

Physico-chemical Characteristics of Golden Lake water, Clement town, District Dehradun, Uttarakhand, India

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Abstract:-This study is emphasis on physico-chemical parameter of Golden lake water, clement town Dehradun. During the present study various physico-chemical parameters viz. water temperature, pH, turbidity total solids, total dissolved solids, total suspended solids, dissolved oxygen, Conductivity, total alkalinity; total hardness, calcium, magnesium, chlorides etc. were analyzed. The result shows the significance correlation in different parameters that indicate the water quality of lake water. It was observed that physico-chemical parameters were fluctuated due to certain anthropogenic activities and seasonal variation.

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Key Words: Physico-chemical parameters, Golden Lake, correlation

Introduction

Water is one of the most abundant compounds found in nature covering approximately three-fourths of surface area of the earth. On the earth surface 50.01% of water is available in lake (Beebi et al., 2004). Lake are intangible resources create different opportunity in socio-economic development of concern area. Lakes are play the very important role in ecosystem for sustain a healthy balance aquatic life and recharge of ground water, conserve soil nutrient, and support our socio economic requirements. The accent time human being uses of lake water in various ways like dinking, agriculture, domestic, raring of fish etc. Today anthropogenic activities and human interference affects the lake water quality. In day by day process degraded water quality directly or indirectly, its impact on aquatic life. Therefore, it is necessary continuous assessment of physical, chemical & biological parameter of water for conservation of lake heath. Golden Lake of Clement town Dehradun famous for scenic beauty & fish culture. It is experience that this lake polluting day by day due to certain activities in catchment area.

Material And Methods

Study Area:

Dehradun district is situated in NW corner of the Uttarakhand state and extends from N Latitude 29° 58" to 38°30' and E Longitude 77°34'45" to 78°18'30. The Doon valley covered by two main River. In the eastern side Ganga river flowing and western side Yamuna river. It is famous for many intangibles.

Following physico-chemical parameters were analysis of lake water with the help of Standard methods of APHA (2001).

1. Temperature
2. pH
3. Turbidity
4. Conductivity
5. Total Solids
6. Total Dissolved Solids
7. Total Suspended Solids
8. Dissolved Oxygen
9. Total Alkalinity
10. Total Hardness
11. Calcium
12. Magnesium
13. Chlorides

Study site:Golden lake is situated in the Clement town, Dehradun. This lake is known for its Scenic beauty and fishery culture. During one year of study period viz. October, 2014 to September, 2015, monthly data presented seasonally. The area of Golden Lake is about 4500m².The catchment area of lake covered by market, Road, Small Patches of forest area Drainage system.

This lake is also habitat for many migratory and native birds. This lake is famous for boating and habitat for various fish species like *Catla catla*, *Silver carp*, and *Labeo sp.* etc.

Result and Discussion: The Average SD values of water physico-chemical parameters or correlation analysis are discussed below and also presented in the Table-1 and Table-2.

Water Colour: The colour of lake water is related to the type and amount of dissolved organic Chemicals. The colour show the aesthetic value, it influence light penetration or affected the planktonic growth and process of photosynthesis. Color of lake water is related to the type and amount of dissolved organic chemicals (**Shaw et al., 2004**). At the present study the green colour of lake water was observed in post monsoon and it is mainly due to the algal growth.

Temperature: Water temperature plays the Negative or Positive effect on water quality parameter and aquatic diversity (**Colman et al., 1992**). The bacterial activities decomposed the organic matter, changed into lake nutrients which are affected by temperature (**Entz, 1972**). The average SD value of Water temperature in golden lake ranged between 22.98 ± 0.051 and 26.07 ± 0.09 during Post monsoon and Pre monsoon respectively. The most suitable temperature for plant growth is 20°C to 35°C (**Patil, et al., 2011**). Similarly, **Bhadula and Joshi (2012)** studied on impact of sewer drain and find out that high temperature of water body due to anthropogenic activities. They further pointed out that water temperature is responsible for metabolic activities of aquatic milieu. During the study time positive correlation with different parameter such as total alkalinity, total hardness, chloride etc. (Table-2).

pH: During the whole study period lake water show the alkaline in nature. The ranged of P^{H} were observed between 8.26 ± 0.056 to 8.00 ± 0.03 Pre monsoons & Post monsoon respectively. The high value of P^{H} may be due to attributed with catchment area. The P^{H} ranged is 5.00-8.5 good for planktonic growth (**Umavathi et al., 2007; Chisty 2002**). At the study time P^{H} was positive correlation with TDS, TSS, DO, Total Alkalinity, Total Hardness, Chlorides (**Gupta et al., 2009**). **Mulongaibalu (2014)** was found the strong positive correlation between DO and P^{H} in River or Lake Water.

Turbidity: Turbidity is another very important parameter of lake water quality, it measured by Nephelometric method .Turbidity caused by suspended particulate matter and dissolved organic matter (**Shaw et al., 2004**). In the present study period value of lake water turbidity ranged from 19.74 ± 0.46 to 14.0 ± 2.29 NTU (Table-1) Pre monsoon and Post monsoon respectively. High turbidity observed in summer may be due to low water table and high rate of decomposition of organic matter. **Mohamed, (2009)** observed the high turbidity during in summer (116 NTU). **Bhadula and Joshi (2011)** studied on major and minor canal of Ganga river and pointed out that physico-chemical parameters were degraded due to manmade activities in minor canal of Ganga river at Haridwar. They further added that turbidity was

higher in minor canal due to dumping of solid waste and formation of algal bloom.

Electrical conductivity: During the present study time the maximum (13.8 ± 1.36 Umho/cm) EC was noted in Pre monsoon and minimum (8.49 ± 1.45 Umho/cm) in Post monsoon. At the study time the Electrical Conductivity shows significant positive correlation with the TS, TDS, total hardness, calcium, magnesium of water (**Mohamed, 2009; Patil, et al, 2012**).

TS, TDS & TSS: During the investigation period the maximum value of TS, TDS, TSS were found 2079.5 ± 22.1 , 1565 ± 9.90 , 542.4 ± 12.1 mg/l respectively in post monsoon season may be due to low water table (**Rai & Singh 2006**). The minimum value of TS, TDS & TSS recorded in Pre monsoon. The minimum values are 1788.2 ± 16.17 , 1321 ± 8.46 & 466.1 ± 10.45 mg/l respectively may be due to effect of rain water (**Verma et al., 2011**). At the present study time the TS, TDS & TSS strongly positive correlation with DO, Total Alkalinity & chloride (Table-2). (**Medudhula et al., 2012**) was observed the positive correlation between TDS & Hardness, Chloride, and Alkalinity in Manair reservoir.

Dissolved oxygen: The dissolved oxygen is most important parameter of aquatic system. Its impact on water body directly or indirectly in different activity such as bacterial, photosynthesis, availability of nutrients, stratification etc (**Vikal, 2009**). At the present study time the maximum average value (6.3 ± 0.11 mg/l) was recorded in Post monsoon and minimum value (5.1 ± 0.51 mg/l) in Pre-monsoon. The minimum value of DO was found in pre monsoon season may be due to increase temperature and high Bacterial activity for decomposition of organic matter (**Kataria, 1996; Korium, & Toufeek, 2008**). During the study time DO show the direct correlation with P^{H} due to during mineralization, decomposition of organic matter release humic acid that' by its effect on P^{H} level (**Lowe-McConnell, 1987**). **Bhadula and Joshi (2014)** have studied on impact of touristic activities on environmental parameters of Ganga river and illustrated that Dissolved oxygen showed negative correlation with temperature.

Total Alkalinity: Total Alkalinity means combination of carbonate (CO_3^{2-}), bicarbonate (HCO_3^{-}) & hydroxyl ions. Total alkalinity in lake water was direct affected by soil sedimentation minerals, water level & catchment area (**Shaw et al., 2004**). During the present study time the maximum value of Total alkalinity was noted 306.84 ± 11.73 mg/l in Pre monsoon season may be due to decrease in water level of lake (**Patil 2011**). The minimum total Alkalinity was 292.72 ± 15.36 mg/l noted in Post monsoon. According to **Maheshwari et al., 2011**) the value of

total Alkalinity ranged between 154 to 354 mg/l support to algal growth and other aquatic life.

Total hardness, Calcium and Magnesium Hardness: In the study time the maximum value 350.07± 25.8 mg/l of Total hardness was noted in Pre monsoon season due to low water table (Patil.S.G.2011). The minimum value of total hardness was found 260.16±18.93 mg/l in Post monsoon season may be due to runoff rain water in lake (Khan. *et al.*, 2012). During the present study time value of Calcium range varies between 57.23 ± 10.04mg/l to 55.22±6.85mg/l in Pre monsoon and Post Monsoon respectively. According to Kaiwal *et al.*, (2003) the presence of calcium in water is more likely in the form of carbonate, it indicates the high value of hardness. The range of magnesium was noted

40.9±2.52 to 30.12± 4.91mg/l in Pre monsoon and Post monsoon respectively. At present study time significant correlation with different parameter such as Water temperature, Total Alkalinity, Total Suspended Solid. (Table-2)

Chlorides: During the present study time Chlorides ranged varies between 55.22 ± 8.94 mg/l to 35.5 ± 5.79 mg/l Post monsoon, Pre monsoon respectively. Umavathi *et al.* (2007) showed that higher concentration of chloride is association with increased level of pollution. At present study time Chloride show significant correlation with different parameter such as Water temperature, P^H, Total Dissolved Solid, DO. Medudhula, *et. al* (2012) observed the significance correlation in same parameter in Manair reservoir.

Table-1:-The average SD value of seasonal variation of physico-chemical parameter of Golden lake, Dehradun

S.N.	Physico-chemical parameter	Post Monsoon	Pre Monsoon
1.	Air Temp.(°C)	24.27±0.422	38.2±0.36
2.	Water Temp.(°C)	22.97±0.0518	26.075±0.095
3.	pH	8.00±0.03304	8.26±0.056
4.	Turbidity (NTU)	14.0±2.29	19.74±0.467
5.	Conductivity (Umho/cm)	8.49±1.45	13.8±1.36
6.	Total Solids (mg/l)	1788.5±16.17	2079.5±22.1
7.	Total dissolved Solids (mg/l)	1322±8.46	1565.25±9.902
8.	Total Suspended Solids (mg/l)	466.5±10.45	542.4±12.1
9.	DO(mg/l)	6.3±0.11	5.1±0.51
10.	Total Alkanity (mg/l)	292.72±15.36	306.84±11.7
11.	Total Hardness (mg/l)	260.16±18.93	350.7±25.8
12.	Calcium (Ca ⁺⁺) (mg/l)	55.22±6.85	57.23±10.04
13.	Magnesium(Mg ⁺⁺)(mg/l)	30.12±4.91	40.9±2.52
14.	Chloride Cl ⁻ (mg/l)	55.22±8.94	35.5±5.79

Table-2 –Correlation with in different physico-chemical parameter of Golden Lake, Dehradun

Parameters	W.T.	pH	TUR.	EC.	TS	TDS	TSS	DO	TA	TH	Ca	Mg	Cl
W.T	1												
PH	- 0.601	1											
TUR.	0.022	- 0.812	1										
EC.	0.751	- 0.979	0.676	1									
TS	- 0.517	0.994	0.866	0.953	1								
TDS	- 0.496	0.992	0.878	0.945	- 0.997	1							
TSS	- 0.688	0.993	0.740	0.995	0.976	0.971	1						
DO	- 0.816	0.952	- 0.595	- 0.994	0.916	0.906	0.980	1					
T. A.	0.312	0.570	- 0.942	- 0.391	0.650	0.669	0.473	0.292	1				
T. H.	0.670	0.189	- 0.727	0.013	0.288	0.311	0.077	- 0.11	0.914	1			
Ca	0.571	- 0.999	0.832	0.97	- 0.997	- 0.95	- .98	- 0.90	- 0.60	0.25	1		
Mg	0.841	- 0.074	- 0.521	0.275	0.026	0.051	- 0.187	- 0.375	0.776	0.964	0.038	1	
Cl	0.948	0.823	- 0.336	-0.921	0.761	0.745	0.882	0.957	0.003	- 0.401	- 0.801	- 0.627	1

Conclusion:

The result revealed that there was significant seasonal variation in some physico-chemical parameters and most of the parameters were in the normal range and indicates better quality of lake water. This lake is famous for fish culture various fishes found in this lake like *Rohu*, *Catla catla* etc. Therefore, there is urgent need to conserve lake, and aware the people for protection of natural lake water.

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