | 58.64 ± 0.92*<br>-61.96% | 65.83 ± 2.11*<br>-20.23% | 63.62 ± 1.24*<br>-12.74% |
| 1.5 | 52.89 ± 2.02*<br>-57.93% | 49.51 ± 1.92*<br>-32.48% | 52.59 ± 1.38*<br>-15.90% |
| 2.0 | 48.63 ± 2.52*<br>-48.69% | 44.64 ± 1.73*<br>-39.12% | 47.64 ± 1.42NS<br>-17.42% |
| 2.5 | 40.50 ± 0.81* | 40.74 ± 1.21*<br>-44.17% | 42.81 ± 1.63NS<br>-18.74% |

***+ indicates increase over control*** **** indicates significant (t value)***
***-indicates decrease over control*** ***NS indicates non-significant***

**Table 4**

***The concentration of total lipid (mg / 100 mg) in different tissues of control and tannery effluent treated fish O.mossambicus (Each value is the mean ± SD of 5 observations)***

| Concentration of the effluent (%) | Total Lipid (mg/100mg) | | |
|---|---|---|---|
| | Gill | Liver | Intestine |
| Control | 9.65±1.16 | 9.42±1.22 | 10.63±2.21 |
| 0.5 | 8.87±1.031NS<br>-7.5% | 8.11±1.01*<br>-14.16% | 9.91±2.03NS<br>-5.09% |
| 1.0 | 6.96±07.81*<br>-27.82% | 7.46±0.921*<br>-21.96% | 9.65±1.75NS<br>-8.25% |
| 1.5 | 5.62±0.703*<br>-42.26% | 6.53±0.775*<br>-21.66% | 8.88±1.61NS<br>-14.97% |
| 2.0 | 5.34±0.695*<br>-45.50% | 5.32±0.721*<br>-44.24% | 7.97±1.90*<br>-23.51% |
| 2.5 | 4.61±0.500*<br>-52.30% | 4.61±0.506*<br>-51.3% | 7.72±1.00*<br>-26.58% |

***+ indicates increase over control***
***-indicates decrease over control***
**** indicates significant (t value)***
***NS indicates non-significant***

## RESULTS AND DISCUSSION

In the present study the sublethal doses of tannery effluent are found to cause significant increase in the concentration of total free amino acids in gill, liver and intestine is corroborated.[15,16,17] There was an overall decrease in biochemical constituents like total proteins, total free sugars and total lipids in all the tissues like gill, liver and intestine. The depletion of protein would suggest as intensive proteolysis which contributes to the increase in the free amino acids. This is supported by the findings of few authors.[18,19,20,21] The decrement of total free sugars in all the tissues confirms that extensive energy demand due to the stress caused by the effluent. This view is further strengthened by few authors.[22,23,24] Accordingly, a decline in total lipids in the gill, liver and intestine of the species in the present study could be due to utilization of the reserve source of energy during metabolic disruptions. This falls in agreement with the observations of many investigators.[25,26].

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