

**EFFECT OF POLLUTANTS ON FISH AND AMPHIBIAN WITH VARIOUS  
HISTOCHEMICAL CHANGES****\*Dr. Mukesh Kumar Napit**Department of Zoology, Govt. Dr. Shyama Prasad Mukherjee Science and Commerce P. G. College, (Old Benazeer)  
Bhopal M.P.**\*Corresponding Author: Dr. Mukesh Kumar Napit**

Department of Zoology, Govt. Dr. Shyama Prasad Mukherjee Science and Commerce P. G. College, (Old Benazeer) Bhopal M.P.

Article Received on 05/01/2021

Article Revised on 26/01/2021

Article Accepted on 14/02/2021

**ABSTRACT**

In present study, the comparative study on midgut trehalase in fifth instars larvae of bivoltine races CSR2, CSR2×4 and CSR4 were done. The maximum activity of trehalase showed at pH 5.5 in all the races at maximum temperature 50°C in CSR2 and CSR2×4 while in CSR4 at 45°C. The digestion time required for 30 minutes in race CSR2 and CSR2×4 and 20 minutes for CSR4. The Km values calculated from the graph. The Km values for CSR2, CSR2×4 and CSR4 were  $10.57 \times 10^{-3} \text{M}$ ,  $2.57 \times 10^{-3} \text{M}$  and  $0.77 \times 10^{-3} \text{M}$  respectively. It indicates that CSR4 showed maximum efficient trehalase activity as compared to other two races.

**KEYWORDS:** Midgut trehalase, Bivoltine, Silkworm.**INTRODUCTION**

The pollutants and drastic environmental variation have also adversely effected and changed water qualities i.e. colour, hardness, turbidity, alkalinity, pH. COD, BOD and TDS etc. Aquatic life, thus, also is affected. Changes in morphology of fish like- colour, pigmentation, length, weight mass, structure of scales, finrays etc. may occur. This can not be ignored that the afore-mention variation may be responsible to develop new varieties or sub species.

Unfortunately, negligible work is done in relation to fish fauna of the area in recent-past. Though, appreciable limnological work is done, yet the fish fauna remained unexplored. The fauna study is of tremendous significance in determining population density and calculating sub specific diversity and conservation of ecosystem in Damoh District.

Industrial waste has long been recognized as serious pollutant of the aquatic environment. Heavy metals have toxic effect in the exposed organism. The presence of metals and pesticides beyond permissible limits in water has been reported world wide. Our study Focuses on the toxic effect of heavy metals and pesticides on Fish and amphibian Fauna and their variations.

Water Samples collected from various sources in different sites of copra, sunar, Viyarma rivers and ponds of Damoh District, were analysed and lead was found within the permissible level. Lead concentration in submerged plants, Fish and amphibian at various sites of river copra sunar viyarma were observed only down

stream sites and Fish and amphibian species collected at Damoh, which was possible due to discharge of lead containing influent from Narsingarh mycem cement Industries along site of the copra and sunar river in Damoh District.

By discharge from the effluent inflows, amount of heavy metal and pesticides in water show an increase. They are present in water in dissolved condition from only at low levels, since heavy metal compounds have low solubility, Mineral suspension and precipitation substances are able to store heavy metal ions on their outer surface. Heavy metals and pesticides can also be found in water organism. They can be taken up by higher organism through the Food chain and sink to bottom as sediment.

All these water bodies have been subjected to various environmental problems. The resulted in deterioration of water quality through inflow of sewage, solid waste dumping other anthropogenic activities thus affecting the biodiversity. In this study all the 8 lakes and 3 rivers of Damoh were used for different purposes. The output of this study would some how lead to the better environmental management and help to save our water bodies.

**MATERIAL AND METHODS**

The water samples were collected during July 2018 - June 2019. The Method of collection, preservation and enumeration of Plankton, fish and amphibian were as per standard method. Eleven Physico-chemical parameters were analysed fish and amphibian population were grouped accordingly.

Fish collected seasonally, from all polluted and non polluted selected sites by hand picking or fishing nets and would be preserved in 5-10% formaldehyde in glass or plastic bottle. Authentic keys for identification and classification of fish, would be used. Days fauna. (1958), fish identification by H.R. Singh, Jhingran (1985).

The key for identification of amphibian is available in ZSI Jabalpur and Calcutta would be taken. Boulenger; G.A. (1990), the amphibian fauna of British India. Annandale; N. (1918); S.K. Dutta; (1997); etc would be sought for amphibian identification.

## RESULTS AND DISCUSSION

### Heavy metals

Heavy metals are those, of which specific gravity (density) is more than about 5g/cm<sup>3</sup>. Heavy metals and their salts and organic compounds are found to be used in various industrial processes, agriculture, manufacture of batteries and electroplating etc. Fraction of them may enter into effluents. Many industries contributing heavy metal wastewater stream are pesticides, mining wastewater stream are pesticides, mining, electroplating etc. Heavy metals are stable elementals, they can not be metabolized by body and bio-accumulation is passed through the food chain to humans. Some metals are naturally found in the body and are essential to health. Iron for example prevents anemia, zinc is cofactor in over 100 enzyme reactions. Some metals such as Mercury. Aluminum, Arsenic, Cadmium, Nickel etc. that act as poison, interfere the enzyme system and metabolism of body.

### Behavioural Abnormalities

Heavy metals directly influence the behavior of the fish and amphibian by impairing mental and neurological function Metals influence neurotransmitter production and alter numerous metabolic processes.

Behavior abnormalities in various fish and amphibian species on exposure to heavy metals have been reported by several researches Frequent surfacing with irregular opercular movement in fishes exposed to cadmium. Others also reported the lethargic response and frequent surfacing in copper exposed *Heteropneustes fossilis* and *Rana tigrina*.

Lethargy and loss of equilibrium may be due to depletion of energy in the body of animal. *Oreochromis mossambica* when exposed to copper showed little behavior change in low concentration Lethargy and loss of equilibrium was observed in high concentration of copper The impairment of carbohydrate metabolism was reported which resulted in the depletion of energy. The release of corticosterol hormone in *Oncorhynchus nerka* when treated with copper Loss of equilibrium, frequent surfacing, sinking and outburst of erratic swimming in mercury exposed fish and amphibian was also reported.

### Bioaccumulation

Heavy metals enter and accumulate in body tissue faster than body detoxification path ways and gradual build up of these toxins occurs. Many studies have shown that fish are able to accumulate and retain heavy metal from their environment. Considerable difference in mercury concentration in muscles of different fishes and amphibian from Sunar and Kopra River in Damoh District was observed. Copper and Zinc accumulation in liver and spleen of *Cyprinus carpio* collected from the Bhadbhada Dam and lake Rajnagar.

It has been observed that accumulation of metal in the tissue of fish is dependent upon exposure concentration and duration as well as environments factors such as salinity, temperature, hardness and metabolism of animal. Environmental factors effect on the accumulation of copper, has been investigated. On *Oreochromis mossambica* concentration and duration of exposure effect the accumulation of copper on *Cyprinus carpio* and *Bufo bufo*.

### Biochemical Abnormality

Nutritionally heavy metals are directly antagonistic to essential trace elements. Heavy metals compete with nutrient elements for binding site on transport and storage of proteins, metal enzymes and receptors, Disruption of metabolic balance of nutrient elements result in marked aberrations in metabolism of carbohydrate, proteins, amino acid, lipid, neurotransmitters and hormones.

In *Clarias batrachus* exposed to 2.5 ppm CdSO<sub>4</sub> recorded the value of glucose gradual fall was whereas cholesterol, total protein, creatinine, urea and potassium values showed a regular increase. Workers reported hypoglycemic conditions in air breathing fish due to cadmium and chromium contamination. Biochemical alteration hyperglycemia in lead exposed *Barbus conchoniensis* has been reported.

Enzyme and most of hormones are made up of proteins. Proteins are sensitive and early indicator of heavy metal poisoning. Enhancement of protein content due to heavy metal contamination was reported. Reduced protein, lipid and cholesterol contents of liver and ovary in *Notopterus notopterus* exposed to HgCl<sub>2</sub> and CdCl<sub>2</sub> and combination of both metals was observed Cadmium, lead, copper, arsenic, Mercury and chromium exposed *Channa punctatus* showed decrease in protein and RNA contents. When *Channa punctatus* fingerlings were exposed to Zinc sulfate solution for 30 days altered the concentration of electrolyte in blood. Bronchial NaK-ATPase activity was inhibited approximately by 30% after 72h of lead exposure on *Oreochromis mossambica*.

### Developmental Abnormality

Early life stages of fish and amphibian such as egg and larval stages are generally more sensitive period on life-cycle. Fish and amphibian embryo is less sensitive to

metal than larvae due to protection offered by chorion. Cadmium has been found to be very toxic to early stages of fish. Cadmium and Zinc can cross the chorion of egg. These metals effect the development of embryo, Zinc has been reported to be less toxic than cadmium to fish eggs. Significant mortality of egg and delay in hatching time of *Cyprinus carpio* when exposed to low concentration of cadmium metal was seen. Abnormal hatching, spinal deformity was observed in *Rana tigrina* embryos.

#### Haematological Abnormality.

Effect of heavy metal on physiology of blood serum has also been studied because blood is a good path physiological indicator. Blood is also good bio-indicator or diagnostic tool to study the problem in organ function. Various changes in red blood cells of various fish species due to different concentration of copper metal and time of exposure have been reported. Increase in hemoglobin concentration in fish *Heteropneustes fossilis*. Decrease in number of erythrocyte in blood of *Labeo rohita* after 48h exposure to copper.

#### Histological Abnormality

Change in histological structure of specific vital organs due to exposure of sub-lethal concentration of metal in various fishes have been reported by several researchers. The gills are primary respiratory organ of the fish. The gill epithelium of fish is major site of gaseous exchange, acid base balance, ionic regulation and excretion of nitrogenous wastes. Gills are the target. organs of water born toxicant such as metal. Low concentration of metal disturbs ionic regulation which in turn effect the gill function and structure.

Histological changes have been reported in gills of exposed fish *Catla catla* and *Labeo rohita* to heavy metals. The changes in gill filament. proliferation of chloride cells in Zinc treated *Catla catla* and *Labeo rohita*. Liver plays major role in metabolism of excretion, digestion and storage of various substances including some toxic substance to fish.

#### CONCLUSION

Heavy metals and pesticides have long been recognized as serious pollutants of aquatic environment. Heavy metals affect organism directly by accumulation in their body. They cause serious impairment in metabolic, physiological and structural system. Heavy metals may affect an organism indirectly by transfer to the next trophic level of food chain. The accumulation of heavy metal in the tissues of an organism can result in chronic illness and cause potential damage of population. Fish are able to accumulate and retain heavy metal and other pollutants from their environment. Accumulation of metals and pesticides in the tissue of fish is dependent upon exposure concentration as well as other factors such as salinity, temperature, hardness and metabolism of organism.

Heavy metals effect on specific vital organs such as liver, gill and kidney. Liver contains the highest metal concentration because it is an organ of storage and detoxification of metals. Liver has also an important role in storage, redistribution detoxification, and also act as an active site of pathological effects, induced by contaminants. Different degree of metal accumulation in various tissues depends upon the biochemical characteristic of metal. Fish and amphibian may accumulate heavy metals by absorption through gills has been observed the concentration of metal in gill reflect the concentration of metal in water in which fish and amphibian species live.

#### REFERENCES

1. AHAMD AND DATTA MUNSHI, J.S. (1987) Variation of copper toxicity on the fingerlings of fresh water Indian carps, *Catla catla* and *Labeo rohita*. Biol. Bull. Indian, 9(3): 185-189.
2. ALLEN P (1995) Chronic accumulation of cadmium in the edible tissue of *Oreochromis aureus* Modification by mercury and lead. Arch. Environ cotam Toxicol, 29: 8-14.
3. ANAND KUMAR A. TRIPATHY, A.P. AND TRIPATHI. N.K. (2001) Effect of dirnecron on the blood parameters of *Heferopneustes fossilis* J. Environ Bio, 22(4): 297-298.
4. AVENANT-OLDWAGE AAND MARX; H.M. (2000). Bioaccumulation of chromium, copper and iron in the organs and tissue of *Clarias gariepinus* in Olifant River kruger National park water SA, 26: 269-582.
5. BARLAS, P.S. AND RANI A.U. (2003) Cadmium Induced antioxidant defense mechanism in fresh water teleost *Oreochromis mossambicus* (tilapia) Ecotoxi ecology and Environment safety, 56(2): 216-221.
6. BEENA S. VISWARANJAN, S. (1987) Effect of cadmium and mercury on the hematological parameters of fish *Cyprinus carpio*, Environ. Eco, 4: 726-732.
7. Boulenger, G.A. (1990) Amphibia in India, Record of Amphibia Zoological Survey of India, 83(1-2): 123-127.
8. CHANDRA, SMITA, RAM, R.N., SINGH, J (2001) Toxic effect of carbofuran on certain hematological parameter in yearlings of *Cyprinus carpio* Aquacult, 2(2): 137-140.
9. CUSIMANO, R. F. BRAKKED. F. AND CHARMAN, G.A. (1985) Effect of pH the toxicities of cadmium copper and zinc to steelhead trout, (*Salmo gairdner*) Can. J. Fish Aquat. Sci, 43: 1497-1503.
10. CYRIAC, P.J. ANTONY, A AND NAMBIAN P.N.K. (1989) Hemoglobin and Haematocrit values in the fish, *Oreochromis mossambicus* (Peters) after short term exposure to copper and mercury, Bull Environ. Contam, Toxicol, 43: 315-320.
11. DATTA, S. SINGH, H. DAS R. C. (2003) Influence of soil sediment factors on acute Toxicity, of

- inorganic mercury to *Catla-catla*, Environment and Ecology, 21. 3: 542-551.
12. Days. F. (1958); Fresh water fish fauna of British India, 1, 2, 3.
  13. Dutta S.K. (1997); Amphibian of India and Sri Lanka (Checklist and Bibliography) odyssey Publishing House, Bhubaneshwar.
  14. Singh H.R. and Jhingran V.G. (1985); Freshwater fishes of Indian region, India, Narendra Publishing House, New Delhi.