Effect Of Sublethal Concentration Of Sugar Factory Effluent On Hepatic Metabolism Of *Channa Punctatus* (Bloch.)

DHARMENDRA SINGH[1], SADGURU PRAKASH[2]
[1]*Department of Zoology, Shiv Pati (P.G.), College, Shohratgarh, Siggharthnagar, U.P.*
[2]*Department of Zoology,M.L.K.(P.G.)College ,Balrampur,U.P.*

Abstract- ***The Snake headed air breathing fish, Channa punctatus were reared in different sublethal concentrations (2.5%, 5%, 7.5 % and 10 %) of the distillery effluent for 30 days. Various biochemical constituents of liver (carbohydrate, fat, protein, nucleic acid and phosphatases enzyme) of control and effluent treated fishes were estimated. In the present investigation, sugar factory effluent exposed fish Channa punctatus showed a significant decrease in protein, glycogen, triglyceride, RNA and DNA contents along with increase in acid and alkaline phosphatases enzyme of liver at all sublethal concentrations as compared to control. The percentage of alteration in liver component was directly proportional to the concentration of effluents.***

Indexed Terms- ***Channa punctatus, Liver. Sugar factory effluent***

I. INTRODUCTION

The disposal of industrial effluents in the aquatic environment is toxic to fishes. Chemical pollution has a great impact on aquatic organisms. Water pollution by discharging of effluents from various industries caused serious problems in many rivers and pounds. The discharges from these industries constitute biohazard to man and other living organisms in the environment because they contain toxic substances detrimental to health (Afroz and Singh,2014). Most of the industries discharge their waste without proper treatment which cause change in physical, chemical and biological characteristic of water. Discharge of untreated industrial effluent into aquatic system depleted the dissolved oxygen content and, by interfering with respiratory metabolism seriously affects aquatic biota and their production.

Mortality of fishes has been recorded in waterbodies receiving various pollutants. Due to chemical pollution, the normal functioning of cell is disturbed and this in turn, may result in alternation in the biochemical and physiological mechanisms of animals. The biochemical constituents i.e. carbohydrate, fat and protein act as energy precursors in fishes exposed to stress conditions. Since works pertaining to the biochemical constituents of fishes are scanty, hence the present study was designed to define the effect of sugar factory effluent on biochemical composition of liver of an air breathing fish, *Channa punctatus*.

II. MATERIALS AND METHODS

Raw sugar factory effluent was collected from Balrampur Chini mills Ltd. Balrampur and Physico-chemical parameters were analysed in the laboratory as per standard methods (AHHA,2005). The *Channa punctatus* (50±5gm and 10±0.5cm) were collected from the local farm and acclimated to laboratory conditions. All biochemical experiments were carried out for a period of 30 days. The experiments were conducted in glass aquaria consisting 10 liters of water (as control) or a specific concentration (2.5 %-10%) of distillery effluent. For each experiment, five replicates were maintained and 10 individuals were reared in each aquarium. A control group was maintained in an identical environment. The fish were regularly fed with commercial food and the medium was changed daily to maintain the concentration and to remove faeces as well as food remnants.

The fishes were dissected out to remove liver from both experimental and control groups after 30th days of exposure. The liver were homogenized in 0.25 M sucrose solution and centrifuged at 1000x g for 10

minutes. The supernatants were filtered and the filtrates were used for analysis of glycogen, triglyceride, protein, nucleic acid and acid and alkaline phosphatases by following standard methods.

Parameters	Methods	Serum Parameters	Methods
Glycogen	Carroll *et al*.(1956)	Acid Phosphatases	Kind and King method (1954)
Protein	Lawery's method as described by David(1992)	Alkaline Phosphatases	King and Armastrong method (1934)
Triglyceride	Barnes and Blackstoc k (1973) method	Nucleic acids	Creiotti (1955)

The data obtained from the proximate analysis of all samples were calculated by average value and standard deviation. The statistical significance of difference between control and experimental group was calculated by student's 't'- test then discussed descriptively.

III. RESULTS AND DISCUSSION

The physico-chemical characteristics of distillery used for the present study are presented in Table.1. From this table, it is clear that the effluent exhibited very high values of total solids (TS), total dissolved solids(TDS), total suspended solids(TSS), chemical oxygen demand(COD), alkalinity (ALK), chloride(Cl), sulphate(SO_4), hardness(HAR) and biological oxygen demand (BOD) from ISI standard.

Table1. Physico-chemical characteristics of distillery effluent (average value of 3 sample)

Parameters	Average	ISI standard	Parameters	Average	ISI standard
pH	4.4	6.0-7.0	ALK (ppm)	10873.50	600
TS (ppm)	42928.50	2700	Cl (ppm)	5848.00	600
TDS (ppm)	30690.00	2100	SO_4 (ppm)	3951.83	2100
TSS (ppm)	1238.50	600	HAR (ppm)	4498.6	600
COD (ppm)	7045.66	250	BOD (ppm)	3212±23.32	30.00

Table 2. Liver composition of *Channa punctatus* after exposure to sugar facrory effluent (N= 10).

Parameters	Sugar factory Effluent Concentrations				
	0% (control)	2.5%	5.0%	7.5%	10%
Total Protein (mg/gm)	8.00±0.16	7.00±0.14 (-12.5%)	6.40±0.18* (-20.0%)	6.10±0.21* (-23.75%)	5.60±0.42** (-30.00%)
Glycogen (mg/gm)	65.50±2.18	63.00±0.14 (-3.81%)	60.20±0.49 (-8.09%)	58.30±0.32* (-10.99%)	57.10±0.12* (-12.82%)
Triglycerides (mg/gm)	14.25± 0.31	11.56±0.21 (-18.87%)	9.23±0.32* (-35.22%)	7.65±0.41* (-46.31%)	6.34±1.47** (-55.50)
RNA (mg/gm)	4.71±0.18	4.22±0.13 (-10.40%)	4.08±1.10 (-13.37%)	3.50±0.14* (-25.69%)	3.10±0.13** (-34.18%)
DNA (mg/ gm)	1.38±0.12	1.12±0.32 (-18.84%)	0.98±0.43* (-28.98%)	0.83±0.11** (-39.85%)	0.75±0.18** (-45.65%)
Acid phosphatase (Lu)	1.85 ± 0.08	2.10±0.09 (+13.51%)	2.32±0.43 (+25.40%)	2.52±0.51* (36.21%)	2.97±0.54** (+60.54%)

Alkaline Phosphatase (Lu)	1.50±0.06	1.70±0.05 (+13.33%)	1.90±0.43 (+26.66%)	2.10±0.12* (+40.00%)	2.30±0.14** (53.33%)

*significant at P< 0.05; ** significant at P<0.01

In the present investigation, sugar factory effluent exposed fish *Channa punctatus* showed a significant decrease in protein, glycogen, triglyceride , RNA and DNA contents along with increase in acid and alkaline phosphatases enzyme of liver at all sublethal concentrations as reared in freshwater (Control). The protein, glycogen, triglyceride, RNA and DNA content were decreased 12.5-30.0%, 3.81-12.82%, 18.87-55.50%, 10.40-34.18% and 10.84-45.65%, respectively. The acid and alkaline phosphatases were increased 13.51-60.54% and 13.33- 53.33%, respectively (Table 2). The percentage of alteration in liver component was directly proportional to the concentration of effluents.

During experimental periods fishes showed various behavioural changes like increase in number of visit to the surface, number of opercular beats/ minute, mucous secretion over body and muscular activity by constant stirring of the fish towards the walls of the aquarium. The increased activity demands extra energy and thereby a depletion of all the three components of the fish. In the present study, the decreased percentage in protein carbohydrate and lipids are not uniform even they are reared in same polluted medium. Similar result were also observed by Jayacandran and Chockalingam (1986) in *Channa punctatus* exposed in tannery effluent, Isaiarasu and Haniffa (1987) in *Mystus armatus* treated with paper mill effluent, by Haniffa and Salvan (1991) in *Oreochromis mossambicus* exposed in textile effluent and by Amudha and mahalingam (1999) in Cyprinus carpio treated with dairy effluent. The results of present study clearly indicate that during stress fishes not utilized all the components simultaneously.

In the present study , during stress condition , the available glycogen were quickly exhausted to meet increased energy demand and to maintain the uninterrupted and increasing energy requirement, the protein and triglyceride breakdown commenced to supply necessary precursor to carry on carbohydrate metabolism by TCA pathway, to release the much needed energy. The carbohydrate resource was also used by the fish to produce protective coating around the body in the form of mucous.

Thus decreased protein, glycogen and triglyceride content in liver may be due to the inhibition of enzymes as well as breakdown of stored protein, glycogen and triglyceride content to meet additional energy requirements under stress conditions.

The RNA and DNA contents were also reduced in effluent exposed fish. The percentage of decrease depends upon the concentrations of effluent. The decreased in nucleic acids suggests decrease in protein synthesis and further suggests the damage to the liver. Enzyme acid and alkaline phosphatases are known as " inducible enzymes" and their activity goes up in the presence of any toxicant to counteract the toxic effect of toxicant (Leland, 1983). According to Parthasarathi and Karuppa (1998), in liver, alkaline phosphatase is capable to inactivate the phosphorylase enzymes involved in glycogen synthesis. Thus any alteration in this enzyme affects the carbohydrate metabolism. Acid phosphatase is a lysomal enzyme that hydrolyses the easter linkage of phosphate esters and helps in autolysis of the cell after its death. Thus the increased activities of acid and alkaline phosphatases observed in the liver of test fishes exposed to sugar factory effluents can be attributed to the destruction of the cell membrane and lysosomes which intern leads to hepatic damage.

Thus the sugar factory effluent affects the crucial pathway of carbohydrate, lipid, protein and nucleic acid metabolism by directly or indirectly affecting certain regulatory substance i.e. enzyme and or hormones.

CONCLUSION

The present investigation can be concluded that factory effluents would bring deleterious changes in

the physiology of aquatic organisms. However, the results of the present study indicate that even after treatment the effluent possesses toxicants to the level of causing severe effects on different behavioural and biochemical parameters of fish and thus, suggested that the treatment process is still to be improved.

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