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Impact of oil effluent on the enzyme activity in blood serum of freshwater food fish *Cirrhinus mrigala*

Kamaraj C* and Thamilmani K**
** PhD Research Scholar, ** Assistant Professor, PG and Research Department of Zoology*
Arignar Anna Government Arts College, Musiri, Tiruchirappalli – 621 211
Tamil Nadu, South India.
Corresponding Author: Dr K. Thamilmani,

Abstract: *The purpose of this study was to estimate the acute toxicity of oil effluent on Cirrhinus mrigala and to evaluate the lethal levels. The 120 hrs median lethal concentration of oil effluent were found to be 20ppt for Cirrhinus mrigala. Further experiments were proceeded with sub lethal concentration of (1/10th conc. of LC50) oil effluent which were evaluated from the LC50 value. After treatment the fishes were reared in ideal condition, then sacrificed dissected at different predetermined interval during the accumulation period, (i.e.) 1st day to 20th day, during the depuration period from 1st day to 15th day for Cirrhinus mrigala in oil effluent treatment for assay studies. The enzyme activity studies carried out under sub lethal (1/10th conc. of LC50) in Blood Serum. The present study indicates that oil effluent induced alterations in the enzymatic activities of the freshwater food fish both at acute and sub-lethal concentrations. These alterations can be considered as a tool for biomonitoring of pharmaceutical drug substances in the aquatic environment. The present work also indicates that oil effluent causes considerable alterations in enzymes activities and is likely to induce tissue damage in Cirrhinus mrigala. Therefore, this effluent should be handling with care and prevent its entrance into aquatic environment.*

Keywords: *Oil effluent; Cirrhinus mrigala; SGOT; SGPT*

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I. Introduction

Fish is very important to man as it is one of the most readily available and valuable source of high grade and cheap protein, which is easily digestible. *Catla catla* is one of the fresh water major carp. It is highly powered food fish with good market demand (Jhingram, 1991). Fish as a bio-indicator species can play an important role in the monitoring of water pollution, as they respond with great sensitivity to changes in the aquatic environment (Smolowitz *et al*., 1991).

The natural aquatic systems were the ultimate recipient of the pollutants (Fleeger *et al*., 2003). Aquatic ecosystems were contaminated with a wide range of pollutants has become a matter of concern over the last few decades (Vutukuru *et al*., 2005). The accumulation and persistence of pollutants by contaminants and toxicants, released from weathering of geological matrix, or from anthropogenic sources, such as industrial effluents and mining wastes. (Ebrahimpour *et al*., 2010) represents a major threat to the biological life. Aquatic animals were the key stone species in many ecosystems (Lonsdale *et al*., 2009). Fishes are one of the most widely distributed organisms in the aquatic ecosystem and reflect the biological effects of environmental pollution. The contamination of aquatic system was attracted the attention of researchers all over the world (Dutta and Dalal, 2008).

Aquatic pollution is one of the current global environmental issues. Due to rapid industrialization and unplanned urbanization many rivers in India are experiencing complicated problems of pollution. It causes reduction in the quality of water. Thus, water bodies are frequently stores for a large variety of xenobiotics which cause the biochemical alternations in fish. Population explosion, rapid industrialization and consequent anthropogenic stress on the environment have resulted in alarming levels of pollution and environmental degradation, particularly of the aquatic environment. The major sources of water pollution are domestic, agricultural and industrial wastes which are discharged into natural water bodies (De, 1996).

Enzymes play significant role in food utilization and metabolism. But this system may g*et al*tered under the stress of pollutants. High conductivity and low dissolved oxygen usually associated with heavy metals and industrial effluent will alter the activity of hydrolytic enzymes like esterases and transminases of the fish exposed to them (Ambrose *et al*., 1994). The proteolytic enzymes participate in the breakdown of protein molecules into amino acids and these amino acids are in turn oxidized to give energy for body function

(Saravanan *et al*., 2000). Enzymes are exceedingly efficient and very specific in terms of nature of reaction catalysed and the substrate utilized.

SGPT is responsible for synthesis and deamination of amino acids during stressful conditions in order to cope with high energy demands. In addition, it can also be used to evaluate environmental stress because environmental stress caused by toxicants or drugs can damage the liver, causing this enzyme to be affected. So we can say that the concentration of this enzyme can be used to detect liver health and normal functioning (Wang *et al*., 2012). Dephosphorylation is a process of removing the phosphate group from any molecule such as nucleotide, proteins, etc., and this dephosphorylation is done in the presence of alkaline phosphatase enzyme. This enzyme also plays an important role in mineralizing the skeletal system of animals, thus concluded that alkaline phosphatase plays a role in the growth and development of bones and teeth (Dong *et al*., 2009). The aim of present study is to check out the alterations of transaminase such as serum glutamate oxaloacetatetransaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT) activity in blood samples of the fresh water fish *Cirrhinus mrigala* exposed to oil effluent.

II. Material and methods

Collection of experimental animal

The fish, *Cirrhinus mrigala* (Length 9.3 ± 0.002cm; Weight 10.5 ± 0.003 g) fresh water food fish were segregated and procured from Karanthai (Golden Fish Farm) farm, Thanjavur, Tamil Nadu, India and were transported in aerated polythene bags to the laboratory. The fishes were acclimatized to lab condition for 3 days before treatment with oil effluent.

Toxicity test

The purpose of this study was to test the toxicity of oil effluent on *Cirrhinus mrigala* and to evaluate the lethal levels of oil effluent. At first tentative experiment were conducted to fix the minimum concentration of oil effluent to obtain maximum mortality for *Cirrhinus mrigala* over 120 hours duration. After confirming the minimum concentration, identified size of *Cirrhinus mrigala* were placed in different tubs (each group consists of 6 animals in 10 liter capacity plastic tubs) and exposed to different concentration of oil effluent which ranges from 10 ppt (parts per thousand) – 30 ppt at an interval of 5 ppt for *Cirrhinus mrigala* for a period of 120 hour. In addition to that a control was also maintained simultaneously.

Effect on SGOT and SGPT

The enzyme activities carried out under sub lethal (1/10th conc. of LC50) concentration in blood serum. Serum glutamate oxaloacetate transaminase (SGOT) and Serum glutamate pyruvate transaminase (SGPT) in the serum were estimated by clinical kit provided by Biosystems Diagnostics Pvt. Ltd., Tamil Nadu (India).

III. Results

Toxicity

The 120 hrs median lethal concentration of oil effluent on *Cirrhinus mrigala* was 20 ppt. During the experimental period the fishes were restless aggressive and have the tendency to leap out of the tubs (struggle for existence). This may be due to the suffocation out of oxygen deficiency. Secretion of mucus in the gill chamber should the lesions in gills of fishes. The 120 hrs median lethal concentration of oil effluent were found to be 20 ppt for *Cirrhinus mrigala*.

Effect on serum enzymes

Serum glutamate oxaloacetate transaminase (SGOT)

The figure 1 represents the level of SGOT in response to oil effluent in serum of *Cirrhinus mrigala*. The mean values of control were found to be 50±5 U/L. During the accumulation period, the mean values were found to be increased significantly from 1st day (70±3U/L) to 20th day (91±1 U/L). During the depuration period, the mean values were found to be decreased significantly from 1st day (87.33±1.15 U/L) to 15th day (58±2 U/L).

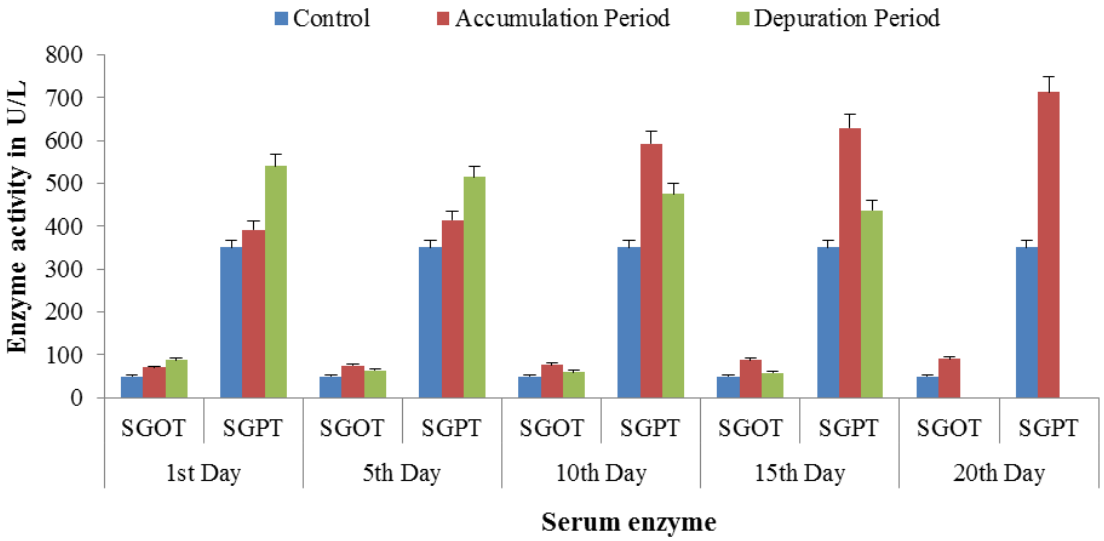

Figure 1 The level of SGOT and SGPT in the blood serum of *Cirrhinus mrigala* during accumulation and depuration period of sub lethal concentration of oil effluent

Serum glutamate pyruvate transaminase (SGPT)

The figure 1 represents the level of SGPT in response to oil effluent in serum of *Cirrhinus mrigala*. The mean values of control were found to be 350±2 U/L. During the accumulation period, the mean values were found to be increased significantly from 1st day (392±2U/L) to 20th day (712±2 U/L). During the depuration period, the mean values were found to be decreased significantly from 1st day (540±2 U/L) to 15th day (437±2 U/L.

IV. Discussion

The 120 hrs median lethal concentration of oil effluent were found to be 20ppt for *Cirrhinus mrigala*. The fishes exposed to sub-lethal concentration (1/10th conc. of LC50) of oil effluent. Gradual increased activity of SGOT and SGPT is observed in the blood samples (70±3 U/L at 1st day to 91±1 U/L at 20th day for SGOT and 392±2 U/L at 1st day to 712±2 U/L at 20th day for SGPT) respectively. Similarly, (Ghorpade, *et al*., 2002) have reported an increase of GPT and GOT activity in muscle and liver after exposure to diethyl phthalate (DEP) on a freshwater fish *Cirrhinus mrigala*.

The accumulation period of the sub lethal concentration of (1/10th conc. of LC50) of oil effluent exposed to *Cirrhinus mrigala* gradually increased activity of SGOT and SGPT the mean values of 70±3U/L to 91±1 U/L. 392±2U/L to 712±2 U/L at 1st day to 20th day respectively. During the depuration period, the gradually degreased of SGOT and SGPT level observed in blood sample the mean value of 87.33±1.15 U/L to 58±2 U/L. 540±2 U/ to 437±2 U/L at 1st day to 15th day respectively.

An increase in SGOT and SGPT has been reported in *Cyprinus carpio* (Mathan, 2006), *Sparus aurata* (Antonella and Landriscina, 1999), *Carassius auratus gibelio* (Zikic *et al*., 2001) and *Cyprinus carpio* (De la Torre *et al*., 2000) after exposures to various metals. (Mathan, 2006) opined that an increase these enzymes may have resulted from tissue damage and increased synthesis of the enzymes to defend against stress. (Antonella and Landriscina, 1999) also suggested that cadmium alters hepatocyte cell membrane structure and concomitantly induces changes in mitochondrial membranes resulting in elevation of these enzymes.

The enzyme activity increased with the increasing fish size (Sadhu *et al*., 1985). The inhibition of SGOT and SGPT activities observed in the serum of *Channa striatus*, exposed to malathion. (Winkaler *et al*., 2007) observed that the increase in SGOT and SGPT level in fish *Prochlodus lineatus* exposed to pollutants.

The increase in GOT and GPT activity may also be due to decrease in metabolic activity, disruption of enzyme system by blocking active sites and tissue damage. Similar observations were made by (Bhatnagar and Tyagi, 1985). (Saqib *et al*., 2002) also reported high levels of GOT and GPT was found in tissues with higher accumulation of pesticide residues.

Similar increase in the activities of SGOT and SGPT was reported in *Channa punctatus* and *Aphanius dispar* in exposed acutely and chronically to mercury (Sastry and Sharma 1980). It is also reported that stimulation of transaminase activity in kidney and brain of *Notopterus notopterus* after exposure to cadmium (Hilmy *et al*., 1985).

V. Conclusion

The 120 hrs median lethal concentration (LC50) of oil effluent on *Cirrhinus mrigala* was 20 ppt. The level of SGOT and SGPT of serum samples were found to be increased significantly during the accumulation of (1/10th and 1/20th Conc. of LC50) sub lethal concentration and it was regained in all serum samples during the depuration period (35 days) significantly. Therefore the present work indicates that oil effluent causes considerable alterations in enzymes activities and is likely to induce tissue damage in *Cirrhinus mrigala*. Therefore, this effluent should be handling with care and prevent its entrance into aquatic environment.

Abbreviations used

SGOT, Serum glutamate oxaloacetate transaminase; SGPT, Serum glutamate pyruvate transaminase; ppt- parts per thousand; LC-Lethal concentration

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