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# The impact of Sublethal Concentration of Distillery Effluent on the body Composition of *Cirrhinus mrigala* (Ham.).

Smt.Sarika Gautam
*Department of Zoology*
*Kamla Nehru P.G College Tejgaon Raebareli (U.P)*

***ABSTRACT***
*The effect of sublethal concentrations of distillery effluent on the body composition of Cirrhinus mrigala (Ham.), commonly known as the mrigal carp, is an important aspect to consider in environmental toxicology and aquatic ecology studies. Distillery effluent contains various pollutants, including organic compounds, heavy metals, and other toxic substances, which can have detrimental effects on aquatic organisms when present in sublethal concentrations. Body composition refers to the proportion of different components within the body of an organism, including proteins, lipids (fats), carbohydrates, minerals, and water. Alterations in body composition can indicate physiological stress or metabolic changes induced by exposure to pollutants. The Indian major carp, Cirrhinus mrigala were reared in different sublethal concentrations (5%, 10%,15% and 20%)of the distillery effluent for 30 days. Various biochemical constituents (carbohydrate, fat and protein) of control and effluent treated fishes were estimated. These concentrations were found to decrease depending on the concentration of the effluent. The decrease in protein content was minimum ( 5.47%) followed by carbohydrate (40.27%) and lipids (43.43%).*

***Key words:*** *Distillery effluent, Cirrihinus mrigala ,Body composition.*

## I. INTRODUCTION:

The rapid industrialization in India has led to a surge in industrial wastewater discharge into nearby natural water bodies without adequate treatment, disrupting the ecological balance of aquatic environments and causing pollution. This continuous influx of pollutants from both natural and human-made sources poses a significant threat to aquatic ecosystems worldwide (1). The release of industrial effluent into water bodies poses toxicity risks to aquatic organisms (2), triggering physiological and biochemical changes in fish that inhibit growth (1-5). Distilleries, in particular, discharge large quantities of wastewater known as "spent wash," characterized by its unpleasant odor, dark color, and high levels of heavy metals, COD, BOD, and TSS, along with low pH and DO, leading to pollution in receiving waters (6). Despite its environmental impact, spent wash is also rich in nutrients such as potassium, sulfur, nitrogen, calcium, iron, magnesium, zinc, and biodegradable organic matter, which contribute to soil fertility (7).

Many of the toxic substances released by industries are lipophilic and remain unaffected by water (7), thereby inhibiting several biochemical and physiological mechanisms crucial for fish metabolism. Fish, being a good source of animal protein due to their omega-3 fatty acid content, are essential for heart health and diabetes management by improving insulin action (8). These substances tend to accumulate in fish fatty tissues or bind to proteins, highlighting the importance of determining critical concentrations above which human health may be affected, rendering commercial fish species unsuitable for consumption (9). Therefore, toxicity tests are indispensable in evaluating water pollution effects, as mere chemical and physical measurements are insufficient to assess potential impacts on aquatic biota.

The disposal of industrial effluents in the aquatic environment is toxic to fishes. Chemical pollution has a great impact on aquatic organisms. Mortality of fishes has been recorded in water bodies receiving various pollutants. Due to chemical pollution, the normal functioning of cell is disturbed and this in turn, may result in alternation in the fundamental 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 distillery effluent on body composition of a common carp and major carp.

## II. Materials and Methods:

Raw distillery was collected from distillery unit, Physico- chemical parameters of the distillery effluent were analysed in the laboratory as per standard methods. The finferlings of *Cirrhinus mrigala* were collected from the local farm and acclimated to laboratory conditions. The acclimated fingerlings of both fishes (weight 500±50mg and 10±0.5cm) were selected from the stock and used for the biochemical experiments. 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 (5%-20%) of distillery effluent. For each experiment, five replicates were maintained and 10 individuals were reared in each aquarium. Total protein, carbohydrate and lipid contents were determined by following standard methods. The results were expressed in percentage.

## III. Results and Discussion:

The physic-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($SO_4$) and hardness(HAR) from ISI standard.

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

| Parameters | Average | ISI standard | Parameters | Average | ISI standard |
|---|---|---|---|---|---|
| pH | 4.1 | 6.0-7.0 | ALK | 10873.50 | 600 |
| TS | 62928.50 | 2700 | Cl | 5848.00 | 600 |
| TDS | 60690.00 | 2100 | $SO_4$ | 3951.83 | 2100 |
| TSS | 2238.50 | 600 | HAR | 7498.6 | 600 |
| COD | 77045.66 | 250 | | | |

**Table 2**.Body composition of *Cirrhinus mrigala* (average value of 10 fish).after 30 days distillery effluent exposure.

| Parameters | Distillery Effluent Concentrations | | | | |
|---|---|---|---|---|---|
| | 0% (control) | 5% | 10% | 15% | 20% |
| Protein | 58.57±1.41 | $57.43\pm0.37^{NS}$ (1.94%) | $56.53\pm1.05^{NS}$ (3.48%) | 55.44±0.25* (5.34%) | 53.24±0.57* (5.47%) |
| Carbohydrate | 14.65±0.57 | $12.75\pm0.25^{NS}$ (12.96%) | 11.25±0.45* (23.20%) | 10.25±0.15* (30.03%) | 8.75±0.21** (40.27%) |
| Lipids | 7.85±1.02 | $7.15\pm0.15^{NS}$ (8.9%) | 6.12±0.14* (22.03%) | 5.48±0.32* (30.19%) | 4.44±0.32** (43.43%) |

*significant at P< 0.05; ** significant at P<0.01; NS=Not significant

Tanle2 present the body composition of *Cirrhinus mrigala* as reared in freshwater (Control),5%, 10%, 15% and 20% of distillery effluent. All the three component significantly decreased in fish reared in 10%-20% effluents. The decrease in protein content was minimum i.e.1.94%-5.47%, while 12.96%-40.27% in carbohydrate and 43.43% in lipids in fish reared in 5%-20% effluents. The percentage of decreasing of body component increases with increasing the concentration of effluents. During experimental periods fishes showed various changes in the behaviour also. These behavioural changes includes increase in number of visit to the surface , number of opercular beats/ minute 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. Palanichamy *et al*.(1990) stated that, when the principal and immediate energy sources gets depleted, the other source exhibited a proportional depletion as the metabolism of these substances are interlinked through a common metabolic pathway i.e. the tricarboxylic acid cycle. Thus decreased protein, carbohydrate and lipid content in body composition may be due to the inhibition of enzymes as well as breakdown of stored protein, carbohydrate and lipid content to meet additional energy requirements under stress conditions.

## IV. Conclusion

In the present study, lower concentrations of distillery effluent do not appear to impose any critical physiological considering the fact that the distillery effluents are amenable for traditional treatments, the partially treated effluents can be utilized for culturing fish. The findings of this study suggest that changes observed in the hematological and biochemical profiles of *Cirrhinus mrigala* are indicative of the biochemical effects resulting from exposure to industrial effluent. This effluent has been shown to impact biologically active molecules like carbohydrates, proteins, and amino acids. Such alterations in the biochemical composition of fish

inevitably affect the nutritional quality of aquatic fauna. Consequently, any variations in these biochemical parameters can lead to reduced efficiency and consumption value of the fish.

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