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# STUDY ON THE EFFECT OF GALVANIZING INDUSTRY EFFLUENT ON THE GILLS OF *HETEROPNEUSTES FOSSILIS* (BLOCH)

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## ABSTRACT

**The gill performs many functions in fish, such as respiration, osmoregulation and excretion. Galvanizing industry effluent induces hispathological changes in gills of *Heteropneustes fossilis* like lifting of respiratory epithelium, fusion of gill lamellae, multiple telangiecetasis and appearance of haemorrhagic areas. These indicate highly toxic nature of the effluent.**

## INTRODUCTION

The gills are among the most delicate structures of the fish body and are extremely vulnerable to pollutants present in surrounding environment. They are liable to damage by any irritant materials, whether dissolved or suspended in water. Many workers observed histological changes in the gills of fishes exposed to various industrial effluents, pesticides, detergents, petroleum, ammonia heavy metals etc. Galvanizing industry effluent is highly toxic due to high BOD, COD and turbidity and also due to the presence of several acids and heavy metals (Majumdar *et al.*, 2007b) Heavy metal salts constitutes a serious type of pollution in fresh water and being stable compounds, they are not readily removed by oxidation, precipitation or other processes and can affect the activities of the recipient animal (Nammalwar, 1985). In the present study an attempt was made to evaluate the histopathological changes in the gills of *Heteropneustes fossilis* exposed to sublethal dose of galvanizing industry effluent.

## MATERIALS AND METHODS

Mature, active and healthy *Heteropneustes fossilis* of size of 10-12 cm were collected from local fish farm and were acclimatized in glass aquarium (size 75 x 45 x 45cm) for one month. They were fed with standard food pellets. The effluent from a galvanizing industry (located on the outskirts of Guwahati city) was collected from discharge point and carefully brought to the laboratory. A group of acclimatized fishes was transferred to the test aquarium in which the effluent concentration was maintained at 2.1mL/100mL. The $LC_{50}$ value was estimated to be 4.2mL/100mL for 96 hours (Majumdar *et al.* 2007a).The fishes were kept in

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the effluent for a period of 90 days and control group was maintained simultaneously. The histopathological studies of gill were done at the interval of 15 days for both control and test groups by following the standard methodology (Verma 1992). The sections were prepared at 5 ÷ thickness and observed under 100x and 400x magnification.

## RESULTS AND DISCUSSION

The present investigation on the histology of gills of *H. fossilis* exposed to galvanizing industry effluent revealed severe damages due to acidic nature and various metallic compound present in the effluent. Marked histopathological changes including necrosis and degenerative changes in the epithelial cells and pillar cells of the gills were observed. The capillaries in the secondary lamellae were dilated. The epithelial cells as well as pillar cells were exfoliated. Consequently haemorrhage occurred in the damaged areas. Partially empty rachis with sloughed tissues indicated disorganization of gill structure. Original shape of the secondary gill filaments was distorted and curling of these filaments was observed (Plate 1). At some places the lamellae appeared like swollen bulging sacs filled with blood cells. Epithelial wall of secondary lamellae seemed to be ruptured. Loss of cellularity and fragmentation of gill lamellae were the most common feature indicating serious impairment in the respiratory function of the gills (Plate 2). The present study was in the line of Dhanapakian *et al*. (2004) who reported degenerative changes in respiratory epithelium of the fishes exposed to aquatic pollutants and metals. They noticed clubbed shaped lamellae indicating progressive degeneration in the gill due to fusion of secondary lamellae. Muller *et al*. (1991) concluded that as a result of lamellar fusion, the lamellar surface area may be reduced minimizing oxygen delivery to the tissues. They further noted that after chronic exposure to the pollutants progressive degenerative changes resulted into complete disorganization of the gill lamellae. The present study also agreed with the finding of Jagadessan (1999); Gupta and Dua (2002) who reported severe damages in the respiratory epithelium of gills exposed to heavy metals. Palaniappan *et al* (2003) also observed damages at cellular level in the gills of *Cirhinnus mrigala* exposed to metallic salts.

In the present study, fishes exposed to very low concentration of effluent resulted in remarkable histopathological changes which lead to decreased efficiency of gill surface for gaseous exchange. Mucous secretion mainly from the base of the primary lamellae and proliferated primary lamellar epidermis form a tenacious outer layer of different consistency leading to obstruction of respiratory exchange. Another characteristics pathological change of the gill observed in the present study was lamellar telangiecetasis recognized grossly by the presence of the small red spots on the secondary lamellae. The lesion had its genesis in the rupture of the retaining pillar cells which normally joins the dorsal surface of secondary lamellae to the ventral. The result was dilation of the lamellar capillary and pooling of the blood, which thrombosed and eventually fibrosed (Plate 3). Palanisamy *et al.* (2011) also reported such multiple

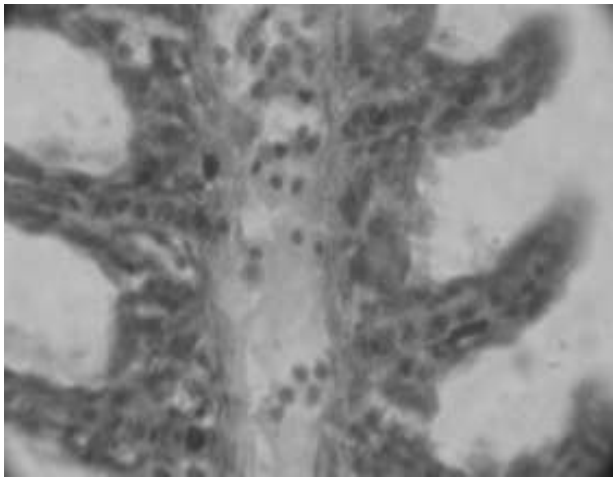

**Plate 1 (**400x**) :** Curling of the secondary lamellae and lifting of respiratory epithelium.

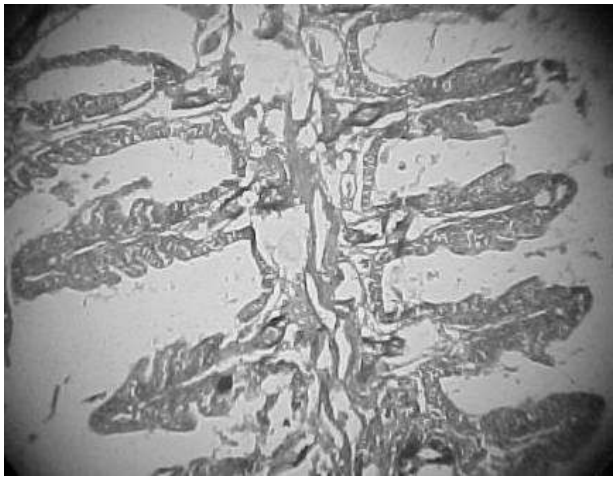

**Plate 2 (100x) :** Loss of cellularity and fragmentation of gill lamellae.

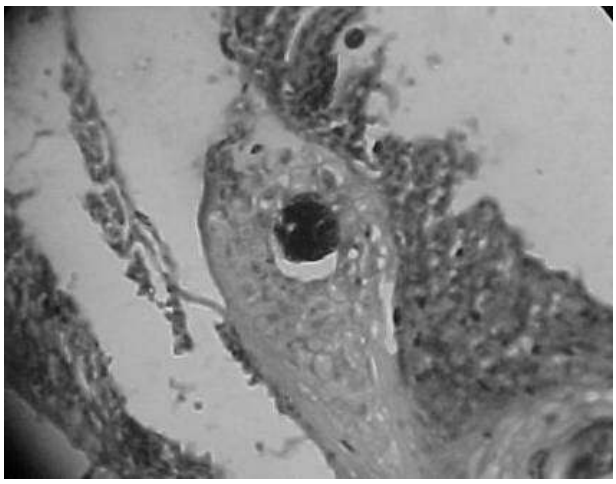

**Plate 3 (100x) :** Prominent telangicetasis with massive degeneration of the branchial apparatus.

telangiecetasis in metal exposed fish. Marked damages in the branchial apparatus along with progressive necrosis, corrosion and appearance of haemorrhagic areas in the gill epithelium accompanied by fusion of secondary lamellae (Plate 4) as observed in the present study indicated a condition of anaemia during the latter part of the experiment. All these changes in histopathological picture might be accounted for the combined effect of chemicals and heavy metals present in the effluent. From the forgone studies it was conclusively established that the contaminants of galvanizing industry effluent can bring about a broad spectrum of changes in the histopathological picture of the gills of the *H. fossilis*.

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