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Impact of plywood effluent on the haematological parameters of fresh water fish, *Labeo rohita*

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Abstract
Haematological parameters have been recognized as a valuable tool for monitoring fish health. In the present study the haematological profile of fresh water fish, *Labeo rohita* was studied. Fishes were exposed to sublethal concentration of plywood effluent decided after LC_{50} determination for a period of 24, 48, 72 and 96 hrs. In haematological profile, selected blood parameter's effect is seen on RBC count, WBC count, Hb, and PCV as well as on Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin (MCH) and Mean Corpuscular Haemoglobin Concentration (MCHC). The plywood effluent significantly decreases the value of RBCs, Hb, PCV, MCH, MCV, MCHC, whereas WBC count increases with plywood effluent treatment and at different time of exposure. It was concluded that the plywood effluent caused haemotoxicity in fish.

Keywords: Haematology, LC_{50}, *Labeo rohita*, plywood effluent

1. Introduction
Water pollution is the contamination of water bodies. This form of environmental degradation occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds. The agrochemicals and industrial discharges may carried away effectively by rains, winds, rivers and floods into the large water bodies and change their physico-chemical properties with high toxicity. The water contamination cause damages to aquatic life especially to fishes, which are very sensitive to wide range of toxicant in the water [9]. Different species of fish show active uptake and accumulation of many toxicants such as herbicides, pesticides, heavy metals and polychlorinated biphenyls from water bodies.

The plywood industry involves the production of plywood from thin layers of wood veneer. The effluent from the plywood industry affects the surface water bodies and ground water adversely. All stages in the conversion of wood from the standing tree to the final veneer or plywood is accompanied by incidental waste in some form or other. During the process of plywood formaldehyde resin is used to stick the layers of thin sheet of wood. Liquid waste from plywood production is generally generated from the washing process of the glue spreader machine and the washing process of other production equipment. Formaldehyde residue/waste generated by many plywood units was being drained through a small outlet into a water channel. The presence of formaldehyde, even in traces, is highly toxic to human health and its long-term adverse impact could be deleterious.

Blood is a suitable means of indicating and identifying the effects of stress, environment and health status of fish in a given area. Blood cell count is a stable index and normally fish tries to maintain it between certain limits. But presence of toxicants in water may lead to change in water quality which may ultimately change one or more haematological parameters [16]. Fish blood is very important to accurately evaluate the health of species [6]. A variety of pollutants affect the water course which receive domestic, industrial and in terms of its ramifications and environment consequence [15]. Alterations in fish blood are also observed due to the influence of capture and capture methods to perturb the blood parameters [5]. Chemical pollutants induce either increase or decrease in haematological levels, their effect depends on fish species, age, the sexual cycle of spawners and diseases [8]. The blood reveals conditions within the body of fish long before any outward manifestation of disease. The close contact of environment to fish makes them susceptible to physicochemical changes reflected in their blood [18]. In recent years blood physiology is used to clinically diagnose the fish due to the close association

between the circulatory system and the external environment. The studies regarding the effect of plywood effluent on the fish blood parameters are very rare. The objective of the study is to compare the effect of plywood effluent on the haematological parameters of the fresh water fish, *Labeo rohita* which were exposed under different periods (24, 48, 72 and 96 hours) with control.

2. Materials and Methods

Active specimens of *Labeo rohita* (10.50 ± 0.10 cm in length and 16.85 ± 1.040 gms in weight) of both sexes were used for the experiments. All fish used were procured from local aqua agri farm. Fish was treated with 0.02% $KMnO_4$ for 2 minutes to avoid any dermal infection. The fishes were then acclimatized under laboratory conditions in static conditions for 15 days and kept in rectangular glass aquaria of capacity 200 liters. They were fed with commercial fish food *ad libitum*. The faecal matter and other waste material were siphoned off daily to reduce ammonia content in water.

2.1. Determination of LC_{50}

LC_{50} for plywood effluent comes out to be 1.27 mg/l. Based on LC_{50} value sublethal concentration 0.127 mg/l ($1/10^{th}$) of LC_{50} were chosen and fish were exposed to sublethal concentrations for 24, 48, 72 and 96 hrs to see the effect on haematological profile.

2.2. Haematological Parameters

Present study deals with the comparison of important blood parameters like Hb, PCV, RBC's, and WBC's count. Haematological analysis was performed by taking blood from fish by heart puncture in eppendorf tubes containing EDTA anti-coagulant. Blood samples from treated group and control was used for haematological analysis viz RBC counting, WBC counting, PCV and haemoglobin. All the haematological parameters were determined by using the standard technique [10]. Red blood cells (RBC) were counted using Neubaur haemocytometer. Blood was diluted 1: 200 with Hayem's fluid. Erythrocytes were counted in the loaded haemocytometer chamber and total numbers were counted per 106 mm^3. Sahli's haemoglobinometer was used to estimate haemoglobin (Hb). Haematocrit levels were determined by drawing fresh blood into micro haematocrit tubes and centrifuged in a micro haematocrit centrifuge (Micro Centrifuge, Remi, Remi Motors, Bombay, India) at 9000 g for 5 min. Mean corpuscular volume (MCV), Mean corpuscular hemoglobin concentration (MCHC) and mean corpuscular hemoglobin (MCH) were calculated using formulae [7],

$$MCV = \frac{\text{Packed cell volume as percentage} \times 10\ \mu m^3}{\text{RBC in millions}}$$

$$MCHC = \frac{\text{Hb in grams x 100 g per 100 ml}}{\text{Packed cell volume}}$$

$$MCH = \frac{\text{Hb in grams x 10pg}}{\text{RBC in millions}}$$

3. Results and Discussion

Haematological values of fish fluctuate under varying ecophysiological conditions. The present investigation clearly reveals that the exposure of fish to a concentration of 0.127 mg/l ($1/10^{th}$ of LC_{50}) of plywood effluent for 24, 48, 72 and 96 hr caused significant alterations in haematological parameters. When fishes are exposed to stressors they evoke non specific response to cope with changes and to maintain homeostatic state [3]. But in case the disturbance remains for longer time it may threaten the fish health and well-being. In fishes change in blood cell distribution is correlated with the change in environment. Therefore in presence of toxicant or other stressors blood parameters can be used as standard laboratory test to determine diseased conditions and metabolic disturbances. The exposure of *Labeo rohita* to sublethal concentration of plywood effluent caused a significant decrease in erythrocyte count, haemoglobin, MCV, MCH, MCHC and haematocrit where as the WBC found to be increased.

RBCs number (million/μ^l), Hb content (mg/dl) and packed cell volume (Haematocrit) percentage decreased significantly after exposure to plywood effluent in comparison with controls ($p \leq 0.05$). Hb and PCV level decreases up to 96 hrs and the decrease is significant with treatment as well as with increase in time of exposure (figure 3 and figure 7 respectively). In case of RBCs, decrease is significant when compared with controls (Figure 1). Madhyastha and Nayak reported the progressive reduction in the total number of the erythrocytes in *Rasbora daniconius* (Ham.) as responses to the sodium lauryl sulphate (an anionic detergent) [11]. It has been later shown that there is a decrease in erythrocytes when the fish *Rasbore daniconius* (Ham) is exposed to detergent for 30 days. Decrease in haemoglobin concentration denotes restricted ability of fish to provide sufficient oxygen to the tissues and this results in decline of physical activity [12]. Prolonged reduction in haemoglobin content is deleterious to oxygen transport and any blood dyscrasia and degeneration of the erythrocytes could be described as pathological condition in fishes exposed to toxicants [13]. The result of the present study is in agreement with Sree lekshmy and Miranda who studied the impact of industrial effluent on the haematological profile in marine catfish, *Arius nenga* [14]. The decreased level of PCV in the present study suggesting that the plywood effluent induced acute anemia under exposure and similar observation was made by Bhatkar [4].

The WBC count increases in the fish with time duration. Highest WBC count was found at 96 hrs and increase was significant (Figure 2). This may be attributed to the induction of some defense mechanism in the body of fish to tide over the pollution stress [17] or might be due to immunological reaction to produce more antibodies to cope with the stress induced by the toxicant [2].

There is significant decrease ($p \leq 0.05$) in MCHC value (Figure 6). Similar trend was found for MCH (Figure 5). These results are in agreement with the study by Adeyemo [1]. The fluctuation in the MCH in the present study, clearly indicates that the concentration of haemoglobin in the red blood cells were much lower in the exposed fish than in the control fish, thereby, depicting an anaemic condition. The significant decrease in the MCHC after exposure, is probably an indication of red blood cell swelling or a decrease in haemoglobin synthesis.

MCV also shows a significant decrease in the value after treatment with plywood effluent as compared to control (Figure 4). These alterations were attributed to direct or feedback responses of structural damage to red blood cells membranes resulting in haemolysis and impairment in haemoglobin synthesis and stress-related release of red blood cells from the spleen and hypoxia, induced by exposure to toxicant [19].

Table 1: Haematological changes in blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

Blood Parameters	Exposure Periods				
	CONTROL	24HRS	48HRS	72HRS	96HRS
RBC	2.47 ± 0.03	1.92 ± 0.01	1.71 ± 0.04	1.50 ± 0.04	1.30 ± 0.03
't' value		12.28**	15.58**	19.44**	23.84**
% Change		+22.26	+30.76	+39.27	+47.37
WBC	20.32 ± 0.12	21.53 ± 0.12	22.12 ± 0.14	23.70 ± 0.10	26.82 ± 0.11
't' value		27.89**	29.99**	30.61**	55.123**
% Change		-5.95	-8.85	-16.63	-31.98
Hb	3.41 ± 0.41	2.51 ± 0.01	1.40 ± 0.02	1.0 ± 0.02	0.81 ± 0.02
't' value		4.391**	9.852**	11.82**	12.75**
% Change		+26.47	+58.94	+70.67	+76.25
MCV	31.10 ± 0.05	29.54 ± 0.04	27.24 ± 0.03	24.11 ± 0.04	22.58 ± 0.01
't' value		20.15**	65.31**	93.54**	102.61**
% Change		+5.01	+12.41	+22.47	+27.39
MCH	28.10± 0.06	23.50 ± 0.07	19.10 ± 0.04	16.38 ± 0.04	14.52 ± 0.03
't' value		16.18**	21.75**	42.95**	62.34**
% Change		+16.37	+32.02	+41.70	+48.32
MCHC	20.50 ± 0.12	19.40 ± 0.10	19.00 ± 0.12	18.40 ± 0.12	17.60 ± 0.14
't' value		9.959**	12.5**	17.84**	22.24**
% Change		+5.36	+7.31	+10.24	+14.14
PCV	9.90 ± 0.87	9.40 ± 0.81	8.70 ± 0.65	7.21 ± 0.74	7.20 ± 0.52
't' value		1.25^{NS}	5.90**	3.62**	6.37**
% Change		+5.05	+12.12	+27.17	+27.27

Values are mean ± SD, n=5, Figures in parenthesis are percentage decrease / increase over control.
* - Significant at 5% (t<0.05) ** - Significant at 1% (t<0.01) NS – Non significant

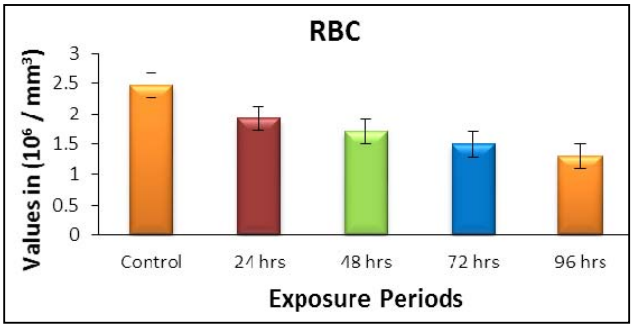

Fig 1: Haematological changes in the RBC of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

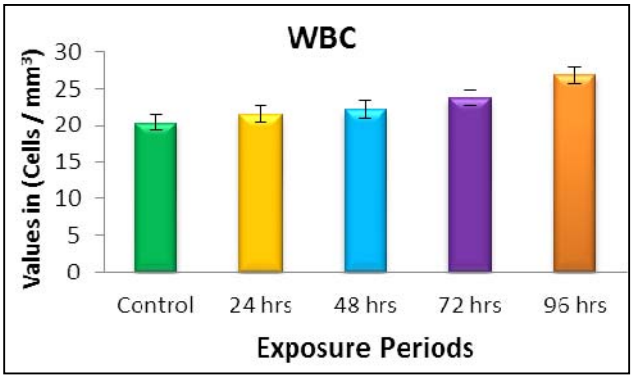

Fig 2: Haematological changes in the WBC of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

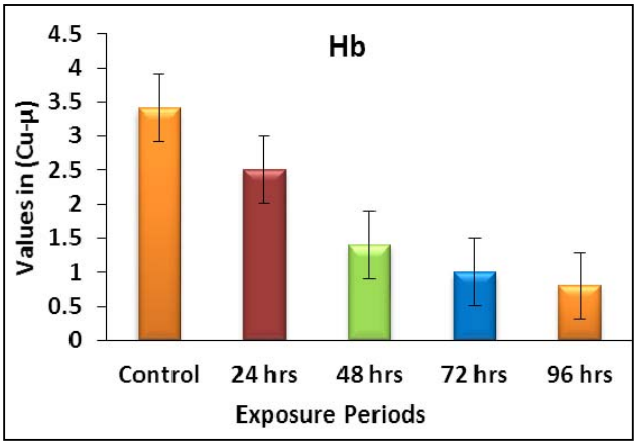

Fig 3: Haematological changes in the Hb of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

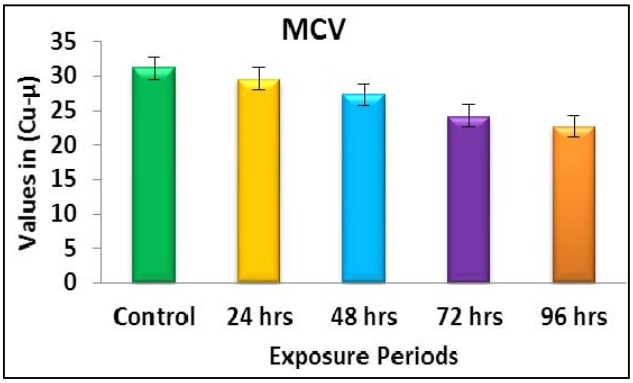

Fig 4: Haematological changes in the MCV of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

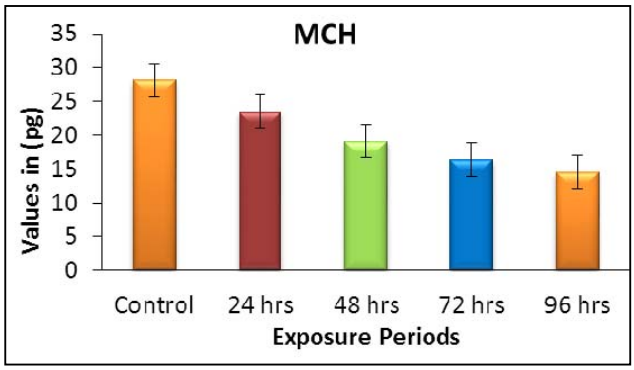

Fig 5: Haematological changes in the MCH of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

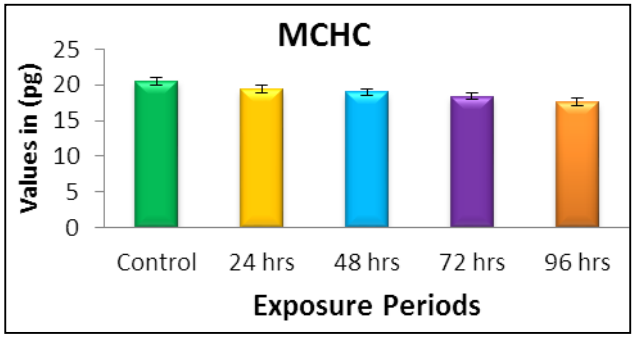

Fig 6: Haematological changes in MCHC of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods.

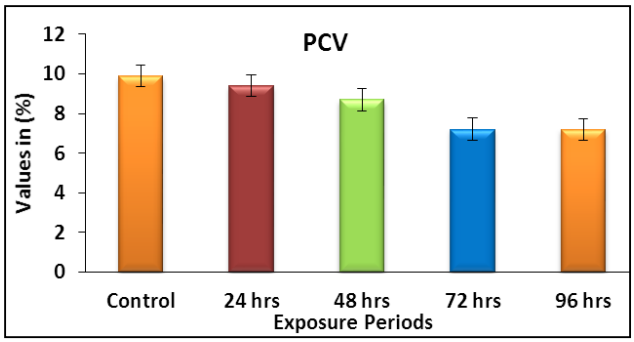

Fig 7: Haematological changes in the PCV of blood due to plywood effluent in the fresh water fish, *Labeo rohita* on different exposure periods

4. Conclusion

The results of the present study showed that the plywood effluent caused alterations in haematological parameters of the fresh water fish, *Labeo rohita*.

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6. References

1. Adeyemo OK. Haematological and histopathological effects of Cassava Mill Effluent in *Clarias gariepinus*. African Journal of Biomedical Research. 2005; 8:179-183
2. Anand kumar A, Tripathy AP, Tripathy NK. Effect of dimecron on the blood parameters of *Heteropneustes fossilis*. Journal of Environmental Biology. 2006; 22(4):297-299
3. Barton AB. Stress in fishes: a diversity response with particular reference to changes in circulating corticosteroids. Integrative and comparative Biology. 2002; 42:517-525.
4. Bhatkar NV. Chromium (III) induced haematological alterations in Indian common carp, *Labeo rohita* (Ham.) Journal of Applied and Natural Science. 2011; 3(2):258-263.
5. Bouck GR, Ball RC. Influence of capture methods on blood characteristics and mortality in rainbow trout (*Salmo gairdneri*). Transaction of the American Fisheries Society. 1966; 95:170-176
6. Celik SE. Blood chemistry (Electrolyte, lipoproteins and enzymes) values of black scorpion fish in the Dardanellus Turkey. Journal of Biological Science. 2004; 4(6)716-719.
7. Dacie S, Lewis S. Practical Haematology, 7th ed, 633, Churchill Livingstone, London, 1991.
8. Golovina NA. Morpho-functional characteristics of the blood of fish as objects of aquaculture. Doctorial thesis, Moscow, Luskova, 1996.
9. Herger W, Jung SJ, Peter H. Acute and prolonged toxicity to aquatic organisms of new and existing chemicals and pesticides. Chemosphere. 1995; 31:2707-2726.
10. Jain NC, Schalm's. Veterinary, Lea and Febiger, Philadelphia, 1996, 1221.
11. Madhyastha MN, Nayak RR. Effect of sodium lauryl sulphate (an anionic detergent) on *Rasbora daniconius* (Ham.) Proc. Symp. Environ. Biol. 1979, 327-336
12. Nussey G, Van Vuren JHJ, Du Preez HH. Effects of copper on haematology and osmoregulation of the Mozambique tilapia, *Oreochromis mossambicus* (Cichlidae), Comp. Biochem. Physiol. 1995; 111:369-380.
13. Shah SL. Haematological parameters in *Tinca tinca* after short term exposure to lead. J Appl Toxicol. 2006; 26(3):223-266.
14. Shalaby AM. Protective effect of Ascorbic acid against Mercury intoxication in Nile tilapia (*Oreochromis niloticus*). Journal of Egyptian Academic Society for Environmental Development. 2001; 2(3):79-97.
15. Sreelekshmy SG, Miranda MTP. Impact of industrial effluent on the haematological profile in marine catfish, *Arius nenga*. International Journal of Research in Fisheries and Aquaculture. 2016; 6(1):4-7.
16. Tawari-Fufeyin P, Igetei PJ, Okoidigun ME. Changes in the cat fish (*Clarias gariepinus*) exposed to acute and lead poisoning. Bioscience Research communications. 2008; 20:271-276.
17. VanVuren JHJ. The effects of toxicants on the haematology of *Labeo umbratus* (Teleostei: Cyprinidae). Comparative Biochemistry and Physiology. 1986; 83(1):155.
18. Wepener V, Van vuren JH, Du preez HH. The effect of hexavalent chromium at different pH values on the haematology of *Tilapia sparrmanii* (Cichlidae). Comparative Biochemistry and Physiology. 1992; 101C(2):375-381.
19. Wilson RW, Taylor EW. The physiological responses of freshwater rainbow trout, *Oncorhynchus mykiss*, during acutely lethal copper exposure. Journal of Comparative Physiology. 1993; 163(1):38-47.