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EFFECT OF UREA TOXICITY ON THE HAEMOGLOBIN LEVEL OF FISH, CLARIAS BATRACHUS

Zoology

Dr. T.S. Naqvi Department of Zoology, Shia P.G. College, Lucknow-226020 U.P. (India) - Co.Author

ABSTRACT

Toxicity of fertilizer urea resulted in decrease of haemoglobin of fish Clarias batrachus. at all concentrations and exposures. The least decrease of 21.67% below control was observed after 24 hours at 3.10 g/L concentration and at the highest concentration of 12.50 g/L, the haemoglobin level had decreased 57.63%, below control.

KEYWORDS:

Haemoglobin, Fertilizer, urea, *Clarias batrachus.*

INTRODUCTION

The fertilizers which are used for increasing crop production decompose to form ammonia, nitrite and nitrate. Ammonia is one of the most important pollutants in the aquatic environment because of its relatively high toxic nature and its ubiquity in surface water systems. Ammonia can enter natural water systems from several sources, including agricultural discharges, industrial wastes. Sewage effluents and alternative fuel conversion processes. It is a natural biological degradation product of nitrogenous organic matter. Nitrite impairs the ability of fish blood to transport oxygen. Nitrite oxidises haemoglobin to methaemoglobin (1,2,3) and increased methaemoglobin levels in fish blood and impairs oxygen transport (4). The toxic effect of fertilizer urea was seen on haemoglobin levels of fish *Clarias batrachus* exposed to LC50 concentration for 24 to 144 hours, and results are given.

MATERIALAND METHODS

Healthy and live fishes *(Clarius batrachus)* were obtained from the Gomti River at Lucknow through fish Catchers. Fishes were brought to laboratory in wide mouthed glass bottles in natural water, and washed 3 times in tap water, then treated with 2.5% $KMnO_4$ to remove infections like protozons, fungi, bacteria, trematodes, arthropods etc. Apparently normal, uninfected and only healthy fishes, were transferred to large glass aquaria. Fishes, were acclimatized for 12 hours. Earlier, the lethal concentrations of urea fertilizer for particular period i.e. for 24, 48, 72, 96,120,144 hours were recorded (5,6). Water characteristics were analysed before and during the experiment following the standard procedure. Proper oxygen supply was maintained throughout the experiment. Fishes were taken out after definite interval and exposed to desired concentration of the fertilizer, avoiding injuries and stresses of all kinds as for as possible. Blood was collected from the live fish (by puncturing the caudal vein) in vials and mixed with anticoagulant Ethylene Diamino Tetra Acetic acid (EDTA). Data in respect of Haemoglobin (gm%) were obtained using Boehringer Mannheim Diagnostics HG-555.

Table 1. Showing water characteristics after dissolving urea fertilizer at different intervals.

Water Characteristic									
Fertilizer concentration (gm/1)	**Exposure time in hours**	**Temperatue (Aquaria) 0C**	**pH**	**Hardness (Total p.p.m.)**	**Hardness (temporary)**	**Alkalinity (pernopthaline) p.p.m.**	**Alkalinity (Methylorange) p.p.m.**	**Alkalinity (Methylorange) p.p.m.**	**Dissolved Oxygen p.p.m.**
* Control	*100 *144	*36.5 *35.9	*29.0 *28.5	*7.05 *7.05	*244 *255	*244 *253	*15.0 *10.0	*245 *255	*9.2 *8.9
3.10	00 144	36.5 35.7	28.0 28.5	8.02 9.05	240 244	240 224	20.0 162.5	305 412.5	9.0 8.7
5.25	00 120	36.5 36.2	27.5 28.0	8.10 8.65	236 227	236 227	25.0 155.0	324.5 402.0	9.1 8.8
8.30	00 96	36.5 36.0	27.0 28.0	8.12 8.57	235 223	235 223	40.5 125.0	365.5 435.0	8.9 8.6
9.45	00 72	36.5 36.2	26.5 28.0	8.15 8.56	232 239	232 219	85.0 49.5	381.5 446.0	9.0 8.4
10.60	00 40	36.5 36.0	26.0 27.5	8.21 8.84	214 196	214 196	121.5 85.0	403.0 454.5	8.9 8.2
12.50	00 24	36.5 36.7	24.0 26.5	8.24 8.93	209 187	209 187	140.0 64.5	423.5 467.0	9.1 8.5

* Control values.

OBSERVATIONS AND RESULTS

Variable changes in water characteristics were observed. (Table - 1). After dissolving the fertilizer, pH of the medium, slightly changed and the other water quality (12) remain almost unaffected.

The least decrease was observed after 24 hours at 3.10 g/L concentration. At the lowest concentration of 3.10 g/L urea, the fish survived for 144 hours, when haemoglobin level had fallen 21.67% below control. The level decreased 4.51% and remained near control, in the initial 24 hours of exposure, as compared to the control. After 48, 72 and 96 hours, the levels declined 8.62%), 15.19% and 20.21% respectively. However, the haemogioleln level increased 19.13% and then decreased 21.67% after 120 and 144 hours of exposures, respectively. All these decreases were significant ($P< 0.001$) except that of 24 hours which was in significant ($P > 0.001$).

At 5.25 g/L concentration also hameoglobin levels had continuously fallen 12.8%, 16.34%, 18 47% and 19.79% after 24 48, 72 and 96 hours of exposures, respectively, below control. However, a slight incr-ease of 18.96% was observed after 120 hours of exposure.

At 8.30 g/L concentration, the haemoglobin level had continuously fallen 19.62%, 22.74%. 26,83% and 33.53 after 24, 48, 72 and 96 hours of exposures respectively, below control.

At 9.45 g/L concentration, the haemoglobin level had continuously decreased 39.86%, 43.35% and 45.89% after 24, 48 and 72 hours of exposures respectively, below control.

At 10.60 g/L concentration, haemoglobin level had decreased 50.83% at 24 hours of exposure but a slight increase of 47.70% was noticed at 48 hours of exposures, from control but the 50% fishes did not survive further.

At the highest concentration of 12.50 g/L, the haemoglobin level had decreased 57.63%, below control. All the decreases in haemoglobin at 5.25 g/L, 8.30 g/L, 9.45 g/L, 10.60 g/L and 12.50 g/L concentrations were significant (P<0,001);.

DISCUSSION

The chemicals of Agrochemical Industry are important causative factors of pollution, very little studies have been done on the haematological profile of fishes due to the effect of fertilizers and pesticides (10,11).

In these experiments, significant decrease in haemoglobin content was observed due to the effect of fertilizer urea and this was more with increasing time intervals. A fall in haemoglobin content is indicative of an impaired erythropoisis and is accompanied by an impaired haemoglobin biosynthesis. Lowering of haemoglobin content in fish blood with urea indicates that the pollutant even at low experimental concentrations blocks denovo synthesis of haemoglobin of some stage, causes increased destruction of erythrocytes, or delays their maturation, interferring thus with normal haematopoisis. A fall in haemoglobin content due to a variety of pollutants has been reported by a number of workers (5,6,7) and observations recorded in this communication are comparable to others.

In Tilapia guinensis various experiments were done using organic fertilizers (14). Histopathological changes due to the use of methiocrab or endosulfan were studied on ranbow trout (13). Sub lethal dose of ammonia and urea concentrations inhibited physiological disorder in rainbow trout Oncorhynchus mykiss, (15), In the same fish ammonia and urea affected the activity of enzyme, gillcarbonic anhydrase (16), The tobacco leaf dust altered the biochemical parameters of Hybrid catfish, Clarias gariepinus and Heterobranchus bidorsalis (17). The organophosphate (Dimethoate) caused Acute Toxicity and Behavioral Responses of Common Carp Cyprinus carpio, (18). In fishes ammonia toxicity caused many physiological disorders (19). Acute toxicity of inorganic fertilizers to African catfish, Clarias gariepinus (Teugals) had also been reported (20). Acute toxicity levels and ethological responses were reported in Channa striatus to fertilizer and industrial wastewater (21). Toxicity in rice-cum-fish culture systems were reported due to the effect of use of different fertilizers (22). Fertilizers and drainage from turf grass affected the quality of ground and surface water (23). Chronic ammonia toxicity to duckweed fed Tilapia, Oreochromis niloticus had also been reported (24). Haematological response of African catfish (Clarias gariepinus) & rat to crude oil exposure had also been reported (25).

The above findings lead to fall in haemoglobin, in fresh blood are common effect of pollutants in the aquatic environment.

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