



Correlation of some physico-chemical parameters of Bicherli Pond, Beawar

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ABSTRACT

limnological research were carried out for two years, from February 2014 to January 2016, at Bicherli Pond, Beawar (Raj). Finding the correlation coefficient is a great way to determine how strongly the two interdependent variables are related. For the water quality metrics, a statistical correlation coefficient and seasonal patterns of several physico-chemical parameters were calculated. Water temperature significantly correlated negatively with clarity and dissolved oxygen and positively with pH, TDS, BOD, COD, and chloride.

Keywords: Physico-chemical characteristics. Correlation coefficient, TDS, BOD.

INTRODUCTION

The ecology of ponds is a highly peculiar and delicately balanced system. Ponds worldwide, both in developed and developing nations, have shown signs of growing enrichment or eutrophication over the past three to four decades due to direct or indirect human influence. They primarily take the form of excessive nutrient discharge from various sources, including as industrial and household wastewater, agricultural runoff, etc., which undoubtedly impacts the aquatic bodies' biotic and abiotic components. If a substantial correlation is found in correlation analysis, it can be used as a very helpful tool to evaluate the parameters of water quality.

Study Area: Bicherli pond (Figure 1) is an artificial pond of shallow fresh water, situated above the Municipal garden and located in the eastern corner of Beawar city at longitude 74°22' and 74-30 E and latitude 26°9 and 26°30' N on southern part of National Highway No. 8, 53 Km from Ajmer. The pond receives an average rainfall of 434 mm annually (Table 1). The water of this pond is being used for washing and irrigation purposes by people and drinking and bathing purposes by cattle. This pond is also used as a dumping ground for domestic effluents and sewage by people residing in residential area near the pond.

MATERIALS AND METHODS

Four sampling sites (1 to 4: Figure 1) were selected in the pond for regular monitoring Water sample were collected at monthly intervals from these sites for a periods of two years February 1999 to January 2001. Physico-chemical parameters were analysed according to standard methods Trivedy and Goel (1986) and APHA (1995).

Temperature, transparency and pH of water were recorded at the sites itself. For the estimation of dissolved oxygen (DO) and biochemical oxygen demand (BOD), water samples were collected separately in 300 ml BOD bottles and fixed at the sites. For remaining physico-chemical parameters, water samples (2,000 ml) were collected from each site and taken to the laboratory for analysis.

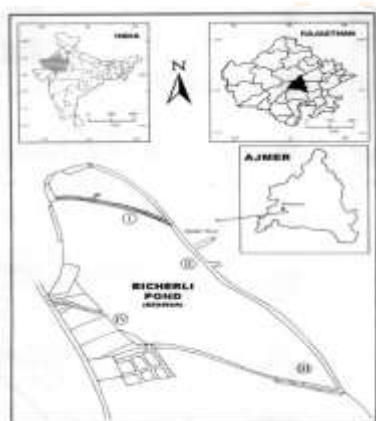
Correlation coefficient r was calculated directly by using Pentium machine (Computer MS-office-2000). Significance at 5% level using student 't' test was determined.

RESULTS AND DISCUSSION

The water temperature of Bicherli pond ranged between 17.1 to 34.8°C. In general terms it remained low during winters, moderate during monsoon and high during summers. thereby following a set pattern directed by seasonal cycle. Water temperature showed a significant positive correlation with pH, TDS, conductivity, BOD, COD and chloride and a negative correlation with dissolved oxygen and transparency. No significant relationship of water temperature was found with phosphate, nitrate, total hardness and fluoride. Similar relationships were also obtained by Zutshi and Vaas (1978), Kaur *et al.* (1997) and Dhakad and Choudhary (2005) and Chouhan *et al.* (2021)

pH, of water remained within the range of 8.46 to 9.9. This indicated that water of Bicherli pond remained alkaline throughout the period of study. Seasonal fluctuations were well marked. Higher values were recorded during summer and lower during monsoon. pH was found to be positively correlated to total alkalinity, conductivity, BOD, COD and total hardness and negatively correlated to DO and nitrate-nitrogen. Similar relationships were also found by Kaur *et al.* (1997). A direct correlation between pH and alkalinity was also found by Zafar (1964) and Singh and Sahai (1979) and Goyal (2024).

TDS ranged between 415 to 898 mgL⁻¹ TDS showed direct relationship with temperature, pH, total hardness and total alkalinity A strong positive significant correlation between TDS and conductivity was recorded. A similar positive significant correlation was also observed by Kumar and Paul (1990), Bhatt *et al.* (1999) and Goyal (2024)



- I- Sample collection site I
- II- Sample collection site II
- III- Sample collection site III
- IV- Sample collection site IV

Figure 1: Location of sample collection sites from Bicherli pond, Beawar, Ajmer

Table 1. Morphometric Features of Bicherli Pond.

No.	Morphometric Features	Pond
1	Longitude	74 ⁰ 22' and 74 ⁰ 30'E
2	Latitude	26 ⁰ 9' and 26 ⁰ 30'N
3	Accesses	53 km from Ajmer
4	Altitude	486 metres
5	Average rainfall	434 mm
6	Mean depth	3.2 metres
7	Water spread	21.35 hectares
8	Gross catchment	8.98 sq km
9	Net catchment	5.99 sq km
10	Storage capacity	6.87 million cubic feet
11	Tehsil	Beawar
12	District	Ajmer

Table 2. Water quality of Bicherli Pond.

Parameters	Values
Water Temperature	17.1 to 34.8° C
pH	8.46 to 9.9
Transparency	15.2 to 30.2 cm
TDS	415 to 898 mgL ⁻¹
Conductivity	802 to 1327 umhos/cm
DO	6.46 to 10.62 mgL ⁻¹
BOD	60.6 to 173.5 mgL ⁻¹
COD	96.7 to 222.7 mgL ⁻¹
Total Hardness	80 to 267 mgL ⁻¹
Nitrates	0.00 to 0.240 mgL ⁻¹
Phosphates	13.2 to 38.7 mgL ⁻¹
Chloride	41.3 to 410 mgL ⁻¹
Fluoride	0.13 to 0.54 mgL ⁻¹
Total alkalinity	158.7 to 395 mgL ⁻¹
F CO ₂	Nil to 6.21 mgL ⁻¹



Table 3. Correlation coefficient of various physico-chemical characteristics of Bicherli pond, Beawar.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
		water Temp	pH	transparency	TDS	conductivity	DO	BOD	COD	TH	nitrate-Nitrogen	phosphate	chloride	Fluoride	TA	Free Co2
1																
2																
3																
4																
5																
6	Water temperature	1.000	0.773*	-0.578	0.448*	0.594*	-0.74	0.948*	0.914	0.36	-0.278	0.108	0.411*	0.173	0.273	0.34
7																
8	pH		1.000	-0.163	0.551*	0.807*	-0.82	0.814	0.693	0.77	-0.73	-0.436	0.763	0.551	0.645	0.48
9																
10	Transparency			1.000	0.221	0.096	0.37	-0.6	0.74	0.43	-0.456	-0.757	0.352	0.358	0.475	-0.31
11																
12	TDS				1.000	0.723	-0.54	0.387	0.29	0.64	-0.616	-0.44	0.647	0.199	0.773	-0.05
13	Conductivity					1.000	-0.91	0.6	0.43	0.78	-0.835	-0.517	0.821	0.55	0.712	0.23
14																
15	DO						1.000	-0.79	-0.7	-0.6	0.658	0.238	-0.645	-0.404	-0.51	-0.37
16																
17	BOD							1.000	0.96	0.37	-0.331	0.068	0.395	0.172	0.285	0.36
18																
19	COD								1.000	0.19	-0.116	0.277	0.237	0.035	0.12	0.29
20																
21	TH									1.000	-0.932	-0.837	0.947	0.808	0.88	0.17
22																
23	Nitrate-Nitrogen										1.000	0.868	-0.884	-0.722	-0.87	-0.2
24																
25	Phosphate											1.000	-0.752	-0.703	-0.8	-0.03
26																
27	Chloride												1.000	0.832	0.847	0.18
28																
29	Fluoride													1.000	0.572	0.27
30																
31	TA														1.000	0.11
32																
33	Free Co2															1.000
34																
35																

DO was found to vary between 60.46 to 10.62 mgL⁻¹ in the Bicherli pond. DO values were minimum in summers and maximum in winters. A significant inverse correlation was seen between DO and water temperature. Inverse relationships was also reported by Rao *et al.* (1985), Yadava *et al.* (1987) and Nadoni *et al.* (2001) whereas Bohra (1977) observed no relationship between DO and water temperature. DO showed positive correlation with nitrate as recorded by Ganapati (1943), Zafar (1964) and Goyal (2024). According to Munawar (1970), DO and nitrate showed an inverse relationship.

BOD values ranged between 60.6 to 173.5 mgL⁻¹. during the study period. Higher values BOD during the summer months and lower in winter months were observed. An inverse correlation between BOD and DO was recorded in the present investigation. Likewise the value of DO decreased with the increase in BOD during summer which may be considered as an indication of increasing pollution. Similar relationship has also been reported by Rao *et al.* (1985), Mittal and Sengar (1990) and Abbasi *et al.* (1996).

COD ranged between 96.7 to 222.7 mgL⁻¹. Higher values of CO was observed during summer months and lower values during winter months. High COD may also be due to presence of a huge amount of accumulated organic matter and its incomplete oxidation as observed by Klein (1973). It was observed in the present study that the value of BOD was positively correlated with COD which was similar to the observations of Tiwari *et al.* (1986), Boyd (1973) and Nadoni *et al.* (2001).

The values of total hardness ranged between 80 to 267 mgL⁻¹ at all sampling sites. Maximum values were recorded in summers and minimum during monsoon. Hardness was found to be negatively related with nitrate and positively with temperature and fluoride. Similar relationships were also observed by Kaur *et al.* (1997).

The nitrate content ranged from zero to 0.24 mgL⁻¹ High values were observed during monsoon and low values during summers. Nitrates indicated negative correlation with temperature in present study. Munawar (1970) also observed an inverse correlation between atmospheric temperature and nitrogen content of the lake.

He explained it on the basis that high temperature accelerates the acidity of denitrifying bacteria in the presence of organic matter. This might explain the decrease in nitrate-nitrogen content in the pond during summer season. But a direct relationship between nitrate-nitrogen and temperature was observed by Nadan and Patel (1992) and Chouhan *et al.* (2021).

Chloride values ranged between 41.3 to 410 mgL⁻¹ and exhibited higher values in summer months and lower in monsoon months. Chloride showed direct relationship with water temperature, free carbon dioxide, total alkalinity, transparency, TDS, conductivity and total hardness while it was inversely related to nitrate and phosphate. Similar relationship were also reported by Gonzalves and Joshi (1946), Singh (1960), Zafar (1964) and Munawar (1970).

The range of fluoride levels was 0.13 to 0.54 mgL⁻¹. This level of concentration was within acceptable limits. During the duration of the research, the highest value was recorded in June and the lowest value in September. Hardness and alkalinity were shown to be significantly positively correlated with fluorides, while nitrate, phosphates, and DO were found to be negatively correlated. Kaur *et al.* (1997) reported similar findings. According to Hannon and Young (1975) and Goyal (2024) areas that contain fluoride have a high alkalinity. Total alkalinity ranged between 158.7 to 395mgL⁻¹. The values increased in summer months and decreased in monsoon months. Total alkalinity showed significant positive correlation with pH, hardness and fluoride and a negative correlation with dissolved oxygen. Seenayya (1971) and Hannon and Young (1975) have also found positive correlation of alkalinity with hardness and pH. Zutshi and Vaas (1978), Tiwari *et al.* (1986) and Kaur *et al.* (1997) also established a positive relationship between alkalinity and fluorides.

Free carbon dioxide ranged from nil to 6.21 mgL⁻¹. Free CO₂ showed inverse relationship with DO. Inverse relation was also observed by Gozalves and Joshi (1946), Rao (1984) and Gupta (1988), whereas Singh (1960) reported a direct relationship.

CONCLUSION

The study helps in predicting probable compositional structure and their interdependence with in the pond ecosystem. The correlation coefficient determination greatly facilitates the tasks of rapid monitoring of water quality parameters and control of water pollution.

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