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# Impact of Untreated and Treated Textile Effluent on haematological parameters of fresh water fish, *Tilapia mossambica*

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**Abstract**

Toxicity studies were carried out in the test organism, *Tilapia mossambica* for a period of 15 days. Haematological analysis was carried out in experimental fish *Tilapia mossambica* exposed to 100% untreated and treated textile effluent. Haematological parameters such as Hb%, Total count of WBC, Differential count of WBC – Neutrophils, Basophils, Eosinophils, Lymphocytes, Monocytes and Total count of RBC were determined. The results of this study suggested that *T. mossambica* when exposed to textile effluent experienced stress and drastic changes in the haematological parameters of fish were recorded.

***Keywords:*** *Untreated and treated textile effluent, Tilapia mossambica, Haematological parameters.*

## 1. Introduction

There are several industries which allow their effluent directly or indirectly into nearby rivers, streams, ponds etc. polluting the water and land causing damage to the flora and fauna and to the soil microbes (Kannagi, 2007). The discharge of toxic effluent from various industries adversely affects water resources, soil fertility, aquatic organisms and ecosystem integrity. Textile and clothing (T & C) is one of the largest and oldest industries present globally (Gereffi, 2002). Among various industries, textile industry discharge large volume of wastewater after dyeing process considering both volume and composition, the wastewater produced by the textile industrial sectors (Mo *et al.,* 2007). Effluent from the textile industry commonly contains high concentrations of organic and inorganic substances and are characterized by high Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Total Dissolved Solids (TDS), Total Suspended Solids (TSS) and pH values but low Dissolved Oxygen (DO) with strong colour (Kutlu *et al.,* 2006). Abnormal high or low dissolved solids disturb osmotic balance of native species. High salt content may cause an increase in non-settleable suspended solids. Higher doses of salt are toxic to aquatic organisms as they expose the organisms to changes in osmotic pressure causing swelling or dehydration. In dyeing and finishing processes a considerable amount of effluent is generated, which is very toxic and contains strong colour, a large amount of suspended solids, a highly fluctuating pH, high temperature, COD, BOD etc.

Fish can serve as bio-indicators of environmental pollution and therefore can be used for the assessment of the quality of aquatic environment (Paula *et al.,* 2001) and (Dautremepuits *et al.,* 2004). Due to chemical pollution, the normal functioning of cell is disturbed and this in turn may cause alteration in physiological and biochemical mechanisms of animals (Sin *et al.,* 1990) and (Maheshwari *et al.,* 1991) resulting in impairment of important functions like respiration, osmoregulation, reproduction and even mortality (Kumaraguru, 1995). Primarily sublethal effects of stress as

biochemical changes at subcellular levels may induce a sequence of structural and functional alterations at higher levels of organization. Thus, biochemical parameters are good tools in detecting the effect of any environmental stress on the well being of fish that too at the earliest possible stage (Borah *et al.*, 2005). Piscine haematology is useful in assessing the health and general conditions of the animal subjected to changing environmental conditions. Recent speculations have suggested that they may be equally valuable as indicators of disease or stress due to pollutants and environmental fluctuations in fishes (Bhatkar *et al.*, 2000).

Numerous studies have been carried out on the effect of different industrial effluent on fish. (Haniffa and Arulselvam, 1991) has studied the biochemical effect of textile effluents on *Tilapia mossambica*. Blood parameters of fresh water fishes have been studied by a number of researchers (Mohammed and Sambo, 2008) and (Vinodhini and Narayanan, 2009), but the research related to textile effluent is wanting. Hence the present study was carried out to assess the effect of exposure of fresh water fish, *T. mossambica* to textile effluent with reference to its haematological parameters under laboratory conditions.

## 2. Materials and Methods

The untreated and treated sample was collected from the textile industry situated in Chennai, Tamil Nadu, India, in polythene containers (5 litres capacity) from the final discharge point where effluent from all the stages of processing are released together. They were brought to the laboratory with due care and stored at 25°C for further analysis. Healthy fish, *Tilapia mossambica* was collected in a clean container of 10 litres capacity ensuring that they was not harmed either physically or physiologically during collection and transportation from the hydrobiological research station, Tamil Nadu Fisheries Department, Chennai, Tamil Nadu, India. The fish was acclimatized to the laboratory condition by following the procedure of (Behringer, 1972) for a week by keeping them in a clean container of 25 litres capacity containing dechlorinated and aerated tap water and fed with formulated fish feed. Fish *T. mossambica* of size 10 to 12 cms and weight 10 grms was selected for haematological analysis. 10 fishes were introduced into plastic tubs containing 5 litres of 100% untreated and treated textile effluent taken separately. The present study was carried out to determine the changes in the haematological parameters such as Hb%, WBC (total count), Differential count of WBC and RBC (Total count) of fish *T. mossambica* after exposure to 100% untreated and treated textile effluent for a period of 15 days. Tap water was used as control. Estimation of Haemoglobin was carried out using Haemoglobinometer. Total count of WBC and RBC, different types of WBC such as neutrophils, eosinophils, lymphocytes and monocytes of fish, *T. mossambica* were carried out by following the procedure of (Blaxhall and Daisley, 1973). The statistical data obtained from this study were expressed as mean ± standard deviation.

## 3. Results and Discussion

Haematological parameters are related to response of the organisms to changing environmental conditions and therefore can be used to screen the health of fish exposed to toxicants. Hence the study was carried out to determine various haematological parameters like Hb%, total WBC count, Differential count of WBC and total RBC count after exposure of *T. mossambica* to 100% untreated and treated textile effluent for 15 days. The results of different haematological parameters of fish *T. mossambica* exposed to textile effluent are depicted in Table – 1 and Plates - 1a, 1b, 2a and 2b.

### 3.1 Estimation of Haemoglobin (Hb%)

The results of the study revealed that the Hb% has low value in *T. mossambica* exposed to 100% untreated effluent (1.4%±0.06) compared to treated effluent (1.6%±0.12) but both the values of Hb% were found to be low when compared with that of control (2.4%±0.05) of fish.

### 3.2 Total count of WBC (thousand/cu.mm)

The results of the study showed that total number of WBC was found to be low in 100% untreated textile effluent (3.4thousand/cu.mm ±0.20) than that of treated effluent (3.8 thousand/cu.mm±0.18) but both the values were found to be less when compared with control value (5.2thousand/cu.mm ±0.15).

### 3.3 Differential count of WBC (million/cu.mm)

In the differential count of WBC of blood of fish, (Plate 1a and 1b), neutrophils, eosinophils, lymphocytes and monocytes of fish, *T. mossambica* was found to be 29million/cu.mm±0.3, 2.0million/cu.mm±0.05, 39million/cu.mm±1.3 and 1.0million/cu.mm±0.03 respectively when exposed to 100% untreated effluent where as in 100%

treated sample neutrophils, eosinophils, lymphocytes and monocytes of fish, *T. mossambica* were found to be 36million/cu.mm±0.03, 3million/cu.mm±0.06, 40million/cu.mm±1.8 and 1.0million/cu.mm±0.03. The results showed that the differential count of WBC of blood in fish, *T. mossambica* exposed to 100% untreated and treated effluent were low when compared with that of control values of neutrophils, eosinophils, lymphocytes and monocytes 54million/cu.mm±1.5, 4million/cu.mm±0.06, 43million/cu.mm±1.9 and 2million/cu.mm±0.04. Basophils was completely absent.

## 3.4 Total count of RBC (million/cu.mm)

The results of total count of RBC's (Plate 2a and 2b) in the blood of *T. mossambica* in control was found to be 1.5million/cu.mm±0.04 whereas number of RBC's in the blood of fish exposed to 100% untreated effluent was 1.24million/cu.mm±0.08 and in the blood of fish exposed to treated sample was 1.41million/cu.mm±0.06 of RBC's was recorded thereby indicating that total number of RBC's were found to be low in the blood of fish exposed to untreated and treated samples when compared with that of control values 1.5million/cu.mm±0.04.

Thus the results of the haematological parameters of blood of *T. mossambica* after exposure to 100% untreated and treated textile effluent revealed that Hb%, Total count of WBC, Differential count of WBC and Total count of RBC were low when compared with that of control values.

It is known that toxicants affect RBC's, WBC's and Haemoglobin% of the blood will cause microcytic anaemia which is a direct toxic action on erythrocytes (Manoj and Ragothaman, 1999). The decreased haemoglobin content following metal exposure usually results in haemodilution, which has been regarded as a mechanism that reduce the concentration of the toxicant/pollutant in the circulatory system (Smith *et al.*, 1979). In the above study absence of cell membrane/wrinkling of cell membrane, changes in the size of RBC and WBC and development of irregular shape of blood cells were observed in the blood of fish exposed to untreated and treated textile effluent to that of morphology of blood cells of control fish. The results of the above study is in accordance with the work of (Lipika and Patra, 2006).

**Table – 1**

**Effect of 100% Untreated and Treated Textile Effluent on the haematological parameters of fish *T. mossambica* after exposure for 15 Days**

| Parameters | Control (*Tilapia mossambica*) | Untreated Sample | Treated Sample |
|---|---|---|---|
| Haemoglobin % | 2.4±0.05 | 1.41±0.06 | 1.6±0.12 |
| Total WBC count (thousand/cu.mm) | 5.2±0.15 | 3.4±0.20 | 3.8±0.18 |
| Neutrophils % | 54.0±1.5 | 29±0.3 | 36±0.03 |
| Basophils % | --- | --- | --- |
| Eosinophils % | 4.0±0.06 | 2.0±0.05 | 3±0.06 |
| Lymphocytes % | 43.0±1.9 | 39±1.3 | 40±1.8 |
| Monocytes | 2.0±0.04 | 1.0±0.03 | 1.0±0.03 |
| Total RBC count (million/cu.mm) | 1.5±0.04 | 1.24±0.08 | 1.41±0.06 |

--- = Absent
± = Standard Deviation

**Plate – 1a Photomicrographs of Total count of WBC after exposure of fish to 100% untreated textile effluent for 15 days.**

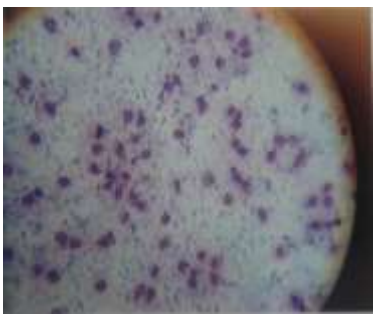


**Plate – 1b Photomicrographs of Total count of WBC after exposure of fish to 100% treated textile effluent for 15 days.**

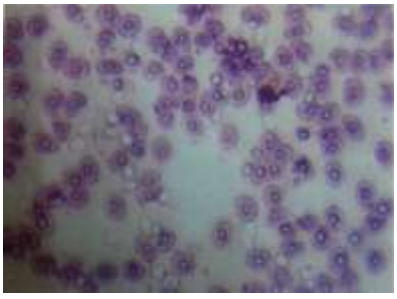


**Plate – 2a Photomicrographs of Differential count of WBC after exposure of fish to 100% untreated textile effluent for 15 days.**

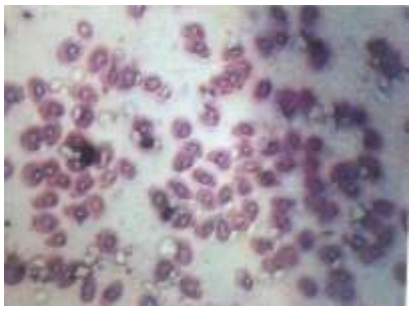
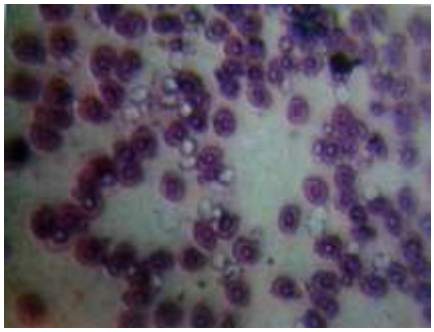


**Plate – 2b Photomicrographs of Differential count of WBC after exposure of fish to 100% treated textile effluent for 15 days**



## 4. Conclusion

Thus from the results of the above study, it can be concluded that the haematological parameters of blood of fish such as Hb%, total WBC count, Differential count of WBC and total RBC count after exposure of *T. mossambica* to 100% untreated and treated textile effluent for a period of 15 days showed different morphological changes. Absence of cell membrane, changes in the size of RBC and WBC and development of irregular shape of blood cells were observed in the blood of fish exposed to untreated and treated textile effluent to that of morphology of blood cells of control fish, but the morphological change of the blood cells were more prominent in untreated sample than that of treated blood sample due to high toxicity of untreated effluent.

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