

Methyl Red Induced Histological Alterations in the Muscle and Intestinal Tissues of *Catla Catla*

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ABSTRACT

Methyl red an azo dye is widely used to color the fibers in the textile industry. Dyes are one of the most important industrial or textile mill effluents that are released into the water bodies and it changes the water quality because of its color. These dyes usually accumulate in water bodies and affect the fauna and other organisms through food chain. The present study deals with the assay of acute toxicity and histological alteration in the tissues of Catla catla exposed to methyl red. The LC₅₀ values of methyl red for 24, 48, 72 and 96 hr were 19, 15, 12 and 10ppm respectively. The tissues of the treated fish such as intestine and muscle were subjected for histology study after 96hr. At lethal concentration, various histological alterations were observed such as shortened and broadened villi, infiltration of mononuclear cells in the lamina propria of intestine and hyaline degeneration in muscle.

Keywords: *Catla catla*, azo dye, Methyl red, LC₅₀, histological alteration.

1. INTRODUCTION

Most of the azo dyes are released into the environment originate from the textile industry and mainly from dyestuff manufacturing industry [1]. The azo dyes represent about 70% by weight of the dyestuffs used [2]. They are the most common group of synthetic colorants released into the environment [3,4,5]. The colored wastewater not only affects the aesthetic and transparency aspects of the water being received, but also involves possible environmental concerns about the toxic, carcinogenic and mutagenic effects of some azo dyes [6,7,8].

Histological changes have been widely used as biomarkers in the evaluation of health of fish exposed to contaminants both in the laboratory [9] and field studies [10,11]. Thus the present study deals with the acute toxic effect of methyl red on a freshwater fish *Catla catla*, with the objective to study the histological alterations on the treated tissues such as intestine and muscle for 96hrs respectively.

2. MATERIALS AND METHODS

Acute toxicity

The live fingerlings of *Catla catla* were procured from Bharat fish farm [Poondy], Thiruvallur, Tamil Nadu, India and it was acclimatized in the laboratory condition. The stock solution of methyl red was prepared by dissolving it in ethanol [12]. Fish were subjected for acute toxicity studies and LC₅₀ value was calculated by probit analysis [13] and the values were tabulated in Table 1.

Histology

The tissues such as intestine and muscle of control and treated with methyl red of *Catla catla* fingerlings for 96hr were subjected for histology study. Histological analysis was performed according to Culling method with few modifications [14].

3. RESULTS

Acute toxicity

Acute toxicity studies were carried out to determine the LC₅₀ value of methyl red, on the freshwater fish *Catla catla*. The Lethal Concentration was found to be 10ppm and it was tabulated in the Table-1. The LC₅₀ values for methyl red for 24, 48, 72 and 96hr were 19, 15, 12 and 10ppm respectively. The lower and upper limits of 96hr LC₅₀ was found to be 9.79 and 10.21.

Histology

Histological alterations of control and treated intestinal tissues of *Catla catla* were shown in Plate (a) and Plate (b) respectively. Histological changes include shortened and broadened villi, infiltration of mononuclear cells in the lamina propria of treated intestinal tissue. Histological alterations of control and treated muscle were shown in Plate (c) and Plate (d) respectively. Histological alterations such as hyaline degeneration and atrophy were observed in the treated muscle tissue.

4. DISCUSSION

The LC₅₀ value of methyl red for *Catla catla* was found to be 10ppm in the present work. Observed histological alterations might be due to the toxic stress developed by methyl red on the fish *Catla catla*. Metanil Yellow treated intestinal tissue of *H. fossilis* displays no significant reductions in the secretory and nonsecretory mucous cells, brush borders of the villi and lamina propria. Consequently, secretions of profuse quantity of mixture of both acid and neutral mucin have been detected in the lumen of the intestine [15]. According to Bhatnagar *et al.*, [16] observed irritation and destruction of the mucosa membrane of the intestine, hampering absorption were due to fluoride toxicity. The histological changes were observed in naphthalene treated tissues of *Catla*

catla including disjointment and edema of intestine [17]. Rogorin treated muscle of *Clarius batrachus* showed edema and mild lymphocyte infiltration, vacuolar degeneration in muscle bundles, atrophy of muscle bundles and edema between muscle bundles and splitting of muscle fibers [18].

5. CONCLUSION

There is the need to focus on environmental pollution since it is the major cause for the damage of all living organisms. The LC_{50} value for *Catla catla* is very low and it indicates that the carps are sensitive to methyl red. The histological alterations of the treated tissues would be essential to estimate their toxicological effects of the dyes on the fauna of aquatic environment. Thus the release of methyl red into aquatic environment produce human and ecological risks, since both the original and their biotransformation products of methyl red could show toxic effects and hence it could cause deleterious effects to the living organisms. Thus the study suggests that methyl red is toxic for *Catla catla*.

Acute toxicity (LC_{50})

Table 1: Acute toxicity (LC_{50}) list showing tolerance of fish *Catla catla* to methyl red

Exposure Time [hr]	LC_{16} [ppm]	LC_{50} [ppm]	LC_{84} [ppm]	Regression	Slope	Confidence Limit	
						Lower Limit	Upper Limit
24	10	19	21	$Y = 6 - 0.806 X$	1.565	15.625	23.104
48	8	15	20	$Y = 11.87 - 2.253 X$	1.601	12.274	18.33
72	6	12	15	$Y = 16.38 - 3.225 X$	1.559	9.917	14.568
96	5	10	12	$Y = 1.19 - 3.39 X$	1.625	9.79	10.21

Histology

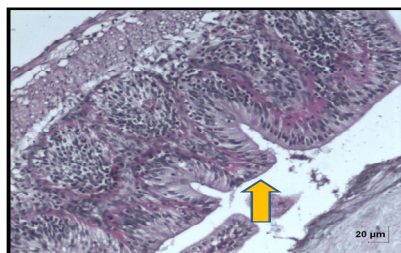


Plate a: photomicrograph of the intestine section of the control fish (*Catla catla*) showing normal

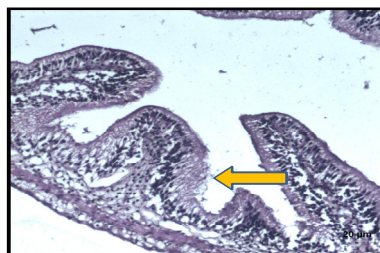


Plate b: photomicrograph of the intestine section of methyl red exposed fish showing infiltration of mononuclear cells in the lamina propria of intestine

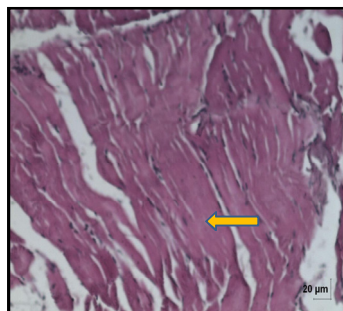


Plate c; photomorphograph of the muscle section of the control fish (*Catla catla*) showing normal

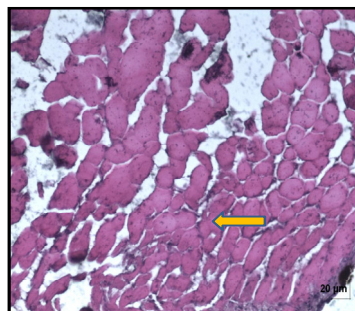


Plate d; photomorphograph of the muscle section of methyl red exposed fish showing hyaline degeneration

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