



# Effect of sugar mill effluent in sublethal concentration on liver metabolism of *Channa marulius* (Ham).

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## ABSTRACT

The disposal of industrial effluents in the aquatic environment is toxic to fishes. *Channa marulius* were reared in different sublethal Concentrations of the distillery effluent for thirty days. Various biochemical constituents of liver of control and effluent treated fishes were estimated. In the present observation, sugar mill effluent exposed fish *Channa marulius* showed a significant decrease in protein, glycogen, triglycerides, RNA and DNA contents along with increase in acid and alkaline phosphates enzyme of liver of all sublethal Concentrations as compared to control. The percentage of attraction in liver component was directly proportional to the concentration of effluents.

**Keywords:** *Channa marulius*, liver, sugar mill effluent, Biochemical constituents, Narkatiaganj.

## INTRODUCTION

An enormous increase in pollution due to discharge of effluents from industrial units into rivers and lakes is a matter of great concern in developing countries. Both the developed and developing countries are suffering from different forms of water pollution. Developed countries which have water pollution problem due to industrial proliferation and modernised agriculture technologies are now on the way of combating the problem throughout improved waste water treatment techniques. But developing countries with lack of technical knowledge, weak implementation of environmental policies and with limited financial resources are still facing problems. The disposal of industrial effluents in the aquatic environment is toxic to fishes. Therefore, fishes become one of the immediate targets of various pollutants than other vertebrates even in minute doses. Hence, they are widely used as a biological indicator of degree of pollution. (Roy *et al.* 2007).

The discharges from industries constitute biohazards to man and other living organisms in the environment because they contain toxic substances detrimental to health (Afroz and Singh, 2014) Discharge of untreated industrial effluent into hydro eco system Depleted the dissolved oxygen content and by interfering with respiratory metabolism seriously affects hydro-biota and their production (Kumar, 1990). Chemical pollution has a great impact on aquatic organisms. Mortality of fishes has been recorded in water bodies due to various pollutants. The normal functioning of cell is disturbed due to chemical pollution. This results in alternation in the biochemical and physiological mechanisms of animals. The biochemical constituents i.e carbohydrate, fats and protein act as energy precursors in fishes exposed to stress conditions. The present study is imperative to focus the effect of sugar mill effluent in biochemical composition of liver of an air breathing fish, *Channa marulius*.

## METHODS AND MATERIALS

The fresh water living and mature specimens of *Channa Marulius* (Saur) of 60±5gm weight groups and 12±5 cm in length were collected from the local ponds of Narkatiaganj, West Champaran Bihar and brought to the laboratory, where they were washed for few minutes in 0.1% aqueous potassium permanganate solution followed by several changes of fresh water to remove any dermal infection. They were acclimatized to the laboratory conditions for 30 days before being utilised for various successive experiments. The fishes were kept at natural photo-period and temperature.

During acclimation fishes were provided with fish tone (an artificial food), tubifex and chopped goat's liver on alternate day respectively. In this way, they 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. Raw sugar factory effluent was collected from Narkatiaganj and its physico-chemical parameters were analysed

in the laboratory of zoology department T.P. Varma college Narkatiaganj as per standard methods (APHA, 1995).

Liver was taken from the body of dissected fish from both experimental and control groups after 30th days of 7 exposure. The liver was homogenised in 0.25 M sucrose solution and centrifugal at 1000x g for ten minutes. The supernatants were filtered and the filtrates were used for analysis of protein, glycogen, triglycerides, nucleic acid and alkaline phosphates by the application of following standard methods.

## RESULTS AND DISCUSSION

The physico-chemical characteristics of distillery used for the study are shown in table-01 From this table it is obvious that the effluent consist 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<sub>4</sub>), hardness (HAR), and biological oxygen demand (BOD) form ISI standard.

In the present investigation sugar factory effluent exposed to fish *Channa marulius* exhibited a significant decrease in protein, glycogen triglycerides, RNA and DNA contents with increase in acid and alkaline phosphates of liver at all sub-lethal concentrations as reared in control condition.

The protein, glycogen, triglycerides, 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 phosphates were increased 13.51-60.54% and 13.33-53.33% respectively as shown in table-02. The percentage of alternation in liver component was directly proportional to the concentration of effluents.

Parameters	Methods	Serum parameters	Methods
Glycogen	Carroll <i>et al.</i> (1956)	Acid Phosphatases	Kind and King Method (1954)
Protein	Lawery's method as described by David (1992)	Alkaline phosphatases	King and Armstrong method (1934)
Triglyceride	Barnes and Black stock method (1973)	Nucleic Acids	Creiotti (1955)

**Table 1: physico-chemical characteristics of distillery effluent (average value of three sample)**

Parameters	Average	ISI Standard
pH	4.6	6.0-7.0
TS(ppm)	42927.50	2700
TDS (ppm)	30692.00	2100
TSS (ppm)	1236.50	600
COD (ppm)	7044.66	250
ALK (ppm)	10872.50	600
El (ppm)	5846.00	600
So <sub>4</sub> (ppm)	3950.83	2100
HAR (ppm)	4496.6	600
BOD (ppm)	3210±22.32	3000

**Table 2: Liver composition of *Channa marulius* after exposure to sugar mill effluent (N=10)**

Parameters	Sugar factory Effluent concentration				
	0% (Control)	2.5%	5.0%	7.5%	10%
Total Protein (mg/gm)	8.00±0.15	7.00±1.13 (-12.5%)	6.40±.16* (-20.0%)	6.10±0.20* (-23.75%)	5.60±0.41** (-30.00%)
Glycogen (mg/gm)	65.50±2.16	63.00±0.14 (-3.8%)	60.20±48 (-8.09%)	58.30±0.32* (-10.99%)	57.10±0.11* (-12.82%)
Triglycerides (mg/gm)	14.25±0.30	11.56±0.20 (-18.87%)	9.23±0.31* (-35.22%)	7.65±0.41* (-46.31%)	6.34±1.46** (-55.50)
RNA mg/gm	4.71±0.16	4.22±0.12 (-10.40%)	4.08±1.10 (-13.37%)	3.50±0.14* (-25.69%)	3.10±0.12** (-34.18%)
DNA mg/gm	1.38±0.11	1.12±0.31 (-18.84%)	0.98±0.42* (-28.98%)	0.83±0.11** (-39.85%)	0.75±0.17** (-45.65%)
Acid phosphates (Lu)	1.85±0.07	2.10±0.08 (+13.51%)	2.32±0.42 (+25.40%)	2.52±0.50 (36.21%)	2.97±0.53 (+60.54%)
Alkaline Phosphates (Lu)	1.50±0.05	1.70±0.04 (+13.33%)	1.90±42 (+26.66%)	2.10±0.11* (+40.00%)	2.30±0.13** (53.33%)

\* Significant at P&lt;0.05

\*\* Significant at P&lt;0.01

During experimental periods fishes exhibited various behavioural changes like increase in number of visits to the surface, number of opercular movements/minutes, mucous secretion over body and muscular activity by constant stirring of the fish towards the wall 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 results were also observed by Jayachandran and Chocklingam (1986).

In *Channa punctatus* exposed in tannery effluent and Haniffa *et al.* (1986) in *Mystus armatus* treated with

paper mill effluent, by Haniffa and Selvan (1991) in *Oreochromis mossambicus* exposed in textile effluent and by Amudha and Mahalingam (1999) in cyprinus carpio treated with dairy effluent. Similar result was also found by Prasad *et al.* (2002) in *C. Marulius* (Ham) treated with dhinashenate and monocil toxicity on the concentration of protein and amino acid on the serum and liver. The results clearly indicates that during stress fishes not utilized all the components simultaneously.

In the present study during stress condition, the available glycogen was quickly exhausted to meet increased energy demand and to maintain the uninterrupted and increasing energy requirement, the

protein and triglycerides break down commenced to supply necessary precursors to carry on carbohydrate metabolism by TCA path way, 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 triglycerides content in liver may be due to the inhibition of enzymes as well as breakdown of stored protein, glycogen and triglycerides content to meet additional energy requirements under stress condition.

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 indicates decrease in protein synthesis and further suggests the damage to the liver. Enzyme acid and alkaline phosphates are known as "Inducible enzymes" and their activity goes up in the presence of any toxicant to counter act the toxic effects of toxicant (Leland, 1983). Alkaline phosphates is capable to in activate the phosphorylase enzymes involved in glycogen synthesis (Parthasarathi and Karuppsamy, 1998). Thus, any alternation in this enzyme affects the carbohydrate metabolism. In this way the increased activities of acid and alkaline phosphates 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 in turn leads to hepatic damage.

Thus, the sugar mill effluent affects the crucial pathway of carbohydrate lipid, protein and nucleic acid metabolism by directly or indirectly affecting certain regulatory substances i.e. enzyme and or hormone. The present investigation shows similarity with the observation of Singh *et al.* (2020) on *Channa punctatus*.

## SUMMARY

The present investigation can be summarised that sugar mill 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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