



STUDY THE PHYSICOCHEMICAL PARAMETERS AND CORRELATION COEFFICIENT OF ATTIGRE LAKE KOLHAPUR (MAHARASHTRA)

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ABSTRACT:

The present study deals with assessment of seasonal variation in the physicochemical parameters and correlation coefficient of Attigre lake for the period of one year. Various physicochemical parameters, such as water temperature, air temperature, pH, Electrical conductivity, Transparency, Total dissolved solids, Free CO₂, Dissolved oxygen, Total alkalinity, Hardness, Calcium, Magnesium, were studied. The results revealed that, different seasons showed fluctuation in physicochemical parameters of lake water. Correlation coefficient resulted in positive and negative relationships between the physicochemical and also showed high significant positive relationship ($P < 0.01$ level) and significant positive relationship ($P < 0.05$ level)

INTRODUCTION:

The life on earth surface is inconvincible without water. Water is the principle need of life on earth and is an essential component for all forms of lives, from microorganism to man. Without adequate quantity and quality of fresh water sustainable development will not be possible (Kumar 1997 and Mahananda *et al.*, 2005). The unplanned urbanization and industrialization (Singh *et al.*, 2002) has resulted in over use of environment and Petak (1980) in particular of water resources. Fresh water resources are becoming deteriorated day by day at the very faster rate. Now water quality is a global problem (Mahananda *et al.*, 2005). Better quality of water depends upon its different physicochemical characteristics. But some correlation is possible among these parameters and the significant one would be useful to indicate quality of water.

Water quality is the characteristics of water which influence its beneficial use as well as the sustainability of ecosystem. All life depends on water and exists in nature in many forms like an ocean, river, lake, clouds, rain, snow and fog etc. Water resources are of artificial importance to both natural ecosystem and human development. The quality of water in any ecosystem provides

significant information about the available resources for supporting life in that ecosystem and the suitability for human use.

In the present work the attempt was made to analyze the physicochemical properties such as air and water temperature, EC, pH, DO, Free CO₂, TDS, alkalinity, hardness, calcium and magnesium, of Attigre lake around Kolhapur city Maharashtra to understand the status of water quality.

MATERIALS AND METHODS:

Study Area:

The present study involves the analysis of water described by its physicochemical parameters of Attigre lake around Kolhapur city Maharashtra. It is located in 16°44.322' N latitude and 074°22.227' E longitude and 13kms away from Kolhapur city. It is constructed by Shrimant Chhatrapati Shahu Maharaj.

Water sampling:

The water samples were collected from Attigre lake for physicochemical analysis. Samples were taken seasonally from period of one year. Water samples were collected in clean polythene container. For each sampling event, temperature was monitored and dissolved oxygen was fixed at the sampling sites while EC, pH, free CO₂, TDS, Total alkalinity, Hardness, Calcium, Magnesium, Chloride were analyzed in the laboratory by using standard methods described by APHA(1985), Trivedy and Goel (1986).

Statistical Analysis:

The relationship between various physicochemical parameters of water samples were analyzed statistically conducting Pearson correlation coefficient analysis (Tiwari and Patel, 1991; Mariappa and Vasudevan, 2002).

RESULT DISCUSSION:-

In the present study frequencies of different physicochemical parameters of Attigre lake of around Kolhapur city are represented in Table-1 and the correlation coefficient between each two pairs of parameters were estimated to conclude the relationship between different physicochemical parameters in Table-2. It can be Summarizes as the following:

Table 1: Seasonal variation in physicochemical parameters of Attigre lake.

Parameters/ Seasons	Monsoon	Winter	Summer	Average
Air temperature	28.95±3.061	27.2±0.4	36.8±0.282	30.98±5.11
Water temperature	24.9±0.886	26.5±2.029	32.65±2.328	28.01±4.09
pH	7.55±0.194	7.09±0.0804	7.38±0.089	7.34±0.22
EC	0.42±0.0079	0.64±0.0315	0.37±0.064	0.481±0.14
TDS	500±0.0088	410±0.00472	360±0.00516	423.33±70.94
Free CO ₂	30.36±0.0621	27.72±0.150	40.48±0.399	32.853±6.73
Dissolved oxygen	7.10±0.231	11.65±0.444	10.95±1.072	9.90±2.44
Alkalinity	47.5±0.108	40.5±0.041	54.25±0.623	47.416±6.87
Hardness	171.8±0.411	190.3±0.41	223±1.737	195.03±25.92
Calcium	35.06±0.166	35.26±0.3929	44.12±1.336	38.15±5.17
Magnesium	20.53±0.43	24.92±0.18	27.53±0.75	24.32±3.55
Chloride	279.95±0.163	316.87±0.833	297.98±1.904	304.27±10.90

Table 2: Correlation coefficient matrix between different physicochemical parameters in Attigre lake

	Air Temp	Water temp	pH	EC	TDS	DO	Free CO ₂	Hardnes	Alkalinit	Calcium	Magnesium
Air Temp	1.00										
Water tem	0.93**	1.00									
pH	0.31	-0.05	1.00								
EC	-0.77**	-0.49	-0.85**	1.00							
TDS	-0.65*	-0.88**	0.51	0.02	1.00						
DO	0.21	0.54	-0.86**	0.47	-0.88**	1.00					
Free CO ₂	1.00**	0.92**	0.34	-0.78**	-0.63*	0.18	1.00				
Hardness	0.86**	0.99**	-0.21	-0.33	-0.95**	0.68*	0.85**	1.00			
Alkalinity	0.94**	0.74**	0.63*	-0.94**	-0.34	-0.15	0.94**	0.62*	1.00		
Calcium	0.98**	0.98**	0.13	-0.63*	-0.79**	0.39	0.98**	0.94**	0.85**	1.00	
Magnesium	0.67*	0.89**	-0.50	-0.04	-1.00**	0.87**	0.65*	0.95**	0.36	0.80	1.00

**Correlation is significant at the P< 0.01 level.

*. Correlation is significant at the P< 0.05 level.

Temperature: Temperature is strong and great important factor for aquatic ecosystem as it affects the organisms as well as physical and chemical characteristics of water (Delince 1992). During the present study air temperature ranges from 27.2^oC to 36.8^oC while water temperature ranges from 24^oC to

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28.35⁰C. The high value of water temperature (28.35⁰C) was recorded in the summer and low value of water temperature (24⁰C) in the monsoon season. Water temperature in summer, was high due to low level, high temperature and clear atmosphere (Salve and Hiware, 2008).

pH: The water of Attigre lake remains alkaline throughout the study period. The pH was recorded within the range from 7.09 to 7.55. The highest value of pH (7.55) was recorded during monsoon season and lowest (7.09) was recorded during winter season due to heavy rainfall and dilution effect by Shiddhamallayya and Pratima(2008); Agarkar and Garode(2001). High value of alkaline pH range from (7.2 to 7.8) in Phirange Kharbav lake of Thane district, Maharashtra recorded by Lendhe and Yergi (2004).

Electrical Conductivity (EC): Electrical conductivity is a numerical expression ability of an aqueous solution to carry electric current. This ability depends on the presence of ions, their total concentration, mobility, valence, relative concentrations and temperature of measurement. Increase in level of conductivity and cations are the products of decomposition and mineralization of organic materials (Abida, 2008). In the present study the value of conductivity ranges from 0.37 to 0.64 μ Mhos/cm. The value of electrical conductivity showed maximum in winter and minimum in summer due to high ionic concentration, pollution status, trophic levels, some domestic effluents and other organic matter in water (Ahluwalia, 1999; Fokmare and Musaddique, 2001).

Total Dissolved Solids (TDS): Water is a universal solvent and has a large number of salts dissolved in it which largely govern in physico-chemical properties. In the present study the value of TDS ranges from 360 to 500 mg/lit. The maximum value of TDS (500) was observed in monsoon and minimum value (360) in summer season. Similar result was observed by Shinde *et al.*, 2011.

Dissolved oxygen: Dissolved Oxygen (DO) is an important characteristic used to check the quality of water. Its concentration in a water body gives direct and indirect information about bacterial activity, photosynthesis, availability of nutrients, stratification, etc. Low DO concentration (< 3 mg/lit) in fresh water aquatic system indicates higher pollution causing negative effects on aquatic ecosystem (Jadhav *et al.*, 2012). In the present study the concentration of DO varied from 7.10 to 11.65 mg/lit. The maximum value of DO (11.65) was recorded in winter while minimum value of DO (7.10) recorded in monsoon season. Similar type of result recorded by Sonawane (2011) in Sukhanariver Aurangabad. High dissolved oxygen during winter period could be due to increased rate of photosynthesis by increased density of phytoplankton in relatively stable environmental condition (Devi, 2007).

Free CO₂: The free carbon dioxide level in water decreases due to photosynthesis by algae and macrophytes, increased due to respiration of all

aquatic organisms. The presence or absence of the free carbon dioxide in water is mostly governed by its utilization by algae during photosynthesis and also through its diffusion from air observed by Lianthuamluaia *et al.*, (2013). In the present investigation the level of free CO₂ ranged between 27.72 to 40.48 mg/lit. Maximum value of free CO₂ (40.48) was recorded in summer season and while minimum value of CO₂ (27.72) in winter season. Lower level of free carbon dioxide might be due to high photosynthetic activity utilizing free CO₂, which is in agreement with the work of Yusuf *et al.* (1996).

Hardness: Hardness of water is due to presence of calcium and magnesium ions. Kannan (1991) has classified water on the basis of hardness value in the following manner, 0 to 60mg/lit soft, 61 to 120mg/lit moderately hard and 121 to 180 is very hard. In the present investigation the hardness was observed in the range of 171.8 to 223 mg/lit. Minimum hardness (171.8) observed in monsoon season and maximum hardness (223) was observed in summer season. Higher value of hardness during summer might be due to the higher rate of evaporation during this period by Lianthuamluaia (2013). High values are probably due to regular addition of large quantities of sewage, detergents and large scale human use by Bhandarkar.S.V and Bhandarkar. W, R (2013). Hardness below 300mg/lit is considered potable but beyond this limits causes gastrointestinal irritation (ICMR, 1975). The total hardness above 200 mg L⁻¹ is not suitable for domestic use like drinking and cleaning.

Alkalinity: Alkalinity represents buffering capacity of water; high alkalinity values are indicative of the eutrophic nature of the water bodies, and unsafe for ecosystem as well as for potable use. The higher value of alkalinity indicated the presence of bicarbonate, carbonate and hydroxide in the water bodies (Jain *et al.*, 2000). In the present study alkalinity of the lake was varied from 40.5 to 54.25 mg/lit. Lowest value (40.5) of alkalinity was recorded in winter season and highest value (54.25) in summer season. Similarly, maximum value of alkalinity in summer was also observed by Garget *al* (2006), Vermaet *al.*(2011) and Vermaet *al.*(2012).

Calcium: Calcium is an important constituent in natural water. It is known that calcium contents play an important role in the biological productivity of the lakes and ponds (Ellis *et al.*, 1948). In the present study calcium hardness was recorded in the range of 35.06 to 44.12 mg/lit. Pawar and Pulle (2005) reported the calcium hardness in the range of 64mg/lit to 100mg/lit. Calcium content was higher (44.12mg/lit) in summer season and lower (35.06mg/lit) in monsoon season. According to Billore (1981) the amount of calcium increases during summer season due to rapid oxidation/decomposition of organic matter. The higher calcium content of water is an indication of pollution and eutrophication of wetland reported by Jagadeshappa *et al.*, (2011).

Magnesium: Magnesium is often associated with calcium in all kinds of waters, but their concentrations remain generally lower than the calcium. According to Dagaonkar&Saksena (1992) magnesium is essential for chlorophyll growth and acts as a limiting factor for the growth of phytoplankton. In the present investigation magnesium was recorded in the range of 20.53 to 27.53mg/lit. Maximum value of magnesium (27.53mg/lit) was recorded in summer season and minimum (20.53 mg/lit) in monsoon season. Calcium and magnesium play an important role in antagonizing the toxic effects of various ions in neutralizing excess acid produced (Munawar, 1970).

Statistical analysis: The statistical analysis of the Pearson's correlation coefficient is presented in table-2. The study of correlation coefficient of various physicochemical parameters shows that they are related with each other. In the present investigation water temperature was significant and positively correlated with air temperature (0.93). EC showed strong negative relationship with air temperature(-0.77) and pH (-0.85). TDS was negatively correlated with air(-0.65) and water temperature(-0.88). DO showed strong negative relationship with pH(-0.86) and TDS(-0.88). In the present study free CO₂ showed very strong positive relationship with air temperature (1.00) and water temperature(0.92). Hardness was significantly correlated with air(0.86) and water temperature (0.99), free CO₂ (0.85), DO(0.68) and strong negative correlation with TDS(-0.95). Alkalinity showed significant relationship with air(0.94) and water temperature (0.74) and pH(0.63), free CO₂(0.94), hardness(0.62) and negatively correlation with EC and DO. Calcium was strongly related with air and water temperature (0.98), freeCO₂ (0.98), hardness (0.94) and alkalinity (0.85). Magnesium showed very strong negative relationship with TDS (-1.00); whereas it showed positive relationship with air temperature (0.67), water temperature (0.89), DO (0.87) and freeCO₂ (0.65) and hardness (0.95).

CONCLUSION:

The present study shows seasonal fluctuation in various physicochemical parameters and these parameters appeared to be within permissible range given by WHO, ISI standards so Attigre lake water is suitable for drinking, domestic as well as irrigation purposes.

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