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Physico-Chemical Study of Kolar Reservoir on its Potable Quality

Shrikant Gangwar[1], Kalpana Dave[2], Ashwani Wanganeo[3]

[1, 3]Department of Environmental Sciences and Limnology Barkatullah University, Bhopal, India

[3]Govt. Chandra Shekhar Azad Lead College, Sehore, India

Abstract: ***The aim of the current study was to gain a thorough knowledge on the trophic status of Kolar reservoir. Variation in physico-chemical parameters of ambient water were assessed over a period of 1 year (January to December) on monthly basis in Kolar reservoir. In the present study pH varied from 7.1 - 8.3 units, turbidity from 2 - 8 NTU, total dissolved solids from 115 - 156 mg/l, Specific conductivity from 177 - 240 mg//l, dissolved oxygen from 4.4 – 7.6 mg/l, Total hardness from 39 – 62 mg/l, total alkalinity from 100 -132 mg/l, chloride from 9 -19 mg/l, nitrate from 0.008 – 0.53 mg/l and Phosphate phosphorous from 0.0005 – 0.173 mg/l. The results indicated that the physico-chemical parameters of the water body were within the permissible limits and as such the water from the Kolar reservoir can be used for drinking, and domestic purpose.***

Keywords: Physico-chemical parameters, Kolar reservoir, Tropic status

1. Introduction

Water is necessary component of all living organisms including plants. The surface water and ground water resources of the country play a most important role in irrigation, industrial, fisheries and hydropower besides providing potable water.

Kolar Dam Constructed across the Kolar River, a tributary of Narmada is located about 35 km away from Bhopal, near Lawakhari village in Sehore District. The dam is about 45 m high. The maximum storage capacity is 270 Mcm. Kolar reservoir is the important sources of potable water supply for the Bhopal city (Jain et al., 2012).

The present studies on the physico-chemical parameter of Kolar reservoir were coursed out in ouder to assess its tropic status.

2. Materials and Methods

Surface water samples were collected from four sampling stations from January, 2016 to December, 2017 on Monthly basis. Samples were collected during first week of every month in the early hours of the day between 7am to 11am.

Kolar reservoir with the geographical coordinates 22°57’38.18’’N and 77°20’25.10’’E and is around 45 m deep near dam sites. For analysis of physicochemical parameters the methods given in Adoni (1985) and APHA (1998) were followed.

Result and discussion

Based on and the monthly variations in physico-chemical parameters of Kolar reservoir, minimum and maximum value obtained during this study are given in Table-1.

Table 1: Range of variation, min, max, average and SD of water quality parameters of Kolar reservoir

S.No.	Parameters	Minimum	Maximum	Average	SD
1.	pH (units)	7.1 (December)	8.3(May)	7.7	0.36
2.	TUR(NTU)	2 (Jan-Dec)	8(August)	5.07	2.06
3.	TDS (mg/l)	115 (January)	156(April)	135.71	13.11
4.	SC (µS/cm)	177(November)	240(April)	208.85	20.19
5.	DO (mg/l)	4.4 (May)	7.6(January)	1.6	1.01
6.	TH (mg/l)	39 (January)	62(April)	51.25	7.58
7.	TA (mg/l)	100(November)	132(May)	119.25	8.32
9.	Cl (mg/l)	9(December)	19(April)	14.5	3
10.	N (mg/l)	0.008(February)	0.53(July)	0.13	0.14
11.	P (mg/l)	0.0005(January)	0.173(August)	0.107	0.071

pH, TUR= Turbidity, TDS = Total dissolved solids, SC= Specific conductivity, DO = Dissolved oxygen, TH = Total hardness, TA = Total alkalinity, Cl = Chloride, N = nitrate, P = Phosphate,

Table 2: Kolar reservoir water analysis correlation (Jan 2016 to Dec 2016)

	pH	*TUR*	*DO*	*TDS*	*CON*	*Cl*	*TH*	*TA*	*Nitrate*	*Phosphate*
pH	1									
TUR	0.56278	1								
DO	-0.32142	-0.26743	1							
TDS	0.530536	0.353426	-0.67314	1						
CON	0.567093	0.405755	-0.65674	0.910259	1					
Cl	0.43296	0.242104	-0.59598	0.609121	0.745283	1				
TH	-0.07901	-0.12919	-0.35985	0.508365	0.26269	0.141895	1			
TA	0.558235	0.479882	-0.26478	0.123089	0.385304	0.205675	-0.40874	1		
Nitrate	0.168458	0.390935	0.238549	0.165098	0.194543	-0.05952	-0.14335	0.340325	1	
Phosphate	0.469713	0.477709	-0.64163	0.769384	0.774177	0.519582	0.238245	0.496958	0.295232	1

Table 2. Kolar reservoir water analysis correlation (Jan 2016 to Dec 2016).
Correlation is significant at the 0.01 level
Correlation is significant at the 0.05 level

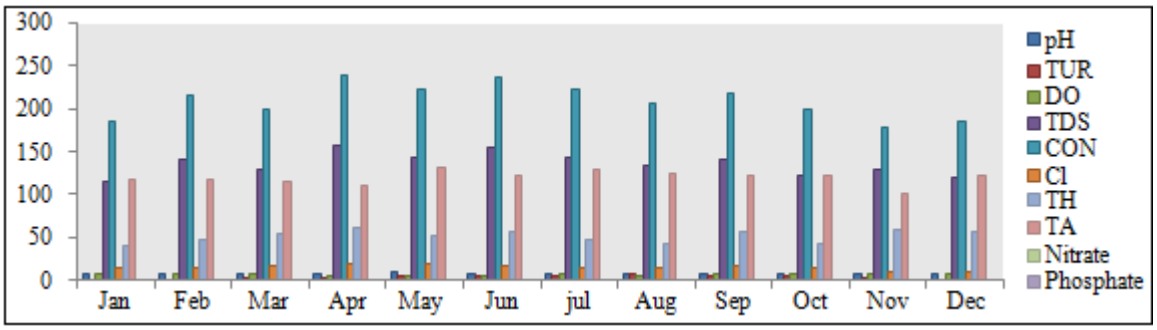

Figure 1

During the present study pH fluctuated between 7.1 to 8.3 units ($\bar{x}$ = 7.7 units; SD = 0.36) Table 1. The pH values indicate alkaline nature of Kolar reservoir. During the study pH was minimum in winter and maximum during summer season. Similar results were reported by Verma and Mohanty (1995) in Danmukundpur pond**.** Shobha et al., (1996) also get nearly same results in Kolar Dam. pH showed significant positive correlation with turbidity, TDS, conductivity and total alkalinity (Table 2).

In the present study water turbidity varied from 2 to 8 NTU ($\bar{x}$ = 9.57 NTU; SD = 3.42) Table 1. Minimum turbidity value was recorded during winter and maximum during rainy season. Similar results were found by Garg et al., (2006) and Garg et al., (2010) in Harsi reservoir and Ramsagar reservoir respectively. During winter season the settlement of silt and clay parcels lead to lowering of turbidity. Dagaonkar and Saksena (1992) also recorded such a phenomena in from Kaila sagar. The turbidity incursions during the rainy months were attributed to runoff from the catchment area. During present study turbidity showed significant positive correlation with TDS (Table 2).

Total dissolved solids during present study ranged from 115 to 156 mg/l with an average ($\bar{x}$ = 135.71mg/l and SD value 13.11) Table 1. The minimum values of total dissolved solids were also observed during winter and maximum in summer months. Similar results have been reported by Kirubavathy et al., (2005) from Orathupalayam reservoir, Garg et al., (2006) from Harsi reservoir; Dhawale and Ghyare (2015) from Pus Dam. Total dissolved solids showed significant positive correlation with conductivity and significant correlation with chloride, total hardness, phosphate and Conductivity (Table 2).

The electrical conductivity of water depends the ions present in water. Specific conductivity recorded during present study varied between 177 to 240 µS/cm, ($\bar{x}$ = 208.85; SD value 20.19) Table 1. Similar values were recorded in Anchar lake (Bhat at al., 2013); Vembanoor wetand Priyatharsini and Dhanalakshmi (2016), Almatti reservoir, Hulyal and Kaliwal (2011). Specific conductivity revealed positive significant correlation with chloride and phosphate (Table 2).

Dissolved oxygen is essential aquatic parameters. In the present study the dissolved oxygen values ranged from 4.4 to 7.6 mg/l ($\bar{x}$ = 1.6 units and SD = 1.01) Table 1. Maximum values of dissolved oxygen were recorded in winter minimum during summer. Photosynthetic activities (Sashay and Sinhala 1969). Results in enhancement of dissolved oxygen showed significant negative correlation with TDS, conductivity, chloride and phosphate (Table 2).

In the present study the total hardness values found ranged from 39 to 62 mg/l ($\bar{x}$ = 51.25 units and SD = 7.58) Table 1. Decrease in water level due to increase in rate of evaporation at high temperature a correspond increase in Total hardness value have been observed. According to WHO, 2011 permissible limit for total hardness of water is 150 mg/l. During present study maximum total hardness value were observed during summer season and minimum in winter months. Similar results were recorded by Wanganeo et al., (2007) in Sarangpani pond; Hujare (2008) in perennial tank, Hulyal and Kaliwal (2011) in Almatti reservoir. Sawyer (1960) classified water bodies on the basis of hardness into three categories, viz., soft (hardness less than 75 mg/l), moderately hard (from 75-150 mg/l) and hard (from 150-300 mg/l). as per the classification of Sawyer (1960) Kolar reservoir ic categorized among soft (hardness less than 75 mg/l) water body throughout the period of study.

Total alkalinity is the sum of total carbonate and bicarbonate. In the present study the total alkalinity ranged from 100 to 132 mg/l with an average value of 119.25 mg/l (SD = 8.32) Table 1. Alkalinity of water body is a measure of its capacity to neutralize acid at a designated pH (APHA, 1998). The higher alkalinity value indicates the eutrophic nature of water body. In present study maximum total alkalinity was observed in summer months and minimum in winter months. Similar trend were also documented by Pradeep and Dwivedi (2016) in Kshir Sagar; Radhika et al., (2004) in Vellayani lake. Spence (1964) classified water bodies into three major categories based on the value of alkalinity, viz, nutrient poor (from 1.0-15.0 mg/l), moderately rich nutrient (from 16.0-60.0 mg/l) and nutrients rich (>60.0 mg/l), As per Spence's categorization Kolar reservoir falls among nutrients rich categories.

A large content of chloride in clean water is an indicator of organic pollution **(**Venkatasubramani and Meenambal, 2007). In the present study, chloride values varied from 9 to 19 mg/l with an average value 14.5 units (SD = 3) Table 1. Minimum value was recorded during winter months and maximum in summer months. Similar results were also

reported by Uchchariya (2012) in Tighra reservoir, Wanganeo et al., (2007) in Sarangpani pond; Lendhe and Yeragi (2004) in Phirange-Kharbav Lake, Garg et al., (2006) in Harsi reservoir. Mahajan and Billore (2014) in Nagchoon pond. Unni (1983) have described that the values of chloride ranging from 17-57.6 mg/l fall under the categorized of less domestic pollution; value from 50.9- 129.9 mg/l, moderate domestic pollution while high domestic pollution reveled chloride values ranging from 129.9- 206.4 mg/l. Kolar reservoir as per the classification in categorized among les domestic pollution wetland. Chloride showed significant positive correlation with phosphate (Table 2).

In the present study nitrate fluctuated between 0.008 to 0.53 mg/l ($\bar{x}$ = 0.13 units; SD = 0.14) Table 1. High concentration of nitrate-nitrogen was observed during rainy months and low in winter months. Similar results have also been obtained by Telkhade et al., (2008) in Chargon lake and Latha (2010) in Kengari lake. Nitrate showed significant positive correlation with sodium during current study.

Macrophysics growth during spring and summer months has resulted in the reduction of nitrate level in ambient water. Where in the winter and fall, when plants stop growing and die, much of the nitrogen is released beak into the water again, increasing the nitrogen concentration.

The source of phosphorous in water body, is the soils of nearby catchment areas, agriculture soli, fertilizer, industrial effluents, depth of water body, aquatic vegetation, bottom fauna and dead eggs of aquatic animals. The Phosphate phosphorous ranged from 0.0005 to 0.173 mg/l wait average value of 0.107 mg/l (SD = 0.071) Table 1. Higher phosphorous content in Kolar reservoir were observed during rainy months and low during winter months. Similar observation were also record by While these results were also confirmed by the observation of Jayabhaye et al., (2008) in Minor reservoir in Sawana; Kumar et al., (2009) in Jawahar sagar, Manimegalai et al., (2010) in walayar reservoir and Kaushik & Sasena (1991). Maximum values of phosphate during rainy months are observed due to runoff of forest and agriculture land beside waste them input of the nearby catchment area. Lee at al., (1981) on the basis of phosphate content have classified the water bodies into five categories, viz., oligotrophic less than 0.007 mg/l, oligo-mesotrophic between 0.008 and 0.011 mg/l, mesotrophic between 0.012 and 0.027 mg/l, meso-eutrophic between 0.028 and 0.039 mg/l and eutrophic more than 0.040 mg/l. on applying Lee's et al., (1981) classification of Kolar reservoir, it can be placed under oligo-mesotrophic water body.

3. Conclusion

All the physico-chemical parameters of Kolar reservoir were observed within the permissible limits of WHO. Hoverer on opening up the catchment area which has resulted in change its land use had better may be coerce of worry in near future if timely conservation strategies as not adopted.

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