INTERNATIONAL JOURNAL OF RESEARCHES IN BIOSCIENCES, AGRICULTURE AND TECHNOLOGY
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www.vmsindia.org

Study on Physico-Chemical Parameters of Kurhada Lake at Pauni, Bhandara District, Maharashtra

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Abstract

The analysis of various physico-chemical characteristic of water quality of Kurhada Lake was carried out from Feb 2013 to Jan 2014. The Kurhada Lake is situated on the South west of Pauni. The following physicochemical parameters were analyzed during the course of study .Atmospheric temperature, Water temperature, pH, Conductivity, Total alkalinity, Chloride, Sulphate, Dissolved Oxygen, Total Hardness, Calcium Hardness, Magnesium Hardness, Nitrate, Phosphate, Iron, Free CO_2, Biological Oxygen Demand, Chemical Oxygen Demand, Total Dissolved Solids, Turbidity. The higher value of Conductivity, total alkalinity, Total Hardness, chloride, Phosphate, Nitrate, TDS and Turbidity in Kurhada Lake indicates its moderately polluted nature.

Keywords : Water quality, Physico-chemical parameters, Kurhada lake, Pauni

Introduction

Water is one of the most important and precious natural resources. But this valued resource is increasingly being threatened as human population grows and demand more water for domestic purposes and economic activities. Protection and management of water bodies have been recognized as priority sector all over the world, since the quality of potable water is directly related to public health. The water body affects the environment in its vicinity like changing of ground water levels, condition of climate etc. The purity and quality are the basic concern to mankind since it is directly related with welfare of human beings (Timmy Katyal and Satake M. 2001). Any damage to this water sources by any agency will not only make life miserable but also disrupt the aquatic ecosystem.

The Kurhada Lake is situated on the South west of Pauni town and is about 805 feet above the sea level. The Geographical position is 79°31'49" E longitude and 20°47'8" N latitude. It receives water from the catchment area 0.50 square mile during monsoon period as well as from municipal drainage. The area of Lake is spread over 17.68 Ha. Gross storage of the Lake is 4 MCFT. The water of this lake is used for fishing and domestic activities. The present study deals with the Physico-chemical parameters of this lake from Feb 2013 to Jan 2014.

Material and Methods

The water samples were collected for physical and chemical analysis, from the marginal area at 1 to 1.5 m depth from two sides of Kurhada Lake with the help of Ruffner sampler. The water samples were collected in dried plastic cans of 2 Lt. Capacity and brought to the laboratory and immediately analyzed. The sample collection was made during the morning hours between 8.30 to 10.30 am. The samples were collected every month from February 2013 to January 2014. The recorded data was segregated in 3 seasons, winter (Oct to Jan), summer (Feb to May) and Monsoon (June to Sept). During the monitoring, Physico-chemical parameters like atmospheric and water temperature, pH were determined on the sampling spot whereas parameters the other parameters like dissolved oxygen, conductivity, total dissolved solids, free CO_2, alkalinity, hardness, sulphate, phosphates, chlorides and nitrates were analyzed in the laboratory as per the standard methods of APHA (2005) and Trivedi and Goel (1984) .

Result and Discussion

The study of various Physico-chemical parameters indicate that the lake exhibit substantial variation in its biotic and abiotic characteristics. The Physico-chemical parameters of water during Feb 2013 to Jan 2014 are given in table No.1. Table No. 2 represent the seasonal variation in Physico-chemical parameters of the Kurhada Lake.

In the present Investigation, the range of atmospheric temperature was recorded between 22.9°C to 32.7°C. Rise in temperature speed up the biochemical reactions and reduce the solubility of gases. The atmospheric temperature was always found higher than the water temperature. Similar results were also found by Salve and Hiware (2006) in Wana Prakalp reservoir near Parali Vaijanath, Maharashtra, Rawat and Jakher (2007) in Gulab Sagar Lake, Rajasthan.

Water temperature recorded was between 21.2^{0}C to 30.1^{0}C. water temperature was high, moderate and less during summer, monsoon and winter respectively. The observations are in complete agreement with the findings of Sehgal (1980). Similar results were also recorded by Ahmed and Krishnamurthy (1990), Kaur et al.(1995), Kataria et.al.,(1996). Intense sunlight and high ambient temperature with hot air increase the temperature of lake water.

The monthly values of Turbidity in the present study were recorded between 25.4 to 48.3 NTU. Turbidity is normally increased during monsoon. Similar results were reported by Dagaonkar and Saksena(1992), Ansari and Prakash(2000), Garg et al.,(2006), Jawale, C.A., et al.(2009). Similar findings were also recorded by Vasumathi Reddy et al.(2009). The inflow of clay, silt, and various other pollutants along with rain water in the monsoon is responsible for high turbidity level in reservoir.

The Conductivity recorded was between 625 µmhos/cm to715 µmhos/cm. During summer the incoming organic matter from the municipal channels may be the main cause of increase in ionic status. Seasonal variation in the conductivity is mostly due to increased concentration of salts because of evaporation of reservoir water. Similar result was also recorded by Trivedy et.al. (1989).

Table No.1: Monthly variation of Physico-chemical characteristics of Kurhada Lake During 2013-2014.

Sr No	Parameters	Feb 2013	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Jan 2014	Min	Max
1	Atm Temp (^{0}C)	26.0	28.2	30.5	32.7	27.9	28.8	27.7	29.7	30.2	27.1	22.9	24.6	22.9	32.7
2	Water Temp (^{0}C)	24.9	27.4	28.3	30.1	26.5	27.2	26.4	27.4	29.6	26.3	21.2	23.1	21.2	30.1
3	Ph	8.36	8.42	8.21	8.56	7.25	7.87	7.10	7.48	7.23	7.51	7.78	7.65	7.10	8.56
4	Conductivity	690	695	700	715	711	680	648	625	663	649	670	679	625	715
5	Total Alkalinity	115	108	152	116	108	112	105	112	108	130	142	131	105	152
6	Chloride	69.0	84	98	96	92	65.0	61.50	52	47.1	46.3	48.5	69	46.3	98
7	Sulphate	31.5	35.4	34.8	57.4	31.2	23.5	22.6	29.5	27.4	12.8	11.6	20.3	11.6	57.4
8	Dissolved Oxygen	6.4	6.5	6.2	5.7	6.3	6.5	6.7	6.4	6.8	7.0	7.1	6.6	5.7	7.1
9	Total Hardness	120.5	160.7	183.6	210.1	183.7	119.9	125.7	105.7	98.1	92.4	95.78	109.3	92.4	210.1
10	Ca hardness	68.25	90.56	101.2	120.1	108.2	74.60	75.25	70.50	66.65	62.30	60.28	66.2	60.28	120.1
11	Mg Hardness	52.30	70.14	82.45	90.0	75.50	45.32	50.50	35.25	31.45	30.10	35.50	43.1	30.10	90.0
12	Nitrate	1.30	1.52	1.70	1.92	1.84	1.08	0.80	0.89	0.72	0.66	0.31	0.74	0.31	1.92
13	Phosphate	0.243	0.279	0.265	0.325	0.090	0.071	0.072	0.081	0.076	0.080	0.070	0.110	0.070	0.325
14	Iron	0.17	0.16	0.19	0.27	0.21	0.17	0.12	0.10	0.17	0.11	0.019	0.12	0.019	0.27
15	Free CO_2	4.5	5.0	5.5	6.3	5.8	4.3	3.20	4.18	5.3	4.0	4.2	3.5	3.20	6.30
16	BOD	7.0	8.3	9.1	10.4	9.5	8.0	7.3	6.5	5.7	5.1	6.2	6.5	5.1	10.4
17	COD	12.7	14.9	14.2	16.3	15.4	15.1	14.8	14.1	13.4	12.5	10.7	11.8	10.7	16.3
18	T. D. S.	256	264	289	300	319	340	328	314	270	268	260	245	245	340
19	Turbidity	25.6	28.5	30.2	31.4	40.5	44.6	48.3	44.5	31.8	28.9	25.4	26.0	25.4	48.3

Table No.2 : Seasonal variation of Physico-chemical parameter in Kurhada Lake During 2013-2014.

Sr No	Parameters	Summer Mean S.D.	Monsoon Mean S.D.	Winter Mean S.D.
1	Atm temp	29.35 ± 2.891	28.525 ± 0.917	26.2 ± 3.175
2	WaterTemp (^{0}C)	27.675 ± 2.163	26.875 ± 0.499	25.05 ± 3.691
3	pH	8.387 ± 0.145	7.425 ± 0.335	7.54 ± 0.294
4	Conductivity	700 ± 10.801	666 ± 37.53	665.25 ± 12.658
5	Total Alkalinity	122.75 ± 19.822	109.25 ± 3.403	127.75 ± 14.244
6	Chloride	86.75 ± 13.35	67.62 ± 17.15	52.72 ± 10.88
7	Sulphate	36.77 ± 11.87	26.7 ± 4.287	18.02 ± 7.340
8	Dissolved Oxygen	6.2 ± 0.355	6.475 ± 0.170	6.875 ± 0.221
9	Total Hardness	168.72 ± 37.96	133.75 ± 34.34	98.89 ± 7.320
10	Calcium hardness	95.02 ± 21.63	82.13 ± 17.50	63.85 ± 3.082
11	Mg hardness	73.72 ± 16.46	51.64 ± 17.11	35.03 ± 5.844
12	Nitrate	1.61 ± 0.263	1.152 ± 0.472	0.607 ± 0.201
13	Phosphate	0.278 ± 0.034	0.078 ± 0.008	0.084 ± 0.017
14	Iron	0.197 ± 0.049	0.15 ± 0.049	0.104 ± 0.062
15	Free CO_2	5.325 ± 0.767	4.37 ± 1.073	4.25 ± 0.759
16	BOD	8.7 ± 1.425	7.825 ± 1.273	5.875 ± 0.613
17	COD	14.52 ± 1.497	14.85 ± 0.556	12.1 ± 1.140
18	Total Dissolved Solid	277.25 ± 20.67	325.25 ± 11.41	260.7 ± 11.35
19	Turbidity	28.92 ± 2.515	44.47 ± 3.185	28.02 ± s 2.944

Fig 1: Satellite Image of Kurhada Lake.

pH in the present study was recorded between 7.10 to 8.56. The maximum pH was recorded in summer season. Increase of algal blooms and aquatic flora of lake offers the tremendous photosynthetic activities in the water. This maximum pH is because of high photosynthetic activities. The accumulation of pollutants also causes the pH to rise in the lake water. Similar alkaline pH values were reported by Yeole and Patil (2005).

The maximum total alkalinity in Kurhada Lake was 152 mg/lit in the month of April and minimum 105 mg/lit in the month of August. In present study maximum values of total alkalinity were recorded in summer which could be attributed to accelerated rate of photosynthesis leading to greater utilization of carbon dioxide and bicarbonates as source of inorganic carbon by phytoplankton and release carbonates which can cause pH to rise dramatically.

Chloride plays an important role in water quality determination. The maximum Chloride in Kurhada Lake was 98 mg/lit in the month of April and minimum 46.3 mg/lit in the month of November. The observations are also in conformity with the findings of Haque (1991) who has reported maximum chloride content during summer from a polluted water body at Aligarh.

Sulphate in the present study was recorded between 11.6 mg/lit to 57.4 mg/lit. In the present investigation, maximum sulphate level was recorded during summer and minimum during the winter season. Ahmed and Krishnamurthy (1990), recorded the maximum sulphate during summer and minimum during the winter in Wohar reservoir, Aurangabad.

The maximum dissolved oxygen in Kurhada Lake was 7.1 mg/lit in the month of December and minimum 5.7 mg/lit in the month of May. Gonjari and Patil (2008), reported a high content of dissolved oxygen in winter and rainy seasons in Triputi reservoir near Satara, Maharashtra. The maximum dissolve oxygen in winter may be due to low atmospheric temperature and minimum dissolve oxygen in summer may be due to high metabolic rate of organisms.

The monthly values of total Hardness in the present study were recorded between 92.4 mg/lit to 210.1 mg/lit. In the present investigations, the total hardness value was maximum during summer and minimum in winter season. Kataria et al., (1996) also recorded maximum value of total hardness in summer, moderate in monsoon and minimum in winter at Kolar reservoir in Bhopal, Madhya Pradesh.

The maximum Calcium Hardness in Kurhada Lake was 120.1 mg/lit in the month of May and minimum 60.28 mg/lit in the month of December. In the present investigation, the maximum calcium hardness during summer was due to low water levels and bacterial decomposition of the organic matter in the lake. Ravikumar et al., (2005), reported maximum calcium hardness in the month of April in Ayyankere tank in Harapanahalli town in Davangere district of Karnataka.

Magnesium Hardness in the present study was recorded between 30.10 mg/lit to 90.0 mg/lit. In

present study lower value of magnesium were recorded in winter which could be attributed higher sedimentation rate leading to their settlement in the bottom, utilization by plankton organisms and its incorporation into chlorophyll. The findings are in conformity with the findings of Tripathi and Pandey (1990) and Shastree *et al.*(1991) who recorded decline in magnesium concentration during winter.

The maximum nitrate in Kurhada Lake was 1.92 mg/lit in the month of May and minimum 0.31 mg/lit in the month of December. Increased concentration of nitrate during summer might be due to increased rate of decomposition of organic matter at higher temperature and formation of algal mats on the surface. These observations are in agreement with the findings of Gochhait (1991).

The monthly values of Phosphate in the present study were recorded between 0.070 mg/lit to 0.325 mg/lit. Telkhede et al.,(2012), maximum in summer and minimum in winter. Maximum values in summer could be related to increased decomposition rate at high temperature and greater release of nutrients there- from, higher rate of evaporation and decrease in water level leading to increase in concentration and microbial-biochemical mobilization of phosphates from particulate stores to dissolved phosphates (Stumm and Morgan, 1995). Several workers Ray and David (1966), Shukla *et al.* (1989), Gochhait (1991) and Ganai *et al.* (2010) also recorded high values of phosphate during summer.

During the year 2013-14 the iron recorded was between 0.019 mg/lit to 0.27 mg/lit. In the present investigation, the maximum Iron is recorded during summer and minimum during the winter season. Similar results were obtained by Puri, Yenkie (2011), Madhuben Sharma (2014) and Salin and Sreedevi (2013).

The monthly values of Free CO_2 in the present study were recorded between 3.20 mg/lit to 6.30 mg/lit. The maximum free carbon dioxide was recorded in summer and minimum during winter. Similar results were obtained by Dwivedi and Pandey (2002), Shastri et al., (2008), Lendhe and Yergi (2004). Maximum Free CO_2 during summer is due to the decomposition of organic matter and the respiration of aquatic flora and fauna, however minimum free carbon dioxide during winter is probably due to decrease in the photosynthetic activity of aquatic flora.

The maximum BOD in Kurhada Lake was 10.4 mg/lit in the month of May and minimum 5.1 mg/lit in the month of November. Seenaya and Zafar (1979) observed the BOD value was lowest during January and highest in May. Bhatt et al., (1999), recorded maximum biological oxygen demand in summer and minimum in winter and stated that high values of biological oxygen demand may be due to higher rate of organic decompositions and gradual decline of biological oxygen demand from monsoon followed by winter, which could be due to decrease in temperature which in turn retards the microbial activities.

During the year 2013-14, the maximum COD in Kurhada Lake was 16.3 mg/lit in the month of May and minimum 10.7 mg/lit in the month of December. Higher value during summer may be due to high decomposition activities and low level of water. However minimum chemical oxygen demand in winter is due to low temperature, low decomposition activities & dilution effect.

Total solids cause ecological imbalance in the aquatic ecosystem by mechanical abrasive action. The monthly values of TDS in the present study were recorded between 245 mg/lit to 340 mg/lit. The minimum values of TDS were recorded in winter during the course of study, which could be related to their utilization by plankton and other aquatic plants and loss of nutrients into the sediment during this period.

Conclusion

The Seasonal Physico-chemical parameters of Kurhada Lake exhibit cyclical variations. The higher value of Conductivity, total alkalinity, Total Hardness, chloride, Phosphate, Nitrate, TDS and Turbidity in Kurhada Lake indicates its moderately polluted nature.

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