



Influence of Sago Effluent on the Levels of the Enzyme Cholinesterase in the Brain Tissue of the Fresh Water Fish *Clarias Batrachus*

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ABSTRACT

Monitoring of Cholinesterase activity has been widely used in aquatic and terrestrial systems as an indicator of pollutant exposure. The reports regarding impact of sago industry effluent on the level of ChE activity are very scanty. In this paper, an attempt has been made to investigate the in vitro impact of sago industry effluent upon the levels of ChE activity in the brain tissues of the fresh water fish, *Clarias batrachus*. The concentration chosen were 25%, 50% and 75% of treated sago effluent. The levels of ChE were decreased with increase in concentrations of the effluent. The control group recorded 268 u/l whereas the experimental groups such as 25%, 50% and 75% treated sago effluent showed 199u/l, 132u/l and 117u/l respectively.

Key words: Cholinesterase, Sago effluent, *Clarias batrachus*.

INTRODUCTION

The aquatic environment is the ultimate sink for all the environment pollutants. Any chemical pollutant either natural or synthetic is most likely to reach the aquatic environment sooner or later. The toxicity may be either acute or

chronic to all forms of biota in aquatic system and also varies to different aquatic organisms. The toxic effects may include both lethal and sublethal concentrations, which may change the growth rate, development, reproduction, histopathology, biochemistry, physiology and behavior (Rand & Petrocelli, 1985).

Alterations in the physiological and biochemical parameters of toxicant treated fish have recently emerged as an important tool for the water quality assessment and to know the pathological status of fish in the field of environmental toxicology (Racicot *et al.*, 1975; Wieser & Hinterleitner, 1980). The alteration in various physiological and biochemical parameters of an aquatic animal due to exposure of different toxicant has been shown to be directly or indirectly related to the behavior, immune system, neurotransmission, energy metabolism and reproduction (Ekwoezor *et al.*, 2001; Adeyemo, 2005).

Accumulation of the environmental pollutants and toxicants has been shown to cause alteration in the activity of many enzymes concerning to cellular energy metabolism (Niwelmski, 1990; Claireaux & Dutil, 1992; Sebert *et al.*, 1993; Almeida *et al.*, 1995).

Enzymes are biological catalysts produced by living cells they catalyze metabolic reactions. They are soluble and colloidal substances characterized by great activity, specificity and susceptibility to the influence of pH, temperature and other environmental changes. Enzymes are the most important tools of the living cells. Cells cannot be without enzymes. They function as catalysts in a wide variety of biological reactions. They alter the speed of reactions without themselves undergoing any permanent change. Pollution monitoring method using enzyme inducement of enzyme depression in fish or other organism has been proposed for studying polluted environments. Enzymes getting into the blood after cell necrosis of certain organism may be used to indicate the tissue damage.

Fish are sensitive indicators of pollutants present in water. These pollutants cause various physiological and physical alterations in fishes. In the present work

alterations in the activities of enzyme Cholinesterase (ChE) has been evaluated in the brain tissue of fresh water fish *Clarias batrachus*.

Patil Manohar (1996) has studied the brain acetylcholine content and acetyl cholinesterase activity of the fish, *Notopterus notopterus* in two different bodies of water. Mathivanan and Bhaskaran (2002) have estimated the acetyl cholinesterase activity in brain homogenates of *Labeo rohita* and *Tilapia mossambica* at different concentrations of malathion in vitro.

Jeyarathi Shanthi and Jebanesan (2001) have studied the effect of sublethal concentration of chlorpyrifos on acetyl cholinesterase activity in brain, liver, muscle and kidney tissues of a fresh water fish *Cyprinus carpio*. Koteswari *et al.*, (2003) have investigated the toxicity of sodium fluoride and aluminium chloride with cholinesterase enzyme from brain of fresh water fish *Oreochromis mossambicus*.

MATERIALS AND METHODS

The Sago industry effluents were collected from a private Sago industry, situated at Ponnachi near Ammapet of Erode District, Tamil Nadu, India. The effluent from the industry was collected and transported to the laboratory and used for further experiments. Fingerlings of healthy *Clarias batrachus* were brought to the laboratory and acclimatized for 15 days. The fish were well fed during the acclimatized period. Feeding was stopped one day before commencement of the experiment.

For the assay of Cholinesterase, the brain of the fishes were cut and homogenized with cold distilled water and centrifuged at 7000 RPM for about 7 minutes. The supernatant was taken for assay. Cholinesterase activity was estimated by kinetic colorimetric method.

RESULTS AND DISCUSSION

In vitro addition of different concentration of sago effluent to fish brain homogenates resulted in a decrease in the activity of cholinesterase. The control

groups were able to record 268u/l whereas the fish treated with 25%, 50% and 75% concentration of treated effluent recorded 199u/l, 132u/l and 117u/l respectively.

Alteration in enzyme activities of the exposed fish is one of the major biomarker indicating the level of changes consequent of pollutants in the tissues, the organs and body fluid of the fish that can be recognized and associated with established health impairment process (Akinrotimi *et al.*, 2009). Moreover, Gabriel and Akinrotimi (2011) noted that biomarker can be used to confirm and assess fish exposure to toxicants, providing a link between external exposure and internal structure and degree of responses to toxicant exposure observed between different individuals.

Measurement of serum cholinesterase activity can serve as a sensitive measure of the synthesizing capacity of the liver if the subjects are normal (baseline) level is known. In the absence of genetic causes or known inhibitors, any decrease in activity in serum reflects impaired synthesis of the enzyme by the liver.

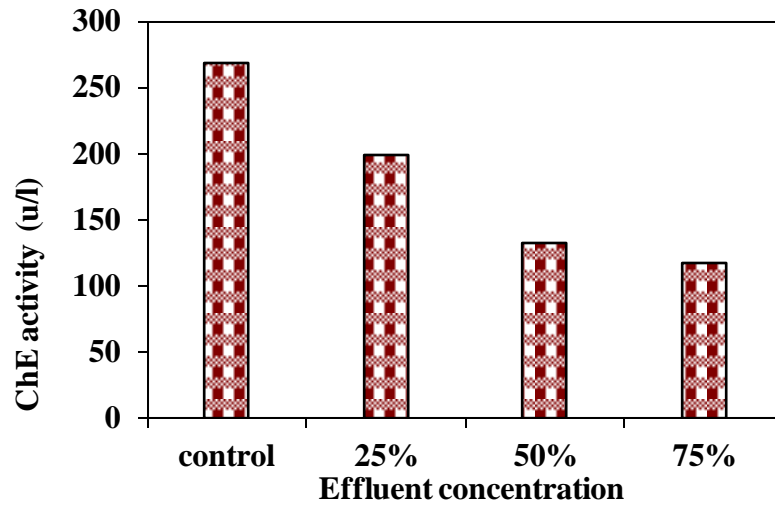


Figure 1. Cholinesterase activities of brain of *Clarias batrachus* exposed to different concentrations of sago effluent

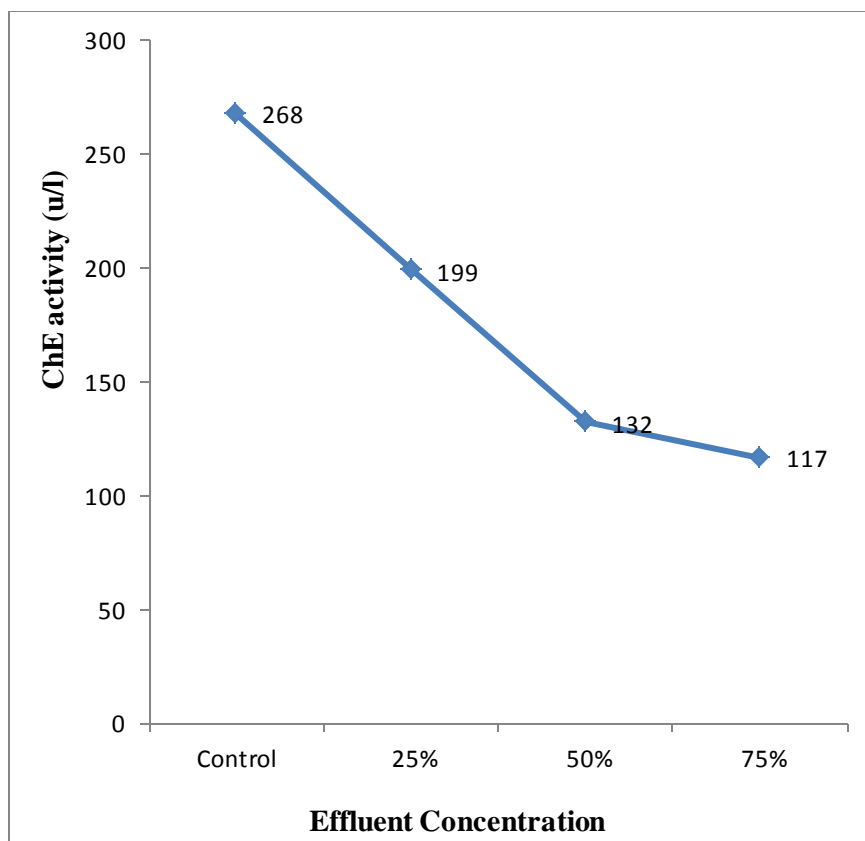


Figure 2. Levels of the enzyme Cholinesterase in the brain tissue of *Clarias batrachus* exposed to different concentrations of sago effluent

In the present investigation the enzyme cholinesterase activity has been decreased significantly in the sub lethal treatment of sago effluent. Koteeswarai *et al.*, (2003) have investigated that sodium fluoride (NaF) has been found to inhibit the cholinesterase activity in fish whole brain homogenates to a striking extent when compared to control the sub lethal concentrations of NaF.

Jeyarathi and Jebanesan (2001) have observed the highest inhibition of acetyl Cholinesterase (AChE) activity in the brain of fish *Cyprinus carpio* reared in sub lethal concentration of chloropyrifos and gradual recovery after. An inhibitory activity of acetyl Cholinesterase in brain and blood of snake headed fish *Channa punctatus* treated in chronic sub lethal concentrations of ammonia (Kumar Ravindar, 1999).

Kumar and Singh (2000) have noticed a significant decrease in acetyl Cholinesterase activity in the brain of *Catla catla* under the exposure of dimathoate.

Balasubramanian and Ramaswami (1991) have noticed a very sharp decline in acetyl Cholinesterase activity in brain, heart and muscle tissue of the fish *Oreochromis mossambicus* treated with the pesticide sevin. The pesticide sevim exerts a reversible inhibiting effect on the AChE activity of different tissues of *Oreochromis mossambicus*.

Gill *et al.*, (1990) have reported that considerable lower level of AChE activity in the brain, gill and liver, in vitro exposure to mercury. The same authors have observed the depressed level of AchE activity in the gills of fish *Barbus conchoniuis* Ham (rosy barb) subjected to cadmium (Gill *et al.*, 1991). Das and Mukherjee (2003) have studied a significant decrease in the activity of brain cholinesterase of fish *Labeo rohita* exposed to sub lethal concentrations of quinolphos and cypermethrin over a period of 45 days.

Jyothi and Narayan (2004) have observed the reduction in the levels of ChE activity of the *Clarias batrachus* exposed to sublethal concentrations of pesticide phorate and carbamate. Similar observations have been made by Tilak *et al.*, (2005) in the fresh water fish (*Catla catla*, *Labeo rohita* and *Cirrhinus mrigala*) exposed to chlorpyrifos. Archana *et al.*, (2009) have studied a significant decrease in the levels of ChE in the fish *Channa striatus* treated in the fertilizer industry effluent. The levels decreased with increase in concentrations of the effluent.

From the above findings, the results of this present investigation clearly confirm the fact that treated sago effluent is an inhibitor of the enzyme cholinesterase involved in controlling the actions of the cholinesterase. The enzyme inhibiting activity of the effluent is related to dose. These results could be due to impairment of nervous system, liver damage as well as myocardial infarction.

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