



Algal blooms and its impact on status of lendra pond at brahmapuri, dist. Chandrapur. (MS), India

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ABSTRACT

An algal bloom is a rapid increase or accumulation in population of algae in aquatic ecosystem and it is recognized by discoloration in water from their pigments. Harmful algal blooms are a rapid uncontrolled growth of algae in aquatic environment. Excess proliferation of phytoplankton species such as Dinoflagellates, Diatoms and Cyanobacteria are referred as harmful algal blooms. Harmful algal blooms represent natural phenomena which poses serious problems to human health, environmental sustainability and aquatic life due to the production of toxic or accumulated biomass. In the present study also, the Lendra pond is suffering from such Harmful Algal Blooms which have already creates its harmful effect on aquatic fauna and indirectly affecting the human health. The sustainability of pond is also in danger. Mass fish kill was reported from Lendra pond which is the result of Harmful Algal Blooms. It is very important to sustain the life of such water bodies to perish our environment and ultimately the human health, too.

Keywords: Algal blooms, Eutrophication, Fish kill.

INTRODUCTION

Recently the eutrophication has become a priority given the increasing pressure on aquatic ecosystem are being subjected from anthropogenic activities. But eutrophication is also be a cultural and characterized by two prime factors, viz., nutrient loading and harmful algal blooms (HAB). In the mentioned pond, named as Lendra, the toxic Cyanobacteria (also represent HAB) is quiet common. Harmful algal blooms represent the natural phenomena caused by a mass proliferation of phytoplankton in water body. The main group of organism generating HAB's is Diatoms, Dinoflagellates and Cyanobacteria. In fresh water body Cyanobacteria and Diatoms are common. All phytoplankton photosynthesize and their growth depends upon different factors such as sunlight, CO₂, availability of nutrients i.e. like Nitrogen and Phosphorus. Additional factors influencing their life are water temperature, pH, climate changes, salinity,

water column stability and anthropogenic modifications of aquatic environment including nutrient over enrichment called eutrophication. Eutrophication can result in visible algal blooms which cause an increase in turbidity of water, can give bad odour to the water body. During bloom, algae produce nocive toxins that can render water unsafe and cause fish mortality and also affect the human health directly or indirectly. In the present study, we are going to report the intensification of Harmful Algal Blooms and its effects on fish health so as to proper remedies should be taken to sustain the life of water body which is used for various purposes, like fishery, recreation, human health and agricultural use.

METHODOLOGY

Study Area: Lendra pond is one of the unique aquatic ecosystems in many respects at Brahmapuri. It is 100yrs. old pond having area of 6.86hctr. It is situated near Railway station. Water of this pond was used for Agriculture, Fishing and Sociocultural practices.



Plate 1: The satellite view of Lendra Pond



Plate 2: Heavy encroachment of pond periphery by macrophytes.

Plate 3: Fish killed by causing damage to gill and operculum.

Study was carried out from June 2005 to May 2007. Algal blooms were collected at random and brought to the laboratory, preserved in 4% formalin and observed under binocular microscope (model Digi 2 pro labomed) attached to the computer, photographed and identified by using pertinent literature (Edmondson, 1970; APHA,1975; Tonapi, 1980; Plaskit, 1997).

RESULTS AND DISCUSSION

The phytoplankton species found in the bloom are as follows:

Microcystis spp.; Anabaena spp.; Anacystis spp.; Oscillatoria spp.; Lyngbya spp.; Nitzchia spp.; Diatoma spp. were abundantly present in the water body blooms. Other phytoplankters were also found in the blooms (Table 1). Pond water is Green in colour and having very bad odour. Water is very turbid and the Transparency is found from 22.83 to 25.67 cm in average. Phosphate and Nitrate level is also reported very high here.

Fish kill:

In the present investigation, very poor fish fauna was recorded from the Lendra pond. Mass of fish kill occurs in this pond due to heavy load of algal blooms, which decaying results into depletion of Dissolved Oxygen and releasing of toxins by algal blooms. During the onset of summer, when water becomes less in the pond basin, several numbers of dead fishes were seen on the basin of pond. Various toxins produced by the Harmful Algal blooms affects the aquatic fauna of the Lendra pond. In the pond, most of the fishes were frequently killed by HAB poisoning. Fish mortality results into the economic loss of fish market.



Plate 4: Pond water become greenish in colour due to algal blooms

Table 1:

SN	Phytoplankton	Quantity	SN	Phytoplankton	Quantity
1.	<i>Microcystis spp.</i>	+++++	21.	<i>Zygnema spp.</i>	+++
2.	<i>Anabaena spp.</i>	++++	22.	<i>Closterium spp.</i>	+++
3.	<i>Spirulina spp.</i>	+++	23.	<i>Cosmarium spp.</i>	++
4.	<i>Anacystis spp.</i>	+++++	24.	<i>Voucheria spp.</i>	++
5.	<i>Oscillatoria spp.</i>	+++++	25.	<i>Scenedesmus spp.</i>	++
6.	<i>Lyngbya spp.</i>	++++	26.	<i>Chlorocloster spp.</i>	++
7.	<i>Agmenellum spp.</i>	++	27.	<i>Coelastrum spp.</i>	++
8.	<i>Nitzschia spp.</i>	+++	28.	<i>Pandorina spp.</i>	++
9.	<i>Navicula spp.</i>	++	29.	<i>Clamydomonas spp.</i>	++
10.	<i>Diatoma spp.</i>	+++++	30.	<i>Tetraedon spp.</i>	++
11.	<i>Fragillaria spp.</i>	++	31.	<i>Phacotus spp.</i>	+++
12.	<i>Gyrisigma spp.</i>	++	32.	<i>Eudorina spp.</i>	++
13.	<i>Synedra spp.</i>	++	33.	<i>Palmella spp.</i>	+++
14.	<i>Gomphonema spp.</i>	++	34.	<i>Euglena spp.</i>	++
15.	<i>Volvox spp.</i>	+++	35.	<i>Phacus spp.</i>	++
16.	<i>Pediastrum spp.</i>	+++			
17.	<i>Chlorella spp.</i>	++			
18.	<i>Ulothrix spp.</i>	++			
19.	<i>Oedogonium spp.</i>	++			
20.	<i>Spirogyra spp.</i>	+++			

DISCUSSION

Eutrophication is considered a major problem for water environments and high levels of phosphate and nitrate inputs from different sources are principal causes of degradation of pond ecosystem. It is a process whereby water receives excess nutrients that stimulate blooms of algae.

In Lendra pond, nutrients are come from many sources like urban and rural wastewater, fertilizers applied to the agricultural fields and rice mill present neighbor to the pond. Inorganic nitrogen and phosphorus compounds and carbon are involved in eutrophication process and human activities can accelerate the nutrient rate entering into the ecosystem. Algal blooms especially Cyanobacteria are able to exploit anthropogenic modification of aquatic environment as evidenced by their higher affinity for nitrogen and phosphorus compared to other photosynthetic organism (Chorus *et al.*, 1999).

Cultivated and uncultivated paddy fields are present nearby the pond which could be the source of fertilizer runoff. The land use pattern around the pond may be direct effect on water quality and aquatic vegetation of

pond (Akasaka *et al.*, 2010). Higher nitrate and phosphate values specify the highly polluted status of Lendra pond. Such consequent water pollution causes visible harmful Cyanobacteria blooms, surface scum, benthic macrophytes aggregation and floating plants mats. The bloom and floating plant mats decay takes place which leads to the depletion of dissolved oxygen in water and release of toxin which loses water clarity and disruption of food web. The algal biomass accretion not only discolor the water but also produce harmful effect and cause reduction in biodiversity due to shedding of benthos and fish kill (Jappesen *et al.*, 2012, Peperzak, 2005).

In the present study, spontaneous fish kill takes place in the pond most frequently during onset of summer season may be due to fish may ingest the algal rich water which enter in the system during respiration and it induces the production of reactive oxygen species with resulting increase of oxidative stress and fish death (Shaharaki *et al.*, 2013). At the same time, algal cell themselves able to produce reactive oxygen species as causative factor leading to fish mortality underlying the important role of oxidizing compounds in bloom toxicity (Tang *et al.*, 2009).

Table 2: Toxins produced by Cyanobacteria and their primary Targets.

SN	Toxin classification	Toxins	Most common Cyanobacteria genera producing toxin	Target organ	Reference
1.	Hepatotoxin	Microcystins	Mycrocystis Anabaena Oscillatoria	Liver	Boopathi <i>et al.</i> ,2014; Jochimsen <i>et al.</i> , 1998 Pearson <i>et al.</i> ,2010
2.	Cytotoxin	Cylindrospermospin	Anabaena, Oscillatoria, Lyngbya	Liver	Pearson <i>et al.</i> ,2010 Humpage <i>et al.</i> 2003
3.	Neurotoxin	Anatoxin	Anabaena, Oscillatoria	Nervous system	Astrachan <i>et al.</i> 1980; Bumke <i>et al.</i> 1999
		Saxitoxin	Anabaena, Lyngbya	Nervous system	Pearson <i>et al.</i> , 2010; Van-Apeldoorn <i>et al.</i> 2007; Strichart <i>et al.</i> 1984
		B-Methylamino L-Alanin	Microcystis, Anabaena	Nervous system	Holtcamp <i>et al.</i> 2012; Jiang <i>et al.</i> 2014
4.	Dermatoxin	Lypopoly-Sachharides	Microcystis, Anacystis, Oscillatoria, Anabaena	Skin	Torokne <i>et al.</i> 2001; Blahova <i>et al.</i> 2013
		Lyngbyatoxins	Lyngbya	Skin	Osborne <i>et al.</i> 2001; Arthur <i>et al.</i> 2008
		Aplysiatoxins	Lyngbya, Oscillatoria	Skin	Churro <i>et al.</i> 2012

Many fishes in the Lendra pond show the damage to the operculum and gills, may be caused by the spines of the Diatoms. Indeed, when gills are damaged by spinous diatoms, the epithelium shows lesions and produces excessive mucus that lead to asphyxiations (Kent *et al.* 1995, Yang 1992). If such fishes are used as a food by human being, it may cause damage to the intestine of human. When toxins are released in water during HAB, their toxic effects on human are believed to occur through different routes. Consumption of contaminated fish food, inhalation through wind dispersed dried algal material, ingestion of water or scum, direct contact with skin or conjunctiva. Total seven number of harmful algae events are reported by India during 1980 to 2015 to the Harmful Algae Dataset HAEDAT (Isabella *et al.* 2016). Toxins produced by Cyanobacteria are given in the Table 2.

Regular monitoring of the Lendra pond status is mandatory so as to control the hazards of toxic algae in order to protect health of fish and fishery, human and to minimize ecosystem and economic losses caused by blooms. However, monitoring and management programmes may alleviate future HAB's episode if prevention method would have adopted. In this regard the reduction in nutrient load in water bodies may help to prevent certain types of HAB's are observed when

sewage or waste discharged input in the pond are deeply monitored.

The aim of the study, that report the present status of the pond to the municipal corporation to take different approaches used to rehabilitate the pond to a clear water state by adopting the different methods to remove algae from water.

CONCLUSION

It is evident that, Lendra pond is essential for the community from utilitarian point of view and still it is grossly neglected, and totally unused now. The pond water was used for domestic purpose; therefore, phosphates from detergents could be strong reason for induction of algal blooms. Heavy emergence of *Microcystis* spp. in Lendra pond may be due to Nitrogen enrichment and high turnover rate of dissolved phosphorus. Emergence of *Oscillatoria* spp., *Anabaena* spp., *Anacystis* spp. produces various toxins which very toxic to fish fauna, directly results in mass fish kill in pond. The said pond is under threat. The study has revealed the need for conservation and the scale of restoration to be undertaken to sustain the Lendra pond.

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