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# Effect of municipal waste water on Catalase enzyme in the larval stages of *Duttaphrynus melanostictus* (Schneider 1799).

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## Abstract

The present study revealed that municipal waste water can alter the water quality of receiving wetland (Borsola beel) and metamorphic tadpoles treated with beel water showed increase in enzyme Catalase level indicating tissue damage and abnormal development activity.

**Keywords**: Polluted water, Tadpole development, Enzyme Catalase concentration.

## 1. Introduction

Wetlands in the vicinity of urban areas incessantly receive large quantity of municipal waste water including domestic, commercial and industrial wastewater. As a consequence, the water qualities of the wetlands are fast deteriorated jeopardising the survival of aquatic life (Das *et al.,* 2002). Commercial and industrial wastewater also contains hazardous metal pollutants which adversely affects the aquatic bio system (Kumar 2006). Among various enzymes that catalyses biochemical reactions within living system, enzyme Catalase (CAT) is a common enzyme found nearly in all living organisms exposed to oxygen (Chelikani *et al.,* 2004). Catalase decomposes harmful $H_2O_2$ to water and oxygen. Functionally, Catalase is an important enzyme in protecting cell from oxidative damage by reactive oxygen species (ROS), (Goodshell *et al.,* 2004). Catalase function is inhibited by the presence of any heavy metal ion which acts as non-competitive inhibitor of the enzyme (Gaetani *et al,.* 1996). Study of Catalase enzyme activity on amphibians especially in developing amphibians still not adequately demonstrated. Since water pollution and aquatic life are inseparable and particularly amphibians are extremely sensitive to environmental changes, the present study was undertaken to perceive the effect of municipal waste water on larval development of *Duttaphrynus melanostictus*.

## 2. Study area

Borsola beel (wetland) is selected as sample collection site because the bill acts as storage of municipal waste water throughout the year. The beel is about 1.4km in length and 0.35km in breadth and covers an area of 0.49sq.km and is situated in the central area of Guwahati city. The beel is located between $91^{44}$ 577º E to $91^{44}$ 886º E longitude and $26^{10}$ 171º to $26^{10}$ 542º N latitude. The beel incessantly receives huge amount of municipal waste water from surrounding areas of the city.

## 3. Materials and methods

The beel water was collected and carefully brought to laboratory and kept in glass aquarium of $1.5^{1}\times1^{1}\times1^{1}$ size for the experiment. The eggs of *Duttaphrynus melanostictus* were very carefully collected from natural breeding grounds (unpolluted) weighted and allowed to grow in polluted water.

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Simultaneously, a control set was also maintained. The growing larval stages were fed with boiled bottle gourd. After 53, 72, 75 and 78 days i.e. 36th, 38th, 42nd and 43rd stages respectively a batch of 12 to 15 tadpoles weighing about 1g were sacrificed both from control and experimental sets for estimation of Catalase level in the tissues. The Catalase enzyme was estimated following standard methodology of Sadasivam and Manickon (1992).

## 4. Result and discussion

The result of the present study is given in Table-1.

**Table 1:** Catalase enzyme concentration in tadpoles exposed to polluted municipal waste water and unpolluted pond water.

| Day | Stages | Control (mµg/g) | Polluted (mµg/g) |
|---|---|---|---|
| 53 | 36th | 80.8 | 94.91 |
| 72 | 38th | 82.5 | 1027.80 |
| 75 | 42nd | 83.7 | 1096.84 |
| 78 | 43rd | 84.8 | 1235.18 |

Municipal waste water quality of Borsola beel is given in Table-2.

**Table 2:** Physico-chemical analysis of Borsola beel water receiving municipal waste water and unpolluted pond water.

| Parameters | | Unpolluted (Pond) | Polluted (Borsola beel) |
|---|---|---|---|
| Turbidity (mg/l) | | 11.3 | 36.3 |
| pH | | 6.9 | 6.6 |
| DO (mg/l) | | 9.07 | 0.9 |
| BOD (mg/l) | | 4.2 | 66 |
| COD (mg/l) | | 9.1 | 212 |
| Heavy metals (mg/l) | As | Nil | 0.2 |
| | Hg | Nil | Trace |
| | Cd | Nil | Trace |
| | Cr | Nil | 0.4 |
| | Pb | Nil | 1.1 |

The present experiment showed deterioration of water quality of beel in comparison to unpolluted pond water. The beel incessantly receives municipal waste water from surrounding areas leading to alteration of physico-chemical characters of beel water especially with reference to BOD, COD level and reduced DO level which are indicative of gross pollution of beel water by organic and inorganic materials of municipal waste water.

Analysis of Catalase concentration showed enhanced level of Catalase in the waste water experimental group of tadpoles in comparison to control group. The quantity of Catalase showed gradual increase during the progressive metamorphic stages

of tadpoles. Normally higher rate of metabolism is involved in developing stages of tadpoles leading to formation of reactive oxygen species and other harmful $O_2$ compound like $H_2O_2$. In the present experiment, in oxygen stress environment, the tadpoles were deprived of dissolved oxygen; as a consequence, the rate of metabolism was disturbed and tissue was under extreme stress condition. Accumulation of toxic $H_2O_2$ and free radicals occurred causing injury to tissues and organs. All these conditions led to increase in the enzyme Catalase level in the tadpoles. These observations were also in the line of Gil *et al.,* (1987) who noticed increase Catalase activity in metamorphic frogs exposed to acute hypoxic condition. Starrs (2001) also reported the relation between lung damage and enhanced enzyme activity including Catalase in mammals.

Municipal waste water also contain heavy metals compound as observed in the present study. Heavy metal compound induce tissue injury and influence antioxidant activity resulting increase in Catalase enzyme concentration. In the present experiment tadpoles at such infant stage are extremely vulnerable to tissue damage due to presence of heavy metal compound in the environment. Similarly, histological abnormalities were reported by Kumar (2006) in tadpole's liver, eyes, gills and intestine exposed to heavy metal chromium. The present observation also agreed to the observation of Lushehak (2011), who found that environmentally induced oxidative stress disturbed the equilibrium of reactive oxygen species (ROS) level including damage to cellular constituents.

The present study conclusively establishes that municipal waste water causes alteration of water quality and the developing tadpoles inhabiting in such polluted water undergo oxidative stress and tissue damage leading to enhancement of Catalase enzyme level and inflicting adverse effect to developmental process.

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