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PHYSICO CHEMICAL CHARACTERISTICS OF LAKHNA DEVI TEMPLE WATER TANK, LAKHNA, BAKEWAR, ETAWAH, U.P. WITH REFERENCE TO CYANOBACTERIAL DIVERSITY

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Abstract

Fresh water bodies in populated plains of tropical countries face various disturbances in the form of pollutant and nutrient inflow, heavy metal and elemental precipitation (wet or dry) and constant silt inflow (natural or anthropogenic). The physico-chemical characteristics are very much important for any water body. In lentic water bodies these characteristics shows very much variation because in summer they have less and in rains large amount of water. These adverse constrain effectively influence the algal assemblage and can be a good indicator of overall health of the water body. In the study different Physico-chemical characteristics and algal diversity were monthly observed for one year duration (Jun. 2008 to May 2009). Some of 31 species of Cyanobacteria recorded from the study site viz. *Microcystis aerughinosa*, *M. flos-aquae*, *M. robusta*, *Chroococcus minor*, *C.minutes*, *Gloeocapsa magma*, *Aphanocapsa littoralis*, *Aphanothece microscopis*, *Coelosphaerium kuetzingianum*, *Merismopedia glauca*, *M. tenuissima*, *Arthrospira spriulinoides*, *Spirulina gigantean*, *S. major*, *Oscillatoria formosa*, *O. subuliformis*, *O. princeps*, *Phormidium ambiguum*, *P. fragile*, *P. lucidum*, *Lyngbya contorta*, *O. epiphytica*, *O.majuscule*, *Cylindrospermum minutissimum*, *Nostoc commune*, *N. punctiforme*, *Anabaena oscillarioides*, *A. oryzae*, *Calothrix gloeocola*, *Rivularia aquatic* and *Gloeotrichia pisum*.

Keywords: Lakhna Devi Temple, Physico-Chemical Characteristics, Cyanobacterial Diversity

Introduction

Now a day the demands on lakes, reservoirs, ponds and rivers is increasing for the drinking water and many other uses, but due to speedy industrialization the pollution is rising up (Ghose and Basu, 1968; Patil and Tijare, 2001; Singh and Mathur, 2005). There is an interesting side of lakes, reservoirs and ponds is the characteristic change due to seasonal

variations which results change in water volume, salt concentration, dissolved substances, gases & organic matters and as a result affects the plant life. Therefore the annual monitoring of water bodies by checking out the algal diversity and the physico-chemical characteristics provides a scientific way to manage such type of water bodies. Fresh water bodies in populated plains of tropical countries face various disturbances in the form of pollutant and nutrient inflow, heavy metal and elemental precipitation (wet or dry), industrial and municipal wastes. This affects the physic-chemical quality as well as the aquatic flora and fauna (Dwivedi and Pandey, 2002).

The algae have a major role in oxygen enrichment of water, binding and removal of certain toxic substances. These algal and specially the Blue Green Algae (BGA) contributions are very crucial for water quality improvement. The aquatic environment supports hydrophytic vegetation with abundant growth of algae. Considerable amount of work has been done about systematic survey, distribution and periodicity of algae in different habitats of India (Pandey, 1973; Kumar, *et al.*, 1974; Prasad and Saxena, 1980; Sukuman, 1980; Suseela & Toppo, 2004; Dwivedi *et al.*, 2005; Sridhar *et. al.*, 2006; Tiwari & Chauhan, 2006; Sultana & Gupta, 2009; Suseela & Toppo, 2010a, 2010b; Suresh *et al.*, 2012). Several important works dealing with the ecological distribution of Cyanophyceae have been done (Rao, 1955; Singh, 1960; Venkateshwarlu, 1969; Mohan *et al.*, 1989; Swaranlatha & Rao, 1998; Mohan *et al.*, 2007). The qualitative abundance of Cyanobacteria has also been recorded (Gupta, 1957; Singh, 1961; Shukla, 1971). However, numbers of species are not constant within fresh water environments (Morrison & Fair, 1966).

The study site Lakhna Devi Temple Water Tank, Lakhna, Bakewar, Etawah, U.P. was selected because it represents a developing town from upper Gangetic plain of India. The water tank of the temple is a cemented pond with religious faith. To check the Cyanobacterial diversity and to generate some physico-chemical properties of the water body the study was carried out. Identification of the effect of these variables on algal assembling and the potential factors influencing the algal growth in the site was also done.

Materials and Methods

Study site: The town is an area with population of ca. 10,470 with moderate to low level of anthropogenic pressure (Anonymous, 2001). The water body selected for the study is situated

east-south to the Lakhana town at 26°38’57.35” N, 79°09’03.91” E and at the elevation of 150 m.

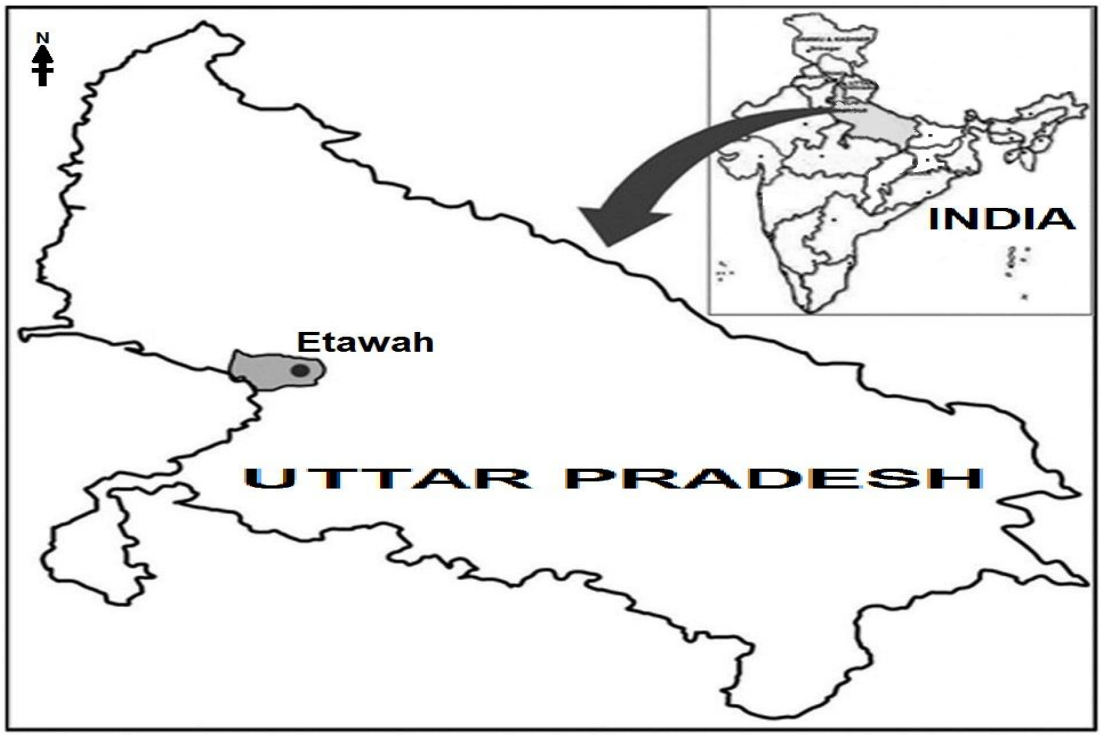

Figure 1. Location of study site, Etawah, Uttar Pradesh

Sampling of data and analysis: Sampling was done from each selected spots in the study sites. The water samples were collected at 30 days interval from the fixed spots around 10:00 am. The samples were collected in wide mouth glass bottle (1.0 litter) and all the samples were brought to the laboratory and stored at 4°C in a refrigerator till the analysis was completed. The details of sampling procedure and analysis of water samples were same as per standard methods (APHA, AWWA, WEF, 1998). The sampling of algal flora was done from the study sites once in a month at the same day of water sampling. The collected samples were preserved in 4% formalin and deposited in the herbarium of Environment Research Unit, Department of Botany, D.A-V. P.G.College, Kanpur, Uttar Pradesh, India. The preserved algal samples were examined and identified with the help of Desikachary (1959), Prescott (1964, 1976), Whitford & Schumacher (1973), Anand (1998).

Results and Discussion

The results of physico-chemical characteristics of water are given in Table 1. As such algae have not only marvelous significance as bio-indicators but intrinsic value in biology of

environments. Cross pollution of water can be studied on both physico-chemical and biological characteristics.

Table 1. Annual variations of Physico-chemical characteristics. W.L.D. = Water Level Depth (cm), T.H. = Total Hardness (m.eq.l^{-1}), T.S. = Total Solids (mg.l^{-1}), D.O. = Dissolved Oxygen (mg.l^{-1}), BOD = Biological Oxygen Demand (mg.l^{-1}), F.A. = Free Ammonia (m.eq.l^{-1}), Carb. = Carbonate (m.eq.l^{-1}), Bicarb. = Bicarbonate (m.eq.l^{-1}), T.Alka. = Total Alkanity (m.eq.l^{-1}), Chlori. = Chloride (m.eq.l^{-1}), W. Tem. = Water Temperature (^{0}C) and Trans. = Transparency (cm).

Months	**W.L.D.**	**T.H.**	**T.S.**	**D.O.**	**BOD**	**F.A.**	**pH**	**Carb.**	**Bicarb.**	**T.Alka.**	**Chlori.**	**W.Tem.**	**Trans.**
Jun.08	220	149	568	1.9	19	1.23	7.98	61	21	82	20	37	9
Jul. 08	300	123	563	2.1	17	1.25	7.90	51	16	67	17	28	8
Aug.08	320	113	584	2.2	13	1.35	7.73	47	12	59	16	26	10
Sep.08	290	95	602	2.7	14	1.68	7.43	45	11	56	17	24	13
Oct.08	210	124	624	2.8	15	1.85	7.35	49	14	63	14	23	15
Nov.08	170	130	640	3.2	18	2.03	7.28	52	16	68	19	18	17
Dec.08	160	133	659	3.5	16	2.11	7.38	54	18	72	21	9	20
Jan.09	140	177	588	3.1	10	2.08	7.64	65	45	110	24	9	18
Feb.09	130	176	584	2.8	9	1.82	7.91	67	42	109	25	17	17
Mar.09	120	170	633	2.7	14	1.80	7.88	68	44	112	28	25	12
Apr.09	118	169	643	2.4	16	1.76	8.22	70	46	116	27	30	11
May.09	100	160	632	2.2	18	1.81	8.06	67	40	107	25	36	10

The occurrence and periodicity of algal samples studied are given in Table 2. The distribution of algae found in aquatic system showed 31 species belonging to class Cyanophyceae in a year. *Microcystis aerughinosa* was the only species, collected from the water body in every month during the study period. The cold winters have been found the most favorable period for their growth, when 25 species (beside *Gloeotrichia pissum,Lyngbya contora*, *L. epiphytica*, *L. majuscule*, *Merismopedia glauca*and *Rivularia aquatic*) were collected from the study site where as only 18 species (beside *Anabaena oryzae,Aphanocapsa littoralis,Coelosphaerium kuetzingianum*, *Gloeocapsa magma*, *Merismopedia tenuissima,Microcystis flos-aquae,M. robusta,Nostoc commune*, *N. punctiforme*, *Oscillatoria Formosa*, *O. princeps*, *Phormidium ambiguum*, *P. lucidum*) were collected in hot summers.

Table 2. Annual variations of Distribution of algal diversity (1 = present and 0 = absent).

Algal spp. (Year 2008-09)	**Jun.**	**Jul.**	**Aug.**	**Sep.**	**Oct.**	**Nov.**	**Dec.**	**Jan**	**Feb.**	**Mar.**	**Apr.**	**May.**
Microcystis aerughinosa	1	1	1	1	1	1	1	1	1	1	1	1
Microcystis flos-aquae	0	0	1	1	1	0	1	1	1	1	0	0
Microcystis robusta	0	0	0	0	0	0	1	1	1	0	0	0
Chroococcus minor	1	1	1	0	0	0	0	1	1	1	1	1
Chroococcus minutes	0	0	0	0	1	1	1	1	1	1	1	0
Gloeocapsa magma	0	0	0	0	0	1	1	1	1	0	0	0
Aphanocapsa littoralis	0	0	0	0	1	1	1	1	1	1	0	0
Aphanothece microscopic	0	0	0	0	0	0	0	1	1	1	1	1
Coelosphaerium kuetzingianum	0	0	0	0	0	0	1	1	1	1	0	0
Merismopedia glauca	1	1	1	0	0	0	0	0	1	1	1	1
Merismopedia tenuissima	1	1	0	0	1	0	1	1	1	1	0	0
Arthrospira spriulinoides	1	0	0	0	0	0	1	1	1	1	1	1
Spirulina gigantea	0	0	0	0	0	1	1	1	1	1	1	0
Spirulina major	0	0	1	1	1	1	1	1	1	1	1	0
Oscillatoria formosa	0	0	0	0	1	1	1	1	1	1	0	0
Oscillatoria subuliformis	0	0	0	1	1	1	1	1	1	1	1	1
Oscillatoria princeps	0	0	0	0	0	1	1	1	1	1	0	0
Phormidium ambiguum	0	0	0	0	1	1	1	1	1	1	0	0
Phormidium fragile	1	1	0	0	0	0	1	1	0	0	0	1
Phormidium lucidum	0	0	0	0	0	0	0	1	1	0	0	0
Lyngbya contorta	1	1	0	0	0	0	0	0	0	1	1	1
Lyngbya epiphytica	0	0	0	0	0	0	0	0	1	1	1	0
Lyngbya	1	1	0	0	0	0	0	0	1	1	0	1

majuscule												
Cylindrospermum minutissimum	0	0	0	0	1	1	1	1	1	1	1	0
Nostoc commune	0	0	0	1	1	1	1	1	1	0	0	0
Nostoc punctiforme	0	0	1	1	1	1	1	1	0	0	0	0
Anabaena oscillarioides	1	1	0	0	0	0	1	1	1	1	1	0
Anabaena oryzae	0	0	0	1	1	1	1	1	1	1	0	0
Calothrix gloeocola	0	0	0	1	1	1	1	1	1	1	1	0
Rivularia aquatic	0	0	1	1	0	0	0	0	0	0	1	1
Gloeotrichia pisum	0	0	1	1	1	0	0	0	0	0	1	1

The Biological Oxygen Demand (BOD) has been found higher (17.5 ± 1.3 mg.l^{-1}) in the summers (Jun., Jul. in 2008 and Apr., May in 2009), when the lesser Cyanobacterial diversity was observed in the study site whereas the lower (13.6 ± 3.9 mg.l^{-1}) value of BOD was observed in the winters (Oct. - Dec. 2008 and Jan., Feb. 2009) with greater diversity. The Dissolved Oxygen (D.O.) & Free Ammonia (F.A.) fallow the inverse pattern and found higher (3.08 ± 0.29 mg.l^{-1}& 1.98 ± 0.13 m.eq.l^{-1}) in the winters while lower (2.15 ± 0.21 mg.l^{-1}& 1.51 ± 0.32 m.eq.l^{-1}) in the summers respectively. The BOD, D.O. and F.A. are the major physico-chemical which may be characterized the pollution level of a water body. The presence of higher F.A. (i.e. more polluted water) gives higher D.O. and lower BOD due to the presence of higher BGA diversity. This supports the view that algae and specially Cyanobacteria could be of greatest benefits in making the water clean from inorganic pollutants which get bound up in them along with oxygenation of water and attributes of microbe profile prospects. The study found that *Rivularia aquatic*, *Gloeotrichia pisum* and *Lyngbya contorta* may be used as indicator species to identify the presence of higher F.A. due to their escaping behavior at the higher level of the F.A.The study gives an idea about the periodic behavior of species in the defined area. The allergenic algae such as *Anabaena*, *Microcystis* and *Oscillatoria* were observed in the study site, thus it has been suggested to avoid bath and intake of this religious water body. Aspects of present investigation appear proves to be of both academic and applied significance.

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