

Hydrological Status of Katraj Lake, Pune, (Maharashtra), India

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Abstract— Lake water samples were collected for the study of physico-chemical status of Katraj Lake. For such assessment the water quality parameters like water temperature, pH, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total hardness, chloride, calcium, magnesium and Nitrate were analyzed during December 2016 to December 2017. Samples were collected from selected site of the lake. The analysis was done based on the standard methods. The results indicate that most of all the parameters were within permissible limits for potable water standards of WHO except water temperature & pH. Throughout the study period water was alkaline in nature. Chloride showed positive relation with water temperature. Water temperature showed high significant negative correlation with dissolved oxygen. Nitrate showed negative correlation with most of all parameters except water temperature. It also showed significant negative correlation with total hardness. Only total hardness showed significant monthly variation.

Keywords— Physico-chemical parameters, Water quality, correlation, Katraj lake, etc.

I. INTRODUCTION

The quality of ground water/surface water depends on various chemical constituents and their concentrations. Water is a resource that has many uses, including recreation, transportation, and hydroelectric power, domestic, industrial, and commercial uses. Water also supports all forms of life and affects our health, lifestyle, and economic well being. Although more than three quarters of the earth's surface is made up of water, only 2.8 percent of the Earth's water is available for human consumption [1-3]. At present, approximately one-third of the world's people live in countries with moderate to high water stress and the worldwide freshwater consumption raised six fold between the years 1900 and 1995 more than twice the rate of population growth. Thus, many parts of the world are facing water scarcity problem due to limitation of water resources coinciding with growing population [4], [5]. Fresh water is a finite resource, essential for agriculture, industry and even human existence, without fresh water of adequate quantity and quality, sustainable development will not be possible [15], [16]. Rivers and lakes play a major role in assimilation or carrying off of municipal and industrial wastewater and runoff from agricultural land, the former constitutes the constant polluting source whereas the later is a seasonal phenomenon [6-9]. With the rapid development in agriculture, mining, urbanization, and industrialization activities, the river water contamination with hazardous waste and wastewater is becoming a common phenomenon. In India almost 70% of the water has become polluted due to the discharge of domestic sewage and

industrial effluents into natural water source, such as rivers, streams as well as lakes [10], [11]. The improper management of water systems may cause serious problems in availability and quality of water. Since water quality and human health are closely related, water analysis before usage is of prime importance. Therefore, present study was aimed to analyze the comparative physicochemical and microbial analysis of katraj lake water samples using standard methods [12-14].

It is said, the lake is constructed in 1750 by Balaji bajirao Peshwa, the water system comprises huge ducts and underground tunnels originating from Katraj lake of the city to the historic Shaniwarwada fort. Katraj lake is located in Pune city. It is a perennial urban pond, located near temple and surrounded by the slum area and human habitation, which is used by inhabiting people around it for various activities like bathing, fishing, washing clothes, and dumping sewages etc.

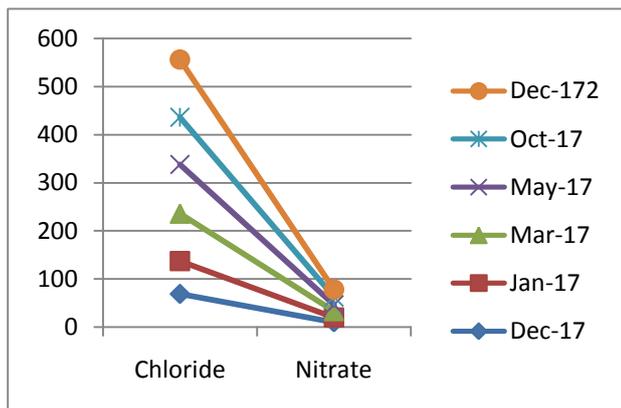
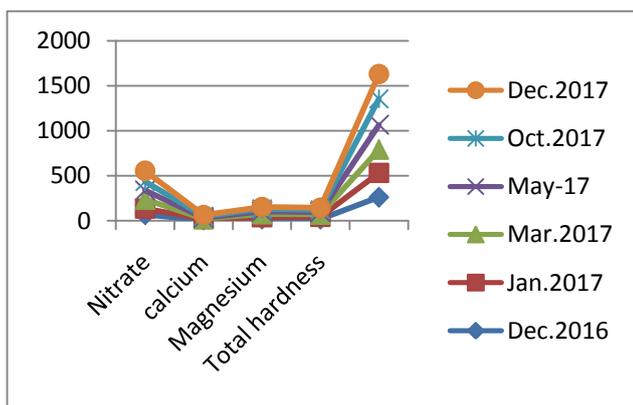
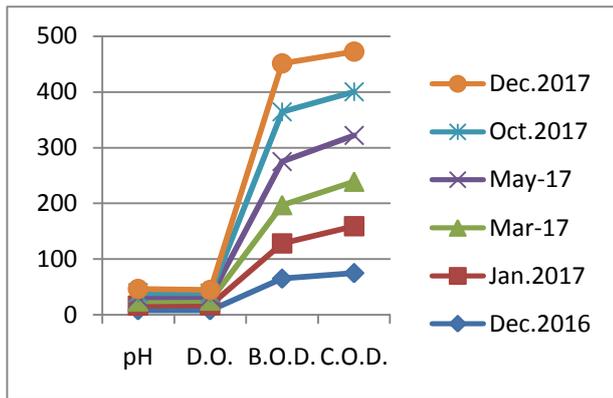
II. MATERIAL AND METHODS

Physicochemical status of Katraj Lake was studied for one year during December 2016 to December 2017. Water samples were collected from various sites at random from the Lake in the day time between 10 to 11 am in plastic bottles. Water temperature was recorded by standard centigrade thermometer on site. For the estimation of dissolved oxygen, water samples were collected separately in 250 ml BOD bottles and oxygen was fixed at the time of sampling on field. pH was recorded by standard pH meter. All other remaining parameters were analyzed immediately on return to the laboratory by titrimetric methods. The physico-chemical parameters for water quality were assessed using standard methods [25].

TABLE I. Analysis of Physico-chemical parameters of Katraj Lake, Pune.

	December 2016	January 2017	March 2017	May 2017	October 2017	December 2017	Desirable Limits
pH	8.1	8.2	7.89	7.30	7.68	7.32	6.5-8.5
DO	8.1	8.9	8.6	6.4	6.9	5.8	--
BOD	65	63	69	78	89	87	--
COD	75	84	80	83	78	72	--
Chloride	69	68	99	102	98	120	250
Nitrate	9.87	10.21	13.20	12.98	16.45	15.65	45
Calcium	20.3	21.6	33.2	29.4	26.6	22.4	75
Magnesium	19.8	23.7	26.4	26.9	25.6	23.8	30
Total Hardness	263	269	259	274	289	276	300

Graphical representation of these parameters:



III. RESULT AND DISCUSSION

The data of physico-chemical parameters of Katraj lake for the year 2016-17 is presented in the table no I. The pH of the lake water in the present investigation was observed in the range from 7.3 to 8.2 is accepted as per BIS. Dissolved oxygen found in the range of 5.8 to 8.9 mg/l. This can be attributed to addition of effluents containing oxidisable organic matter and consequent biodegradation and decay of vegetation at higher temperature leading to consumption of oxygen from water [17-19]. DO Concentration below 5 mg/l may adversely affect the functioning and survival of biological communities and below 2 mg/l may lead to fish mortality [20]. Biochemical oxygen demand (BOD) found in the range of 63

mg/l to 89 mg/l, is the measurement of the amount of biologically oxidisable organic matter present in the waste. Chemical oxygen demand (COD) value found in the range of 72 mg/l to 84 mg/l. COD test which measure the oxygen required for the oxidation of all the substance present in water, included those are not biologically decomposable[21-22]. COD is a reliable parameter for judging the extent of pollution in water. The COD of water increases with increasing concentration of organic matter. Chloride found in the range of BIS. The values are from 68 to 120 mg/l. Nitrate concentration depends on the activity of nitrifying bacteria which in turn get influenced by presence of dissolved oxygen [23-24]. In the present study the values of nitrate ranged from 9.8 to 16.45 mg/l, which is below desirable range of BIS. The total hardness found is in the range of BIS standard at near about all stations [5]. The values of hardness are found to be 259 to 289 mg/l.

IV. CONCLUSION

It is concluded from the present study that the pH values exceeds the desirable range as per BIS, means it make water alkaline. Dissolved oxygen found very less as recommended by ICMR standards and the values of Biochemical oxygen demand (BOD) are found higher, in lake water samples. As DO decreases BOD increases. COD values are within the limits as per BIS 2490. All other parameters tested are within the desirable limits of BIS. All locations need proper treatment for lake water to use the water effectively without any pollution inserted from outsource. If some precautions will be taken for the lake water then it can be used for domestic and irrigation purpose as well as for aquatic life.

REFERENCES

- [1] APHA, AWWA, Standard Methods for Examination of water and wastewater, 19th Edition Washington DC, 1994.
- [2] R. Agrawal, "Physico-chemical analysis of some groundwater sampler of Kotputlu town Jaipur, Rajasthan," *International Journal of Chemical Environmental and Pharmaceutical Research*, Rajasthan, vol. 1, issue 2, pp. 111-113, 2010.
- [3] Nishtha Koul, R. S. Lokhande, and J. K. Dhar, "Assessment of physico-chemical, microbiological and pesticide content in potable water in metropolitan city of Delhi, India," *Journal of Applicable Chemistry*, vol. 1, issue 4, pp. 512-518, 2012.
- [4] BIS, Specification for drinking water, Bureau of Indian standards, New Delhi, pp. 171-178, 1998.
- [5] A. V. Gray and L. I. Wang, "Case study on water quality modelling of Dianchi lake South west China," *Water sci. Technol.*, vol. 40, pp. 35-43, 1999.
- [6] R. Mohanraj, M. Sathishkumar, P. A. Azeez, and R. Sivakumar, "Pollution status of wetlands in urban Coimbatore, Tamilnadu, India," *Bull. Environ. Cont Toxicol.*, vol. 64, pp. 638-643, 2000.
- [7] S. S. Parihar, A. Kumar, A. Kumar, R. N. Gupta, M. Pathak, A. Shrivastav, and A. C. Pandey, "Physico Chemical and microbiogicesf analysis of underground water in and ground Gwalior city, M.P., India," *Res. J. Recent Sci.*, vol. 1, issue 6, pp. 62-65, 2012.
- [8] A. Mishra, A. Mukherjee, and B. D. Tripathi, "Seasonal and temporal variation in physico-chemical and bacteriological characteristics of river Ganga in Varansi," *Int. J. Environ. Res.*, vol. 3, issue 3, pp. 395-402, 2009.
- [9] M. V. Vincy, Brilliant Rajan and A. P. Pradeep Kumar, "Water quality assessment of a tropical wetland ecosystem with special reference to backwater tourism, Kerala, South India," *International Research Journal of Environment Sciences*, vol. 1, issue 5, pp. 62-68, 2012.

- [10] Mangukiya Rupal, Bhattacharya Tanushree, and Chakraborty Sukalyan, "Quality characterization of groundwater using water quality index in Surat city, Gujarat, India," *I. Res. J. Environmen Sci.*, vol. 1, issue 4, pp. 14-23, 2012.
- [11] B. Nirmala, B. V. Suresh Kumar, P. A. Suchetan, and M. Shet Prakash, "Seasonal Variations of Physico Chemical Characteristics of Ground Water Samples of Mysore City, Karanataka, India," *I. Res. J. Environmen Sci.*, vol. 1, issue 4, pp. 43-49, 2012.
- [12] M. R. Mahananda, B. P. Mohanty, and N. R. Behera Mahananda, "Physico-Chemical analysis of surface and ground water of Bargarh District, Orissa, India," *IJRRAS*, vol. 2, issue 3, pp. 284-295, 2010.
- [13] H. Murhekar Gopalkrushna, "Determination of physic- chemical parameters of surface water samples in and around Akot city," *International Journal of Research in Chemistry and Environment*, vol. 1, issue 2, pp. 183-187, 2011.
- [14] R. E. Raja, L. Sharmila, P. Merlin, and G. Chritopher, "Physico chemical analysis of some groundwater samples of Kotputli Town Jaipur, Rajasthan, India," *Indian J. Envirion Port.*, vol. 22, issue 2, pp. 137, 2012.
- [15] S.D. Jadhav, M.S. Jadhav, "A critical assessment of safe drinking water of Krishna River in Satara District (Maharashtra), India," *International Journal of Research in Advent Technology*, vol. 5, no. 10, pp. 10-13, 2017.
- [16] B. N. Sunkad and H. S. Patel, "Water quality assessment of fort lake of Belgaum (Karnataka) with special reference to zooplankton," *J. Environ. Biol.*, vol. 25, pp. 99-102, 2004.
- [17] A. Saravanakumar, M. Rajkumar, J. Sesh Serebiah, and G. A. Thivakaran, "Seasonal variations in physico-chemical characteristics of water, sediment and soil texture in arid zone mangroves of Kachchh-Gujarat," *J. Environ. Biol.*, vol. 29, pp. 725-732, 2008.
- [18] D. Satyanarayana, P. V. S. Prabhakara Murthy, and V. V. Sarma, "Distribution of particulate trace metals in the Western Bay of Bengal," *Mahasagar- Bull. Natl. Inst. Oceanogr.*, vol. 23, pp. 103-115, 1990.
- [19] S. D. Jadhav, M. S. Jadhav, and R. W. Jawale, "Study of chloride and nitrate concentration of Mula-Muth River in Pune City (Maharashtra)," *International Journal of Chemical and Life Sciences*, vol. 2, issue 4, pp. 1140-1142, 2013.
- [20] S. Senthilnathan, and T. Balasubramanian, S. D. Jadhav, and M. S. Jadhav, "Analysis of Some physico-chemical parameters of Mula-Mutha River at Pune (Maharashtra), *International Journal of Trends in Scientific Research and Development (IJTSRD)*, vol. 1, issue 6, 2017.
- [21] World Health Organization Guidelines for drinking-water quality third ed recommendations. Geneva: World Health Organization 2004.
- [22] S. Senthilnathan and T. Balasubramanian, "Distribution of heavy metals in estuaries of southeast coast of India," *Indian J. Mar. Sci.*, vol. 26, pp. 95-97, 1997.
- [23] D. G. Zinjad, "Study of physico-chemical parameters of drinking water in Pravara Areas around Pravara River," *Journal of Applicable Chemistry*, vol. 2, issue 3, pp. 545-548, 2013.
- [24] J. Suresh, P. Venkateswarlu, and A. V. L. N. S. H. Hariharan, "Studies on the Phisico- chemical characteristics of water in Pidaparathi village [Anaparathi mandal] E.G.Dt., A.P.," *Journal of Applicable Chemistry*, vol. 1, issue 3, pp. 427-432, 2012.
- [25] S. D. Jadhav and M. S. Jadhav, "Analysis of Some Physico-chemical Parameters of Mula-Mutha River at Pune (Maharashtra)," *International Journal of Trends in Scientific Research and Development (IJTSRD)*, vol. 1, Issue 6, 2017.
- [26] World Health Organization Guidelines for drinking-water quality third ed recommendations. Geneva: World Health Organization, 2004.