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Toxic Effect of Textile Bleaching Effluent on the Fresh Water Fish, *Cyprinus carpio*

Swapna S.

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ABSTRACT

Impact of textile bleaching effluent on the food utilization of *Cyprinus carpio* was studied at different days during experiment (7, 14, 21 and 28 days). LC_{50} 24 h of treated textile bleaching effluent was determined using Finney's Probit analysis. Feeding rate, absorption rate, metabolic rate and growth rate of the fish were recorded by exposing them to control 1%, 2% and 2.5% concentrations of effluent. Food utilization parameters were reduced in the group exposed to different sub lethal concentrations compared to control group. Results were discussed in the light of toxicity of textile bleaching effluent.

Keywords Pollution, Effluent, Food consumption, Acute toxicity, Fish.

Swapna S.
Department of Zoology, Sree Narayana College, Chempazhanthy 695587, Thiruvanathapuram, Kerala, India
Email: drsswapna@gmail.com
*Corresponding author

INTRODUCTION

Water pollution caused by industries constitute a potential threat to health of the ecosystem. With the intensification of industries, the process of treatment of industrial discharge has lagged behind the industrial growth. Toxic substance present in these industrial effluents can affect aquatic life and thereby disrupting the entire ecosystem (Jiyavudeen and Puvaneswari 2016). Toxicity test of chemicals on animals has been used for a long time to detect the potential hazards posed by chemicals to man. Aquatic bioassays are necessary in water pollution control to determine whether a potential toxicant is dangerous to aquatic life. Growth rate is the fundamental measure of physiological fitness and food intake is a vital factor for fish growth. Reports are available on the decline in food consumption (Okereke *et al.* 2016), appetite suppression and cessation of feeding (Amutha and Krishnaveni 2017) in fish under the pollution stress. Food utilization parameters are often a sensitive indicator of toxicity because bioenergetics comprises energy transformation in living organisms. Alterations in food utilization and growth in fish exposed to domestic effluent (Kolawole *et al.* 2020), sago effluent (Ramesh and Nagarajan 2014) have been reported. The present investigation was undertaken to evaluate the toxic effect of "treated" textile bleaching effluent on food utilization parameters in the fish, *C. carpio.*

MATERIALS AND METHODS

The fish *C. carpio* (wt 1 ±0.5 g) were selected for the present study because of their wide availability. Fish procured were acclimatized to laboratory conditions

(28 ± 2 ^{0}C) and were fed *ad libitum*. The 24 h LC_{50} value of treated textile bleaching effluent was calculated by Probit Analysis (Finney 1971). Considering the range of 'application factors' (Anderson and D' Apollonia 1978) by chronic and sub lethal tests, three sub lethal concentrations of treated effluent (1.5 %, 2% and 2.5%) were evolved in order to perform the studies on the biological effect of effluent on the fish.

Three groups of fish as 5 each were introduced to the medium of sub lethal concentration. Control was maintained in normal tap water without toxic effluent. During the period of experiment, the fish were fed *ad libitum* at 9, 12 and 15 h daily. Every day, the medium was renewed with appropriate concentration of effluent. The experiment was continued for 28 days. Weight of the fish was noted on day 1 and on day 28 of the observation. For each concentration 3 replicates were maintained.

The 'Sacrifice method' (Maynard and Loosli 1962) was employed to determine the growth of the fish. The IBP formula (Petrusewicz and MacFadyen 1970) for food utilization with modification (Arunachalam and Palanichamy 1982) was employed to workout food utilization parameters. The results were subjected to statistical analysis, ANOVA and Student't' test at appropriate context.

RESULTS AND DISCUSSION

The 24 h LC_{50} value of' treated textile bleaching effluent was 27.23%. The food utilization parameters such as feeding rate, absorption rate, metabolic rate and growth rate of experimental fish relative to controls were found to decline with an increase in effluent concentration (Table 1). Maximum feeding rates were recorded in 1.5% concentration of treated effluent. Feeding rate recorded for control, 1.5%, 2% and 2.5% concentration of effluent were 28.37mg/g/day, 24.22mg/g/day, 22.30mg/g/day and 15.22mg/g/day respectively. The reduction in feeding rate was statistically significant ($p<0.001$) compared to control. A short fall reported in the feeding rate may have been a consequence of damage to taste receptors. Increase in ejection with increase in effluent concentration mayalso directly reflect the quality of food i.e. contaminated with the chemicals present in the medium.

Table 1. Feeding rate, Absorption rate, Metabolic rate and Growth rate (mg/g/day) changes of the fish, *C. carpio* following exposure to different sub lethal concentrations of textile bleaching effluent for 28 days.

Estimations	Control	Sub lethal concentrations of effluent		
		1.5	2	2.5
Feeding rate	28.37	24.22	22.30	15.22
±SD	0.30	0.40	0.29	0.30
% Change		14.63	21.40	46.35
Absorption rate	22.92	19.99	15.94	10.94
±SD	0.25	0.34	0.39	0.35
% Change		12.78	30.45	52.27
Metabolic rate	19.39	17.37	14.36	10.26
±SD	0.19	0.39	0.35	0.32
% Change		10.42	25.94	47.09
Growth rate	3.52	2.74	1.58	0.68
±SD	0.06	0.05	0.05	0.08
% Change		22.16	55.11	80.68

Absorption rate of different experimental groups were 22.92 mg/g/day, 19.99 mg/g/day, 15.94 mg/g/day and 10.94mg/g/day for control, 1.5%, 2% and 2.5% effluent respectively. The percent decline (52.27%) of absorption rate was maximum in fish treated in 2.5% concentration. The absorption rate values showed a significant ($p<0.001$) decrease. Under the stress of highest test concentration (2.5%) there was a severe decline in the rate of metabolism from 19.39 mg/g/day (control) to 10.26 mg/g/day.

A concentration dependant decline in growth rate was observed in *C. carpio* exposed to different sub lethal concentration of effluent. Maximum decline in growth rate (0.68mg/g/day) was reported in fish treated with 2.5% effluent. The reduction in growth rate was also statistically significant ($p<0.001$) compared to control. It has been observed by Patro (2016) that growth rate of fresh water fish, *Oreochromis mossambicus* decrease significantly after exposure to industrial wastewater effluent for 7, 14, 21 and 28 days. Reduction in feeding activity, loss of body fluids, loss of ions from body under the conditions of stress, restlessness and agitated movements could have attributed to the decrease in body weight (Bhanot and Hundal 2019).

Analysis of variance (one factor) was applied to

Table 2. Analysis of variance (ANOVA) to evaluate significance of difference in the effect of three sub lethal concentration of treated textile bleaching effluent on food utilization parameters. **, indicate significance at 1% level.

Source	DF	Sum of squares	Mean squares	'F' value
Feeding rate				
Between groups	3	271.200967	90.429656	872.8731**
Within groups	8	0.828800	0.103600	
Total	11	272.117767	24.737979	
Absorption rate				
Between groups	3	243.069667	81.023222	716.0691**
Within groups	8	0.905200	0.113150	
Total	11	243.974867	22.179533	
Growth rate				
Between groups	3	13.780567	4.593522	2064.5044**
Within groups	8	0.017800	0.002226	
Total	11	13.798367	1.254397	
Metabolic rate				
Between groups	3	141.910767	47.303589	467.5808**
Within groups	8	0.809333	0.101167	
Total	11	142.720100	12.974555	

evaluate the significance of difference in the effect between three sub lethal concentrations of effluent (Table 2). The marked difference between the sub lethal concentrations as indicated from the significant level showed that every sub lethal concentration used in the present study is independently effective in influencing the food utilization parameters.

Toxic effect of textile bleaching effluent in the fish has been clearly manifested in the present study. Though the effluent was said to be "treated", it still contain toxic pollutants that could impart detrimental impact on food utilization parameters in fish. Hence it is recommended that proper treatment of effluent should be done up to acceptable level before discharge into the aquatic systems.

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REFERENCES

Amutha K, Krishnaveni S (2017) Impact of dairy industrial effluent on fresh water fish, *Catla catla. World J Pharmaceut Res* 6 (13): 532— 538.

Anderson PD , D'Apollonia S (1978) Aquatic Animals. In: Butler GC (ed). Principles of Ecotoxicology. John Wiley & Sons Publications, New York.

Arunachalam S, Palanichamy S (1982) Sub lethal effects of carbaryl on surfacing behavior and food utilization in the air breathing fish, *Macropodus cuponus. Physiol Behav* 29: 23—27.

Bhanot R, Hundal SS (2019) Acute toxic effect of untreated sewage water in *Labeo rohita* (Hamilton 1822). *J Entomol Zool Stud* 7 (3): 1351—1355.

Finney DJ (1971) Probit Analysis. 3rd edn. Cambridge University Press, London, pp 333.

Jiyavudeen M, Puvaneswari S (2016) A study on the effects of industrial effluents on the biochemical components of the fish *Mugil cephalus i*n Uppanar Estuary South East Coast of India. *Int J Modn Res Revs* 4 (8): 1224 —1227.

Kolawole AA, Ataitiya R, Junaid QO, Mustapha ARK (2020) The effect of domestic effluent on growth and Hematological parameters of Clarius gariepinus (Burchell 1822) (Pisces, Clariidae). *Anales de Biologia* 42: 129 —136.

Maynard AC, Loosli KJ (1962) Animal Nutrition. Mc Graw Hill, New York, pp 553.

Okereke JN, Ogidi OI, Obasi KO (2016) Environmental health impact of industrial wastewater effluents in Nigeria – A review. *Int J Adv Res Biol Sci* 3 (6) : 55 —67.

Patro L (2016) Impact of industrial effluent on the changes in behavior and body weight of a fresh water fish, *Oreochromis mossambicus*, Peters. *Int J Adv Res Inn Ed* 2:1—7.

Petrusewicz K, MacFadyen A (1970) Productivity of terrestrial animals, Principles and Methods. IBP hand book, Black well Scientific Publications, pp190.

Ramesh F, Nagarajan K (2014) Influence of treated sago effluent on the growth rates of the fresh water fish, *Catla catla. Int J Bioassays* 3 (04): 2013 —2016.