International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 8 Issue 1, January-2019, Impact Factor: 4.059

Histopathological Changes in The Gills of Oreochromis Mossambicus Exposed to Untreated and Treated Textile- Dyeing Effluents.

Trupti V. Mhaskar[1], Tejali S. Ayare[2]

ABSTRACT

Most of the fish death by pollutants demonstrate gills damage, since it is located outside the body that is directly exposed to water as a medium of life. Thus this is the first organ to be affected by polluted water. Histopathology is the most common tool for determining the deleterious effects of toxic substances on exposed fish. During the present investigation an attempt has been made to evaluate the intensity of damage caused to gills, on exposure to various concentrations of untreated and treated effluents.

Keywoards: Effluent, Fish, Gills, Histopathology.

INTRODUCTION

Histopathology is mainly directed to study the effect of chemicals on the structural components of the living system and the ways in which cells and tissues respond to injury. Any damage to the cells and tissues may affect its normal functioning. There exists a clear correlation between pathological condition of a cell or a tissue and its affected functions. A study of histology reveals important information regarding structural changes at cellular or subcellular levels of an organ. A study of pathological changes in the micro-anatomy of tissues is called histopathology. It is extensively used for detecting various induced lesions in the tissues of experimental animals.

In case of fishes, the histological examinations can provide useful data regarding various cellular damages with the help of which probable cause of death of fish can be stated. This information along with physiological and biochemical data may provide a more complete and accurate description of the activity of a toxicant. Vital organs like gills, liver, kidney, spleen, intestine etc get adversely affected due to various water pollutants.

Therefore histological examination of these tissues has an immense importance in toxicity studies. Histological changes in fish on exposure to various effluents have been studied by many workers such as G. Ravanaiah and C. V. Narasimha Murthy (2010); P. Palanisamy, G. Sasikala et.al., (2011); Shivani Sharma and Susan Manhor (2011); Tripathy M, Mishra R. P. et.al., (2011); Jehan M. Sorour and Dalal Al Harbey (2012).

Since, histopathological changes reveal structural effect within a short period of time; the present study was under taken in order to examine the effect of textile-dyeing effluent on gills and liver of *Oreochromis mossambicus*.

MATERIALS AND METHODS

Experimental animals were collected from an unpolluted sources. Disease-free healthy fishes were acclimatized for a period of 14 days. Animals of similar length and weight were selected for the experimental work. The selected fish were exposed to various concentrations of the untreated and treated effluent. And the acute toxicity tests were carried out for the period of 96 hours. After carrying out the range finding tests, different concentrations were selected for conducting acute toxicity tests on untreated and treated effluents.

The concentrations (dilutions) selected for the untreated effluent were in the range of **0.01% to 1%** and the percent mortality was found in between **28% to 100%**. Similarly, the concentrations (dilutions) selected for the treated effluents were in the range of **1% to 100%** and the percent mortality was found in between **70% to 100%**. At the end of the experiment, the animals were sacrificed and various organs like gills and liver were removed for histopathological studies.

The gills were fixed in Bouin's fluid whereas liver was fixed in Susa fixative and dehydrated using alcohol grades. After cleaning with xylene, they were embedded in paraffin wax. Sections were cut and stained with haematoxylin-eosin. Slides were observed under microscope.

Relative acute toxicity of Untreated and Treated effluent of textile-dyeing industry on *Oreochromis mossambicus*

Table: 1

Exposure duration (Hrs)	LC_{50} (%)	TUa (Acute toxicity unit)	Safe concentration (%)	Total efficiency (%)
Untreated Effluent				
24	0.9	111.11	0.09	-
48	0.4	250	0.04	-
72	0.4	250	0.04	-
96	0.16	625	0.016	-
Treated Effluent				
24	46	2.17	0.21	98.04
48	44	2.27	0.22	99.09
72	1	100	10	60
96	0.56	178.57	17.85	71.42

RESULTS

- Histology of Gill from control fish:

The gills of the control fish forms the major respiratory organ and are situated under the operculum. They consist of four holobranches on each side of the pharynx. Each holobranch consists of two hemibranches projecting from the branchial arch (gill arch) in such a way that the free edges diverge and touch those of the adjacent holobranch. Each hemibranch consists of row of long thin filament called as primary lamella. On the upper and lower surface of each filament there are series of thin parallel folds called as the secondary gill lamellae, that forms the major respiratory surfaces. The gill filaments are supported by a cartilagenous gill ray which acts as mechanical support and a site of attachment for the adductor mucles. The secondary consists of basal lamella, a large connective tissue and one layered thick epithelium. Epithelial cells are supported and separated by pillar cells.

- The structural changes recorded in the gills of the fish exposed to various concentrations of untreated and treated effluent can be summarized as follows;

i. The primary lamellae of gills showed congestion of blood.
i. Hyperplasia of interlamellar tissue and the adhesion of the adjacent secondary lamellae.
ii. Deformed secondary lamellae with enlarged mucus cells.
iii. Dialation of the capillaries in the secondary lamellae.
iv. Exfoliation of the epithelial as well as the pillar cells with vacuolar degeneration.

DISCUSSION

The fish, in spite of exposure to the lowest concentrations of the textile-dyeing effluents has produced considerable pathological changes in the tissues. Gills were selected for their primary role in respiration and their direct contact with the aquatic environment. Histological assessment of the gills of experimental fish *Oreochromis mossambicus* after 96 hour exposure to various concentrations of textile-dyeing effluents revealed marked histopathological alterations in comparison to the gills of fish under control. The vulnerability of gills is considerable because their external location and intimate contact with the medium in which they are exposed makes them susceptible to damage by any irritant materials, whether dissolved or in suspended forms (Roberts, 2001).

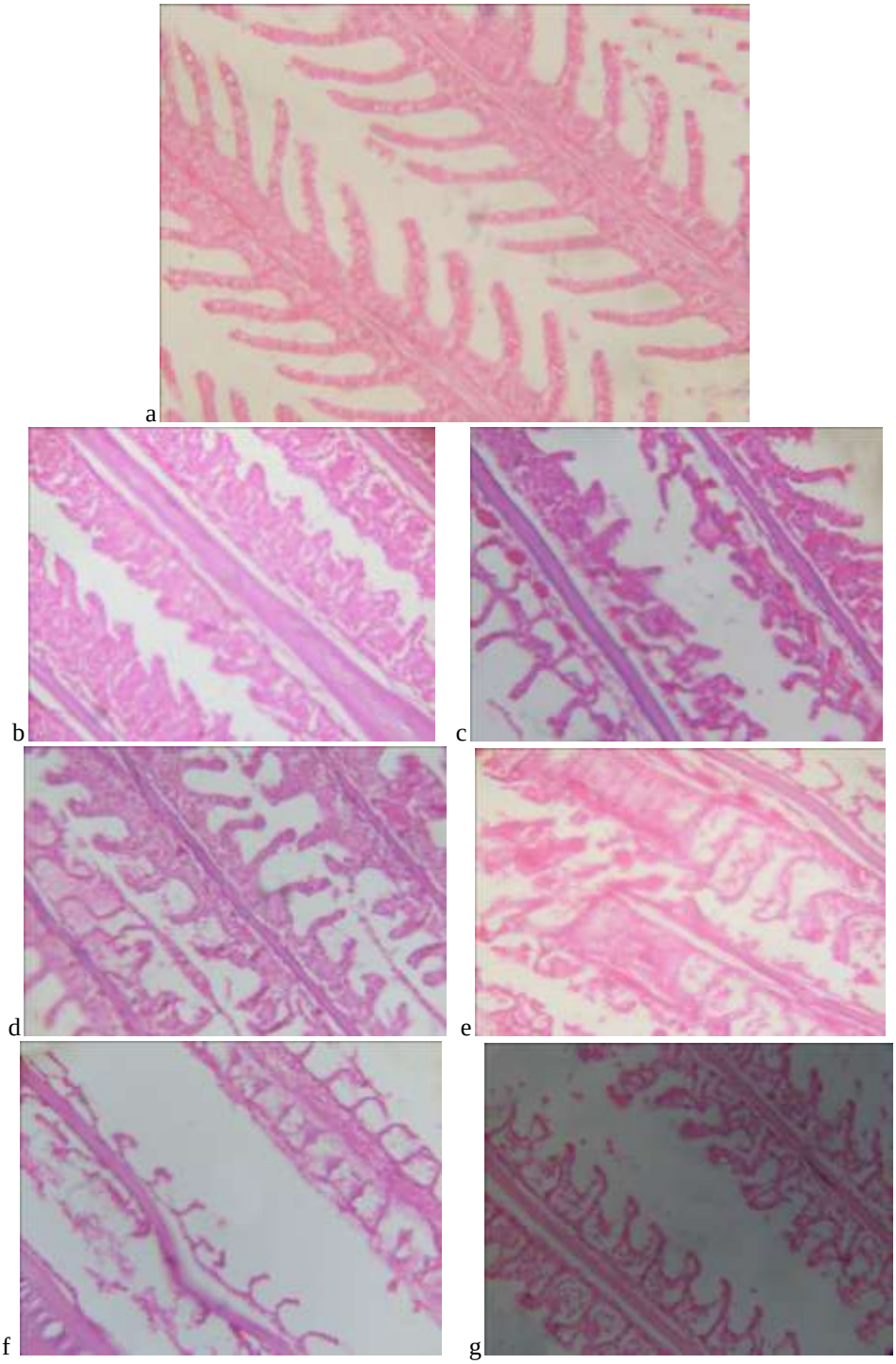
In fact the gills of all the specimens showed dilation of the lamellar capillary and pooling of blood leading to aneurysm (telangiectatic lamellae). The occurrence of aneurysm was noticed in most of the secondary lamellae. According to Roberts (2001), if there are many telangiectatic lamellae, respiratory function may be affected. Similar pathological alterations were reported in *Oreochromis niloticus* exposed to treated sewage water by Antonio et.al. (2008).

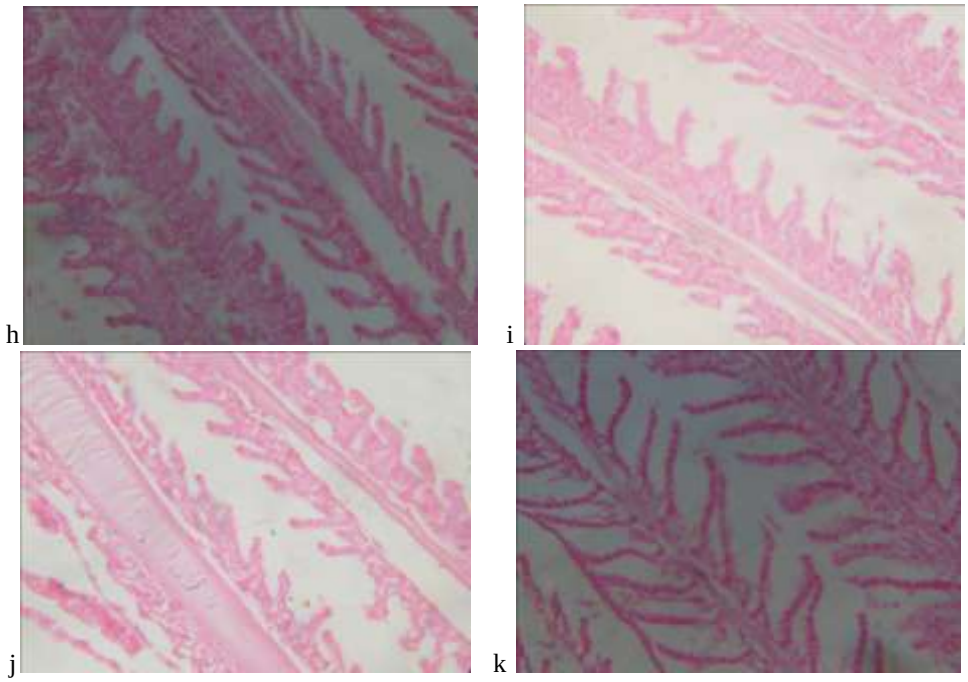
Increased occurrence of epithelial proliferation, necrosis, intensive vasodilatation and thickened lamellar epithelium were observed in most of the specimens. These alterations are usually a sign of comprised respiratory and ion-regulatory capacity (Lease et.al.' 2003). All these lesions may affect the respiratory function. Increased thickness of the

epithelial layers has been reported to result from hyperplasia following experimental exposure to the effluent. Similar changes were reported in fish Labeo rohita on exposure to textile mill effluent by Nikalje. S.B, Muley. D.V, Angadi. S.M (2012). Srivastava et. al. (1998) reported lamellar fusion and vasodilation in rainbow trout on exposure to malachite green, a textile dye.

Thus it is evident that gills are sensitive indicators of toxicity. Being the first of the crgans to come in contact with the toxicant they suffer great damage. Gill damage leads to the deficiency of the oxygen supply especially in waters with low oxygen content. Even if the concentrations are not lethal, oxygen deficiency may cause further injuries to other organs and systems especially the nerve cells. Since gills are responsible for osmoregulation too, damage to gills would lead to serious consequences.

The histopathological study revealed that the untreated and treated textile-dyeing effluents have severe toxic effects in the tissues of vital organs such as gills and liver of the experimental fish *Oreochromis mossambicus*





[Figure a: Histopathological structure of gills in control fish.}
{Figure b to f: Histopathological structure of gills exposed to different concentrations of untreated effluent i.e., 0.01, 0.1,0.18,0.32,0.56%]

[Figure g to k: Histopathological structure of gills exposed to different concentrations of treated effluent i.e.,1, 10,18,32,56%

CONCLUSION

Based on the above mentioned findings, it may be concluded that the effluent from the industry affects the general health of the experimental fish, reducing their ability to adapt variations in the environmental factors. Further the continuous stress due to exposure to the pollutant may eventually lead to the ecological death not only of the individual but of the entire ecosystem.

REFERENCES

[1]. Abdel- Moneim A. M., Abou Shabana N. M., Khadre S. E. M. and Abdel- Kader H. H. 2008. Physiological and histopathological effects in catfish (*Clarias lazera*) exposed to dyestuff and chemical wastewater. Int. J. Zool. Res. 4: 189-202

[2]. Adewoye, O. O. Fawale and O. D. Owolabi. 2005. Toxicity of Cassava a waste water effluents to African catfish: *Clarias gariepinus*. Ethiop. J. Sci., 28: 189 – 194

[3]. Antonio Figueiredo-Fernandes, Ana Luzio, Sofia Garcia-Santos, Joao Carrola and Sandra Monterio. 2008. Gill histopathological alterations in Nile Tilapia, *Oreochromis niloticus* exposed to treated sewage water. Brazillian Archives of Biology and Technol. 51(5): 1057-1063

[4]. Antonio Figueiredo-Fernandes, Jorge V. Ferreira-Cardoso, Sofia Garcia-Santos,. 2007. Histopathological changes in liver and gill epithelium of Nile tilapia, *Oreochromis niloticus*, exposed to waterborne copper. Pesq. Vet. Bras. 27(3): 103-109

[5]. Fatma, A. S. Mohammed 2009. Histopathological studies on *Tilapia Zillii* and *Solea velgaris* from Lake Qarum, Egypt. World of fish and marine sciences 1(1) : 29-39

[6]. Gupta Ashok Kumar and Ashwani Kumar 2006 Histopathological lesions in the selected tissues of *Cirrhinus mrigala* (Ham.) fingerlings exposed to a sublethal concentration of mercury. Journal of Environmental Biology 27(2): 235-239

[7]. K. Jayachandran and K. Pugazhendy 2009. Histopathological Changes in the Gill of *Labeo rohita* (Hamilton) Fingerlings Exposed to Atrazine. American-Eurasian Journal of Scientific Research 4 (3): 219-221

[8]. Lease, H. M., J. A. Hansen, H. L. Bergman and J. S. Meyerc 2003. Structural changes in gills of Lost River suckers exposed to elevated pH and ammonia concentrations. *Comp. Biochem. Physiol. C*, 134: 491–500

[9]. M. K. Mohanta, Salam, M. A, A. K. Saha, A. Hasan and A. K. Roy 2010. Effects of Tannery Effluents on Survival and Histopathological Changes in Different Organs of *Channa punctatus*. Asian J. Exp. Biol. Sci. Vol 1 (2): 294 – 30

[10]. M. S. Butchiram, K. S. Tilak and P. W. Raju 2009. Studies on histopathological changes in the gill, liver and kidney of *Channa punctatus* (Bloch) exposed to Alachlor. J. Environ. Biol. 30(2): 303-306
[11]. Nagarajan, K. and Kumar, R. S. 2006. Observations on histopathological changes in the gills, liver and intestine of an Indian fresh water major carp, *Labeo rohita* exposed to treated and untreated sago effluent. Journal of Experimental Zoology 9(1): 181-188
[12]. Nikalje, S. B., Muley, D. V. Angadi, S.M. 2012. Histopathological changes in gills of a freshwater major carp *Labeo rohita* after acute and chronic exposure to textile mill effluent (tme). International Journal Of Environmental Sciences Volume 3, No 1: 108-118
[13]. O.J. Osarogie, E.T. Ogie, O.B. Efosa, 2016. Heavy metal toxicity and histopathology of select organs of tilapia fish (Tilapia zilli) from Ikpoba River, Benin City, Nigeria, FUNAI, J. Sci. Technol.2(1) 10-22
[14]. P. Palanisamy, G. Sarikala, D. Mallikaraj, N. Bhuvaneshwari and G. M. Natarajan 2011. Histopathological lesions in gills of air-breathing catfish *Mystus cavasius* exposed to Electroplating industrial effluent Nickel Int. Journal of Applied Biology and Pharmaceutical Technology. Vol-2,(2): 150-155
[15]. Pathan T. S., Thate P. B., Shinde S. E. and Sonawane D. L. 2012. Histopathological effects of paper mill effluent in the ovary of a freshwater fish, *Rasbora daniconius*. J. of fisheries and aquaculture. Vol.3 (1): 29-32
[16]. R. K. Daksh and A. Capoor 2011. Toxic effects of Tannery chemicals on the histopathology of fresh water teleost, *Catla catla* (Ham.). Research Journal of Agricultural Sciences, 2(2): 351-353
[17]. Tilak, K. S., Veeraiah, K. and Yacobu 2001. Studies on histopathological changes in the gill, liver, and kidney of *Ctenophrayngodon idellus* (valenciennes) exposed to technical fenvalerate and EC 20%. Poll. Res. 20 (3): 387-393
[18]. V. Nero, A. Farwell, A. Lister, G. Van Der Kraak, L. E. J. Lee, T. Van Meer, M. D. Mackinnon, D. G. Dixon 2006. Gill and liver histopathological changes in yellow perch (*Perca flavescent*) and goldfish (*Carassius auratus*) exposed to oil sands process- affected water. Ecotoxicol. and Environ. Safety. 63: 365-377