



A study on physico-chemical parameters of Dah lake water, District-Ballia (U.P.), India

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Abstract: The back water of river Saryu is a prime source of water for Dah Lake, located in Ballia district, have been studied to project the pristinity of water with respect to different pollution sensitive parameters i.e. organic pollutants–BOD, DO, COD, Inorganic pollutants - Electrical Conductivity, Turbidity, pH, total alkalinity, Chloride, Total hardness etc. The pH (7.68), total alkalinity (180.5 mg/l), Chloride (133.12 mg/l), Total hardness(139.83 mg/l), Calcium (60.26 mg/l) and Magnesium hardness (19.38 mg/l) were found well within the prescribed standard for drinking water (BIS 10500:1991) during the study period i.e. April 2006- March 2008. The study inferred that the water quality of Dah Lake is still free from the any kind of pollutants, must be due to its higher assimilative capacity. It also indicates the higher potential for pisciculture and drinking water sources (after disinfection) for the nearby villages which may ultimately improve the economic condition of the surrounding habitation.

Keywords: Assimilative capacity, Dah lake, Dissolved oxygen, Physico-chemical characters, Water quality

INTRODUCTION

Water is one of the most important natural resource available to mankind. Knowing the importance of water for sustenance of life, the need for conservation of water bodies especially the fresh water bodies is being realized everywhere in the world. Lakes, rivers and reservoirs are most important water resources and used for several purposes. Physicochemical Analysis on Dah Lake was aimed to assess the deterioration of water quality. A number of authors have studied the physical and chemical characteristics of some Indian water bodies *i.e.* Rawat, 2002; Arjariya, 2003; Sharma and Sarang, 2004; Tiwari and Chauhan, 2006; Tamot and Sharma, 2006; Vyas *et al.*, 2006; Kumari *et al.*, 2007; Khare and Jadhav, 2008; Srivastava *et al.*, 2009; Patra *et al.*, 2010; Puri *et al.*, 2010; Koli and Ranga, 2011; Gupta *et al.*, 2011; Sharma *et al.*, 2011; Parameswara *et al.*, 2012; Kulkarni and Tapase, 2012; Khan *et al.*, 2012; Naik *et al.*, 2012. The Characteristics feature of Eastern Uttar Pradesh is the presence of numerous lakes, ponds and reservoir which offer immense scope for fish culture practices. In the district Ballia itself, there are three large lakes viz.; Surha, Reoti and Dah Lake which cover an area of about 600 hectares of perennial Lake. Besides, there are nearly 476 small tanks and water depressions with a total area of 458 hectares. River Ganga, Gharaghra and Tons with 29 km. of length pass through this district. Such a vast area water is presently in a state of deletion and neglect and warrants immediate attention of the fishermen if

exploitation on scientific basis.

Dah Lake is an ox-bow lake formed by the former channels of the river Gaghara the two ends having been silted up subsequently to the adoption of a new course of the river. The lake, extending between the parallels 25°55'34.56"N latitude 84°12'12.35"E longitude cover an area of 117.37 hectors of perennial water. The lake, with a more or less steeply margin on the outer side ad a little margin slop on the inner side (forming a narrow strip of littoral region) has a shallow basin and looks like a river bed. During monsoon period, it swells to inundate though a small marginal lake but became confluent with several large low lying areas and also establishes continuity with the river Ghaghara. The Lake receives water through two streamlets via Bhedia nala and Nara. During rainy season both these streamlets collected rain water from far distant areas and discharge into the lake. However, during late winter and summer, they completely dry up leaving a few discontinuous water patch. The objective of the study was to monitor the water quality of the lake with respect to its suitability for drinking water and pisciculture potential.

MATERIALS AND METHODS

Monitoring of the Lake carried out twice in month during April, 2006 to March, 2008 from 8 pre-identify locations following the standard sampling procedure (NEERI, 1991). The samples were transported to the laboratory and analysis for the different parameters viz Electrical conductivity, Turbidity, pH, BOD, DO, COD, total

alkalinity, Chloride, Total hardness following standard procedure (APHA, 2005).

RESULTS AND DISCUSSION

The physicochemical parameters of the Dah Lake have been given in the table 1. The mechanism of controlling the chemistry of surface water has been discussed by the Gibbs (1970). According to him there are three basic origins for chemical load of dissolved salts in surface water, atmospheric precipitation, rock weathering and crystallization. The temperature has greater role in the dynamic of aquatic ecosystem. In the present study both the atmospheric and water temperature fluctuated from 31.0°C to 34.6°C and 28.3 °C to 30.0°C respectively at different studied sites. The variation in water temperature may be due to monitoring time and fluctuation in the weather conditions of the area (Jayaraman *et al.*, 2003). Temperature dictates the behavioral characteristics of organisms, solubility of gases and salts in water bodies. No other factor has so much influence as temperature (Welch, 1952). The Electrical conductivity (E. C.) ranged from 17.8 to 37.7 µmho/cm. The maximum values (37.7) were recorded in spring and minimum (17.8) in winter. The increase of E. C. is a indication of the enrichment of the ions in water bodies and may be due to natural sources or by the anthropogenic sources. Since no significant manmade contributor was noticed during the study which indicated that only natural sources imparting the variation that too not significant. Similar kind of observation has been recorded by Rajyalakshmi *et al.* (1988) i.e. specific conductivity varied between 8.70 to 8.90 m mhos/cm in the ponds of Chilka fringe area indicating the high salt contents. The Turbidity of the lake water did not fluctuated significantly and remained under the prescribed limit i.e. 8.78 against the prescribed highest desirable of 5 NTU and maximum permissible limit 25.0 NTU. The pH of the Dah lake at most of the studied sites was more than 7.5 except at 2, 4 and 7 location. The pH and alkalinity goes hand to hand and are inversely proportional to water and air temperature. These are positively correlated to each other (Ranjan *et al.*, 2007). As per the water classification (CPCB-DBU-2008) on the basis of pH water falls under the "A" class and is fit for drinking purpose provided all other parameters also fall under the class. Rajyalakshmi *et al.* (1988) recorded higher values of pH ranging from 8.3 to 8.9 in the ponds of Chilka fringe area. Chattopadhyay *et al.* (1988) reported pH between 7.2 to 8.4 in the coastal saline water ponds. Wetzel (1975) reported that the value of pH ranges from 8 to 9 in Indian waters. The pH of pond water was influenced by the monsoon, temperature and soil conditions. Dissolved oxygen (DO) concentration in the water bodies is a kind of indication of general health of lake. During this study the DO level was found more

Table 1. Physicochemical parameters of water quality of Dah lake.

Parameters	Unit	Site-I	Site-II	Site-III	Site-IV	Site-V	Site-VI	Site-VII	Site-VII	Mean	Range	SD
Atmospheric temp.	°C	32.4	33.6	34.2	33.8	32.4	34.6	33.2	31	33.15	34.6-31	1.17
Water temperature	°C	29	28.4	29.5	28.5	30	29.2	28.7	28.2	28.93	30-28.2	0.61
E C	µmhos/cm	32.3	37.7	30.8	17.8	24.5	18.8	28.2	33.2	27.91	37.7-17.8	7.055
Turbidity	NTU	6.4	7.4	6.74	8.78	7.27	8.6	6.5	8.23	7.49	8.78-6.4	7.055
pH		7.97	7.35	7.88	7.48	7.89	7.97	7.39	7.57	7.68	7.97-7.35	0.943
DO	mg/l	7.17	6	6.81	7.56	8.5	6.72	6.36	8.55	7.21	8.55-6.00	0.266
BOD	mg/l	1.58	1.16	1.74	1.78	1.43	2.1	1.71	1.28	1.59	2.1-1.16	0.302
COD	mg/l	4.32	3.67	3.32	4.12	3.34	3.86	4.1	3.22	3.74	4.32-3.22	0.42
Total Alkalinity	mg/l	165	186	155	205	187	193	153	200	180.5	200-153	20.2
Chloride	mg/l	120	115	117	145	164	134	142	128	133.12	164-115	16.74
Total hardness	mg/l	75.0	70.4	77.5	79.3	78.0	100.0	89.0	76.0	80.65	70.4-100	9.42
Ca ⁺ hardness	mg/l	57.6	52.8	58.5	52.5	60	67.5	75.7	57.5	60.26	75.7-52.5	7.789
Mg ⁺ hardness	mg/l	17.4	17.6	19	26.8	18.3	24.4	13.1	18.5	19.38	26.8-13.1	4.291

than 6 mg/l which showed a very good health of the lake i. e. under the “A class of water as per the Water classification. DO level in the water bodies is temperature dependent. It also depletes as the organic load increases. Similar kind of study is also reported by Rajyalakshmi *et al.* (1988) which indicated DO concentration ranging from 3.40 to 6.52 mg.l-1 in the brackish water ponds of Chilka fringe area. Thampy *et al.* (1988) observed that DO concentration fluctuated between 1.4 to 8.2 mg/l in the saline ponds at Cochin. Devaraj (1988) noted concentration of DO from 3.7 to 8.2 mg/l. In the present study, the dissolved oxygen ranged from 6.0 to 8.0 mg.l-1 during the first year of study while during second year it ranged from 6.1 to 8.4 mg/l.

Biochemical Oxygen Demand (BOD) is the key parameter which indicates the organic load of the water body or aquatic ecosystem. BOD in the study area varied from 1.16 to 2.1 mg/l during study period which indicates that the existing ecosystem do not have any significant source of organic pollution and existing system is capable of assimilating the organic load in case any pollution occurred. Similar finding has been projected by the Paramesher *et al.* (2012) at Kunigal lake in India. Chemical Oxygen Demand (COD) is a measure of oxygen equivalent to the requirement of oxidizing organic matter contents by a strong chemical agent. The COD test is helpful in assessing the toxic conditions and the presence of biologically resistant organic substances. The COD concentration fluctuated between 3.22 mg/lit- 4.32 mg/l. The variation is not much. The COD data infer that no chemically active substances are entering in the aquatic ecosystem which may alter the primary productivity of the system. The alkalinity of water is its capacity to neutralize acids; it ranged from the 153 mg/l to 200 mg/l which is well within the desirable level of alkalinity for drinking water assigned by BIS (1991). Rajyalakshmi *et al.* (1988) and Gupta *et al.* (2008) and Parameswara *et al.* (2012) reported similar observation in the Kunigal Lake in Tumkur district, Karnataka of the India. The Chlorides occurs naturally in all types of water and waste water forming a major inorganic anion. In the present study the values ranged from a minimum of 115 and maximum.164 mg/l. Similar findings are projected by the Singh *et al.*, (2011) for Kodaikanal Lake (Dindugal District), in India. Calcium and Magnesium were the dominant cations in the lotic aquatic ecosystem (Buckney, 1980). Calcium concentration was minimum of 52.5 mg/l to the maximum of 75.7 mg/l and the magnesium concentration of the present study is ranged from 13.1 mg/l to 26.8mg/l and present observation is in line with the reports of Kumar *et al.* (2006).

Conclusion

The present study concluded that the pristinity of Dah Lake is maintained with respect to the studied physico-chemical parameters and the water resources may be utilized for the propagation of the pisciculture at commercial scale which may uplift the economic status of the nearby habitation apart from the irrigation and drinking water source (after disinfection).

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