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DIURNAL VARIATIONS OF DISSOLVED OXYGEN, BIOCHEMICAL AND CHEMICAL OXYGEN DEMANDS IN THE WATER SAMPLES OF SHANTHISAGAR LAKE, DAVANGERE DISTRICT, KARNATAKA

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ABSTRACT

The present study is carried out to determine the diurnal variation of water quality parameter in Shanthisagar lake, Davangere district. In this study, various physico-chemical parameters like temperature, pH, dissolved oxygen, biological oxygen demand and sediment oxygen demand were determined. By considering the physio-chemical parameters of water obtained in the present study the dissolved oxygen is rich in water is beneficial for aquatic life. The physico-chemical parameters showed the diverse variation in the lake.

Keywords: Diurnal variations, DO, BOD, SOD, Shanthisagar lake, water quality

1. INTRODUCTION

Freshwater bodies are consider as one of the important natural wealth for the survival of all the living things of the biosphere. The rate of deterioration of water quality of fresh water resources like lentic and lotic water bodies is now a worldwide problem. For sustainable utilization of the water resources, periodic assessment of the freshwater bodies are very much necessary **[1]**. Nutrient rich water bodies are often associated with an increase in algal blooms

and hypoxia in aquatic systems indicates eutrophic status **[2-3]**.

Lakes are considered to be one of the most productive and biologically rich inland surface water ecosystems. Lake is defined as an aggregate of water bodies They are either natural or man made water bodies. They are either natural or man-made. It is estimated that India has about 4 1 million It is estimated that, India has about 4.1 million hectares of wet land of which 1.5 million hectares are natural and 2.6 million hectares are man made. A study by the Wild Life Institute of India reveals that, 70-80 % of individual fresh water marshes and Lakes have been lost during last 50 years.

There are three major lakes around Davangere city. Due to rapid developments and heavy urbanization there is a reduction in catchment area. In addition to this, other human activities and discharge of sewage have caused heavy pollution to these Lakes Hence, these Lakes are at the verge of these Lakes. Hence these lakes are at the verge of disappearance. If these Lakes are properly restored it will greatly help in solving the water problems along with other environmental advantages. Keeping this in view, the present work is undertaken and as a case study.

Ecological conditions may change significantly within aquatic ecosystem during 24 hours period. Solar radiation varies from high intensities at mid-day to darkness. Surface temperature and concentrations of dissolved gases may also fluctuate between extremes of day and night, especially in shallow, littoral areas **[16-19]**.

Dissolved oxygen is an indication of the general health of the water bodies. The objectives of the study is to determine the diurnal variation of dissolved oxygen, biological oxygen demand and sediment oxygen demand in Shanthisagar lake. However, the study of diurnal variations in water with respect to Shanthi Sagar lake in particular is lacking. Hence, the present investigation is carried out.

2. MATERIALS AND METHOD

2.1Study Area

Shanthi Sagara lake is the second largest irrigation water body in Asia. It is found in Kerebilchi village of Channagiri taluk of Davanagere district in Karnataka, India **(Figure 1& 2)**.

Shanti Sagara lake, has a water spread area of about 6,550 acres (2,651 ha), has a circumference of 30 km. It has a total drainage basin of 81,483 acres.

It irrigates 4,700 acres of land and more than 50 villages are benefited by it.

The lake receives the drainage of 20 square miles. The embankment is constructed between two hills, and embankment is of no great length; it is around 950 ft, but it is of stupendous width (Max 120 ft (37 m), min 70 ft (21 m)), height and strength, though not quite straight. The main road connecting between Channagiri and Davanagere pass through on this embankment. It has resisted successfully the floods of centuries, but owing to the great pressure of the volume of the water in lake (Mysore: a gazetteer, vol 2, p. 482).

2.2 Analysis

Present study was conducted during January 2015.Samples were collected every day in the morning and afternoon during every day. Stoppered BOD glass bottles used for water sample collection were cleaned with distilled water prior to sample collection. Containers were again rinsed with sampling water before collecting water sample. Temperature was recorded in the field with the help of mercury thermometer and dissolved oxygen samples were fixed with alkaline potassium iodide and manganous sulphate at sampling sites. Sediment samples were collected manually by adding some sediments from the bottom to it. The collected samples were brought to the laboratory for analysis. The analysis is done by modified winkler's method **[4, 14]**.

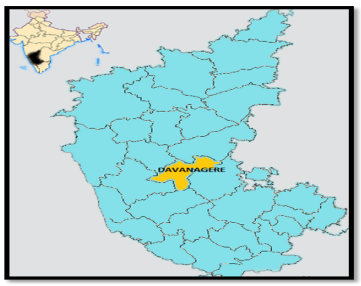

Figure 1: Location of the study area (Source:www.veethi.com)

Figure 2: Views of Shanthisagar lake

3. RESULTS AND DISCUSSION

3.1 **Variation of DO and BOD in water sample of Shanthisagar lake**.

Figure 4 and 5 shows the diurnal variation of DO and BOD during morning and afternoon. The DO in Shanthisagar lake varied from 3.8 to 10.6 mg/L. The BOD in lake varied from 6.1 to 8.1 mg/L. The DO is high and BOD is low which is favorable for aquatic organisms.

3.2 Diurnal variation of DO and SOD

Figure 6 shows the diurnal variation of DO and SOD. The DO in this water body varied from 3.7 to 4.8 mg/L. The SOD in Shanthisagar lake varied from 19.5 to 28.6 mg/L.

3.3 Water analysis

The difference between air and water temperatures was never more than 4°C in Shanthisagar lake but Aravinda *et al* **[8]** have never noticed more than 1.8°C in Kundawada lake of Davangere district. Most of the time sunlight was available when an over saturation in DO of the lake water was recorded. Afternoon onwards DO concentration gradually minimum. The pH of the lake water was alkaline and it ranged from 7.9 to 8.5 **(Figure 3)**. It was found to be directly related to changes in CO3 concentration as pH of the water increased during the morning time and decreased in the afternoon. The increase in pH during day time may be due to high rate of photosynthesis, although the range of variation of pH was usually minimum.

Water transparency is an important factor in the growth and distribution of living beings **[7]**. The transparency has indirect relationship with nutrients and was affected by the growth of algal biomass. Transparency depicted an inverse relationship with a number of water quality parameters in diel variations.

Total alkalinity of water is due to the presence of mineral salts and it was primarily caused by the CO_3 and HCO_3 ions. High alkalinity leads to the increase in temperature which also coincides with the nutrients and HCO_3 in particular. It has also been observed that relatively higher values of alkalinity were favorable for the growth of plankton as reported by many researchers **[7, 9-10]**.

Total dissolved solids (TDS) of water indicates the density of chemicals and as a measure of edaphic relationship that contributes to the yield of water **[11]**. The chloride content of water gave an idea of organic matter, nitrate and harmful substances **[12, 7]**. Dissolved oxygen (DO) is importance in the study of status of a lake. DO content has direct influence on primary productivity of water. BOD is defined as the amount of oxygen required by the microbes to stabilizing decomposable organic matter under aerobic condition. COD indicates the oxygen required for chemical oxidation of organic matter and oxidisable inorganic contents with the help of strong chemical oxidants **[7]**.

Harish Kumar *et al* **[13]** studied the seasonal variations in the ionic levels such as phosphate, nitrate, carbonate, bicarbonate and chloride in the surface water samples of Kundavada lake of Davangere district (Karnataka) of the study area caused by natural and human anthropogenic activities. Their results showed that the lake is included under mesotrophic category and needs certain degree of

treatment and it also protected from the possible source of contamination. The water quality parameters have been variously engaged in the classification of water bodies and the level of nutrient enrichments **[15, 19]**.

Anusha Balangoda **[20]** evaluated the diurnal and seasonal Dissolved Oxygen fluctuations and their effects on water quality, was conducted in a eutrophic polymictic reservoir. She reported that artificial aeration increased the dissolved oxygen concentration in the deep portion of the reservoir and the existing aeration was inadequate to amplify the DO concentration in the entire reservoir.

3.4 Correlation coefficient

There is a little variations in water temperature than air temperature is a major and critical limiting factor for biotic components because most of the aquatic organisms often have a narrow temperature tolerance **[5-7]**. A positive correlation was recorded between air and water temperature (r=0.905) at 0.01 level. Water transparency has an inverse correlation with many of the water parameters. pH has positive correlation with air and water temperature and negative relation with water transparency (r=-0.270). Dissolved oxygen showed positive correlation with water temperature, transparency and pH. The correlation of Do with many parameters supports the role of photosynthesis in governing the above parameters.

BOD has negative relation with transparency, DO and positive correlation with temperature and pH.COD has positive relation with many parameters and negative correlation with transparency and BOD. Total alkalinity showed positive correlation with water temperature (r=0.930), BOD (r=0.990) and COD (r=0.950) and negative correlation with transparency (r=-0.680). Total hardness (TH) has positive correlation with air, water temperature, pH, COD, BOD and alkalinity. TH showed negative relation with transparency (r=-0.850) and DO (r=-0.450). Chloride content of water has positive correlation with water temperature, BOD, COD and total alkalinity. Chloride has negative relation with transparency and DO (r=-0.580). Total dissolved solids (TDS) showed negative relation with transparency, DO and positive correlation with temperature, BOD, COD, total alkalinity, TH and chloride **(Table 1)**.

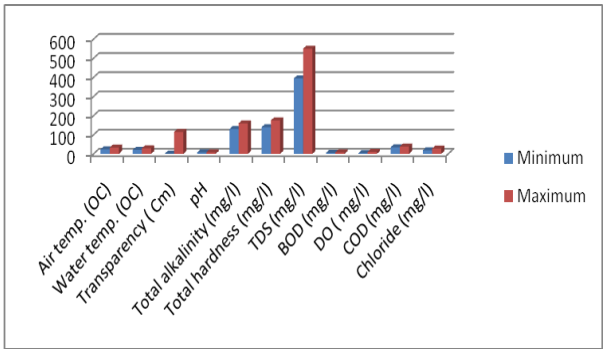

Figure 3: Range of physico-chemical parameters of water in Shanthisagar lake

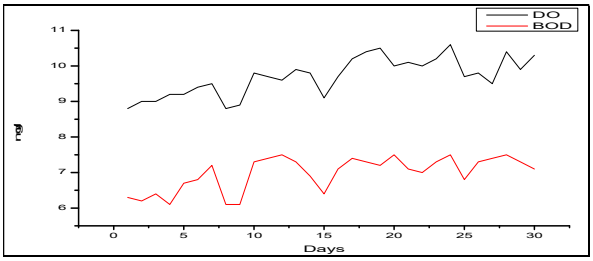

Figure 4: Diurnal variations of DO and BOD during morning

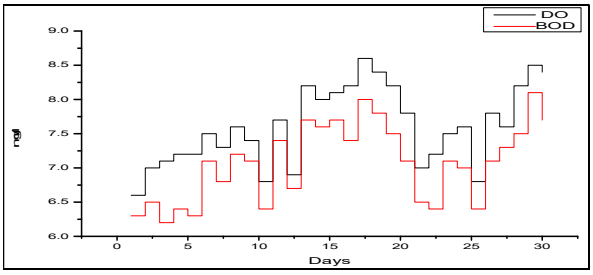

Figure 5: Diurnal variations of DO and BOD during Afternoon

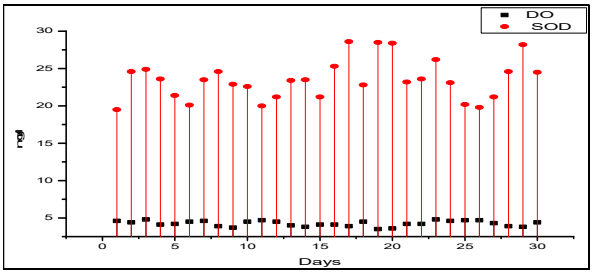

Figure 6: Diurnal variations of DO and SOD in Shanthisagar lake

4. CONCLUSION

In this present study, it was found that the maximum and minimum parameters were not at the level of pollution. In the light of standard of water quality recommended by WHO, the lake water should be used for drinking, cooking and fisheries. In order to maintain the health of the lake with respect to water quality it is essential that authorities should take immediate step on the awareness should be created regarding the effect of water pollution on the health of the human beings. People should be advised at least to boil the water to kill the pathogens before the water used for drinking purpose. The present study will be supportive for further ecological consideration and monitoring of water quality, production, fisheries improvement and lake management strategy in future. The current study will be helpful for further assessment in monitoring the water quality, yield, fishery development and lake management in future.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this article.

5. REFERENCES

[1] Abhishek Nigudgi and B. G. Mahendra. Diurnal Variation of Dissolved oxygen in Appa lake. International Research Journal of Engineering and Technology, 2018, **05 (07)**: 1852-1855.

[2] Rabalais, N.N., R.J. Díaz, L.A. Levin, R.E. Turner and D. Gilbert. Dynamics and distribution of natural and human-caused hypoxia. Biogeo-sciences, 2010, **7:** 585-619. DOI: 10.5194/bg-7-585.

[3] Paerl, H.W., N.S. Hall and E.S. Calandrino. Controlling harmful cyanobacterial blooms in a world experiencing anthropogenic and climatic induced change. Sci. Total Environ., 2011, **409:** 1739-1745. DOI: 10.1016/j.scitotenv.2011.02.001

[4] APHA. Standard Methods for the Examination of Water and Waste Water, 20th ed. Public Health Association, Washington, D.C.1998.

[5] Shankar V and Sangu RPS. Studies on diurnal variations in abiotic factors in relation to plankton density in Ganga near Motighat, Hardar. Proc. Nat. Symp. Fish Environ. 1986. pp. 120–124.

[6] Mudgal K.D, Kumari , and Sharma D.K. Hydro-chemical analysis of drinking water quality of Alwar district, Rajasthan., Nature Sci.2009, **7(2):** 30-39.

[7] Khwaja, S., Manish, V., Suresh, G., Chirag, G., Virendra, K. S., & Mohammad, D. H. Diel variations in limnological characteristics of Omkareshwar reservoir of Narmada river, India. Journal of Ecology and the Natural Environment, 2014, **6(1)**: 12-24.

[8] Arvinda, H.B., Thirumala, S., Suresh, S., Puttaiah, E.T., Manjunath, H and B. Suresh. Diurnal variation in water quality of Kundawada lake in Davangere district, Karnataka. Indian Journal of Environmental protection, 2012, **32(9):** 766-771.

[9] Joshi,V.P, Gautam,A.and Sati O.P. Diurnal variations in physico-chemical characteristics of the Alaknanda river at Srinagar during winter season. Geobios. 1991, **10:** 166–167.

[10] Sujitha P.C, Mitra D.D, Sowmya P. K and Mini P.R. Physico-chemical parameters of Karamand river water in Trivandrum District, Kerala, India. Int. J. Environ Sci. 2011, **2(2):** 472-490.

[11] Raja P, Amarnath Muhinder A, Elangovan R and Palanivel M. Evaluation of physical and chemical parameters of river Kaveri, Tiruchirappalli, Tamil Nadu, India. J. Environ. Biol.2008, **29(5):** 765-768.

[12] Prasad, N.R and Patil J.M. A study of physicochemical parameters of Krishna river water particularly in Western Maharashtra. J. Chem. 2008, **1(4):** 943-958.

[13] Harish Kumar, K, Thirumala,S and B.R.Kiran. Seasonal variations in ionic composition in the water of Kundavada Lake, Davangere district, Karnataka. Journal of Xidian University, 2020, **14(5):** 2719-2724.

[14] Trivedi, R.K., Goel, P.K. and Trishal, C.L. Practical methods in Ecology and Environmental Science, Environmental Publications, Karad (India), 1995.

[15] Sindhu SK, Sharma A. Study on some physicochemical characteristics of ground water of district Rampur - A statistical approach. E. Journal of Chemistry, 2008, **4(2):** 162-165.

[16] Abowei JFN. Salinity dissolved oxygen, pH and surface water temperature conditions in Nkoro River, Niger Delta, Nigeria. Adv. J. Food Sci. Technol.2010, **2(1):** 36-40.

[17] Singh MR, Gupta A, Asha S, Beeteswari KH. Physicochemical properties of water samples from Manipur river system, India. J. Appl. Sci. Environ. Manage., 2010, **14(4):** 85-89.

[18] Sipkoska-Gastarova B, Vrzovski B, Stojanova A, Strezevo JP, Macedonia B, Lisice JP, Macedonia V. The vertical and seasonal variations of temperature and dissolved oxygen in the water of Strezevo reservoir. BALWOIS. 2010: 1-5.

[19] Khwaja Salahuddin, Manish Visavadia, Suresh Gor, Chirag Gosai, Virendra Kumar Soni and Mohammad Dilshad Hussain. (2014). Diel variations in limnological characteristics of Omkareshwar reservoir of Narmada river, India. Journal of Ecology and the Natural Environment, 2014, **6(1):** 12-24.

[20] Anusha Balangoda. Effect of Diurnal Variation of Dissolved Oxygen in a Eutrophic Polymictic Reservoir. American Journal of Environmental Sciences, 2017, **13(1):** 30. 46.
DOI: 10.3844/ajessp.2017.30.46.

Table 1: Correlation coefficient between different physico-chemical parameters in Shanthisagar lake, Davangere district

	AT	WT	Transp.	pH	DO	BOD	COD	TA	TH	Cl	TDS
AT	**0.000**										
WT	**0.905**	**0.000**									
Transp.	**-0.670**	**-0.751**	**0.000**								
pH	**0.799**	**0.475**	**-0.270**	**0.000**							
DO	**-0.040**	**0.448**	**0.195**	**0.475**	**0.0000**						
BOD	**0.690**	**0.910**	**-0.870**	**0.180**	**-0.710**	**0.000**					
COD	**0.821**	**0.928**	**-0.750**	**0.420**	**-0.500**	**0.900**	**0.000**				
TA	**0.695**	**0.930**	**-0.680**	**0.178**	**-0.730**	**0.990**	**0.950**	**0.000**			
TH	**0.878**	**0.985**	**-0.850**	**0.430**	**-0.450**	**0.915**	**0.970**	**0.940**	**0.000**		
Cl	**0.750**	**0.910**	**-0.645**	**0.240**	**-0.580**	**0.850**	**0.900**	**0.900**	**0.920**	**0.000**	
TDS	**0.920**	**0.980**	**-0.705**	**0.510**	**-0.430**	**0.880**	**0.950**	**0.910**	**0.980**	**0.950**	**0.000**

***Values above 0.50 depicting significant at 0.01 level; 0.51 and 0.40 values significant at 0.05 level**