

## Studies on physicochemical status of two ponds at shahdol district (M.P.)

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### Abstract

Physicochemical characteristics of two ponds at Shahdol were studied for a period of one year in 2018-19. The investigation was focused on the determination of water quality parameters such as temperature, pH, DO, alkalinity, nitrite, nitrate and other factors showing that the water quality of these ponds. However it was negatively correlated with phosphate and ammonical nitrogen. Maximum concentrations of reactive silica was noted during rainy Season in both the water bodies.

**Keywords:** Physico-chemical, ponds, water quality, Shahdol district.

### 1. Introduction

An ecosystem has two major components, abiotic and biotic which are interdependent. The chief abiotic factors are light, temperature pH, DO and basic inorganic and organic compounds. The biotic factors comprise flora and fauna along with aquatic microbes. Since, both these components mutually influence and interact with each other, a thorough understanding of an ecosystem is not possible without analysing these factors.

In India, several studies have been made to understand the physicochemical properties of lakes, reservoirs and ponds (Jain *et al.* 1996, Mohanraj *et al.* 2000, Sah *et al.* 2000)<sup>[1-3]</sup>. However, much information is needed especially with reference to specific water bodies of small dimensions. George (1961, 1962)<sup>[4-5]</sup> has studied the physicochemical characteristics of shallow ponds at Delhi. In the present investigation an attempt has been made to assess the variation in physico-chemical parameters of two ponds (Old & New) at Shahdol district (M.P.).

### Materials and methods

The Shahdol district lies in the north-east part of Madhya Pradesh extending from 29°39'28" and 24°16'13" North latitude and from 80°32'56" to 82°12'21" East longitude approximately. The region lies in the heart of the country. The district is surrounded by Sone river and Rewa district in North, Mandla in South, Surguja and Bilaspur in East and Umaria and Katni in the West. It is situated 489 meter above the sea surface.

Monthly collections of water samples were made between 9.0 A.M. and 11.0 A.M. during the period from July 2018 to January 2019. Detailed ecological observations were made on these ponds from the time of accumulation of rain water i.e., from July to the period till the fishes were taken out from the ponds. The physicochemical analysis of the water samples was done as per-standard procedures given by APHA (1998)<sup>[6]</sup>.

### Results and discussion

The physicochemical parameters and their monthly fluctuations are presented in Tables 1 and 2.

**Table 1:** Physicochemical analysis of water samples of New pond.

S.No.	Parameters	Summer season	Rainy season	Winter season
1.	Water temperature (°C)	24.58	26.74	19.56
2.	Secchi transparency (cm.)	30.60	35.06	74.08
3.	Conductivity (µmhos/cm.)	391.61	178.48	250.30
4.	TDS (mg/l)	134.64	125.86	114.26
5.	pH	8.12	7.70	8.17
6.	Free CO <sub>2</sub> (Mg/l)	1.08	1.20	1.77
7.	Total CO <sub>2</sub> (Mg/l)	114.34	106.31	99.00
8.	Total Alkalinity (Mg/L)	143.08	114.10	137.29
9.	Dissolved O <sub>2</sub> (Mg/L)	7.65	7.55	8.67
10.	Chloride (Mg/l)	50.80	31.52	35.08
11.	Total Hardness (Mg/l)	194.15	120.64	161.22
12.	Sodium content (Mg/l)	7.38	4.71	5.37
13.	Potassium (Mg/l)	2.04	1.39	1.81
14.	Nitrates (Mg/l)	0.083	0.033	0.041
15.	Phosphate (Mg/l)	0.04	0.05	0.03
16.	Sulphate (Mg/l)	1.60	0.49	1.32
17.	Reactive silica(Mg/l)	2.16	2.55	2.27

**Table 2:** Physicochemical analysis of water samples of Old pond.

S.No.	Parameters	Summer season	Rainy season	Winter season
1.	Water temperature (°C)	25.05	26.95	19.96
2.	Secchi transparency (cm.)	28.18	27.75	68.69
3.	Conductivity (µmhos/cm.)	384.69	359.68	309.73
4.	TDS (mg/l)	171.28	172.27	144.11
5.	pH	8.88	8.83	8.73
6.	Free CO <sub>2</sub> (Mg/l)	0.34	1.18	1.37
7.	Total CO <sub>2</sub> (Mg/l)	122.73	126.49	117.72
8.	Total Alkalinity (Mg/L)	136.95	121.16	135.25
9.	Dissolved O <sub>2</sub> (Mg/L)	7.38	7.38	8.40
10.	Chloride (Mg/l)	36.91	31.86	29.37
11.	Total Hardness (Mg/l)	181.17	155.69	160.08
12.	Sodium content (Mg/l)	7.26	5.51	5.64
13.	Potassium (Mg/l)	1.56	1.07	1.23
14.	Nitrates (Mg/l)	0.141	0.099	0.219
15.	Phosphate (Mg/l)	0.05	0.06	0.04
16.	Sulphate (Mg/l)	1.19	0.039	0.93
17.	Reactive silica(Mg/l)	2.18	2.27	2.41

**Table 3:** Correlation analysis of New pond and Old pond.

Water temp.	Secchi	Conductivity	TDS	pH	Free CO <sub>2</sub>	Total CO <sub>2</sub>	Total Alkalinity	DO <sub>2</sub>	Chloride	TH	Sodium	Potassium	Nitrates	Phosphate	Sulphate	R-silica
0.996	0.995	0.497	0.889	-0.28	0.759	0.547	0.996	0.997	0.876	0.912	0.985	0.934	-0.022	1.00	0.99	0.15

Seasonal variation in water temperature, indicating minimum (19.56°C) and maximum (26.95°C) during winter and rainy season respectively. During the period of study, it was observed that the water in the Old Pond was coolest in winter season and hottest, during the rainy season (Tables 1&2). In the present investigation a positive correlation was observed 0.996 (Table 3). A similar fluctuation pattern of water temperature was also recorded by Saha *et al.* (1971)<sup>[7]</sup>, Saran and Adoni (1985)<sup>[8]</sup>.

The average seasonal value of Secchi disc visibility was found to be highest (74.08 cm.) in the case of New pond during winter season; whereas it was lowest (27.75 cm.) during rainy season at Old pond. (Tables 1 & 2). Correlation with positive 0.995 observed New and Old ponds. George (1976)<sup>[9]</sup> and Silva and Davies (1986)<sup>[10]</sup> had also found the value of Secchi depth to be low during summer season.

The seasonal variation of conductivity was minimum (178-48 micro mhos/cm) and maximum (391.61 micro mhos/cm) in the New pond during rainy season and summer season respectively. The analysis of correlation for conductivity showed that the calculated 'r' value (0.497) (Table 3). Sreenivasan (1970)<sup>[11]</sup> studied the reservoirs of south India. According to him conductivity of reservoirs varied widely. During the course of study it was observed that the seasonal average values of TDS was high in summer season at New pond. But in the case of Old pond, there was vary narrow range of variation between the values recorded during summer and rainy season. The New pond showed moderate seasonal variation during study period. When the data of TDS values were computed for analysis of correlation, it was found that the values (0.889) significantly with New and Old ponds (Table 3). George (1976)<sup>[9]</sup> and Verma *et al.* (1984)<sup>[12]</sup> have also reported similar findings.

Seasonal variation of hydrogen ion concentration value 8.88 was higher during summer season in Old pond, while it was minimum 7.70 in the rainy season at New pond. In the present investigation a negative correlation was observed -0.28 (Table 3). The different ranges of pH have been observed by several researchers in different water bodies but it invariably remained towards alkaline side (Vyas, 1968<sup>[13]</sup> and Sreenivasan, 1970<sup>[11]</sup>).

The maximum average seasonal values of free CO<sub>2</sub> (1.77 mg/L) was found in New pond and lowest value 0.34mg/L was found in Old pond (Tables 1&2). Correlate value 0.759 was observed.

The average seasonal values of total CO<sub>2</sub> touched the peak level at all the sampling stations located in the water bodies during summer season; while it was found to be least in winter season. Results of analysis of correlation for total CO<sub>2</sub> showed that the 0.547. Chakraborty *et al.* (1959)<sup>[14]</sup> recorded maximum values of free carbon dioxide in rainy season.

The average values of seasonal variations denote that the total alkalinity (114.10 mg/L) was minimum in New pond during rainy season and maximum (143.08 mg/L) in the same water body during the summer season. The r value (r=0.996) was significant between New pond and Old pond. Similar observation was also reported by Chaurasia and Adoni (1985)<sup>[15]</sup>.

The seasonal average values of dissolved oxygen presents a clearer picture. The highest values were computed during winter season and the lowest during the rainy season except Old pond, where the values of dissolved oxygen content were similar during summer season and rainy season. It was also noted that the correlation (0.997) between water bodies was New pond and Old pond. Inverse relationship of

temperature and DO has also been observed by Rao (1955)<sup>[16]</sup> and Chaurasia and Adoni (1985)<sup>[15]</sup>.

The minimum average value (31.52 mg/L) of chloride was noted in the New pond during rainy season and its maximum (50.88 mg/L) was also recorded at New pond lake, during summer season (Table 6.10a). Regarding the seasonal values of Old Pond, the least value (29.37 mg/L) was observed in winter season; while the chloride content touched its peak level (36.91 mg/L) during summer season. The analysis of correlation (0.876) for chloride showed insignificant variations. Zafar (1964)<sup>[17]</sup> and Sreenivasan, (1970)<sup>[11]</sup> also reported higher concentration of chloride during summer season.

During the course of present investigations, conspicuous seasonal fluctuations in total hardness of water were observed. It was maximum (194.15 mg/L) and minimum (120.64 mg/L) at New pond during summer and rainy season respectively. It was also indicated  $r$  value of  $r = 0.912$ .

Sodium and Potassium as seasonal variation is concern the maximum value was recorded during summer season, while it was minimum in rainy seasons. Potassium is an important element and plays a vital role in the metabolism of fresh water environment (Wetzel, 1975 and Goldman and Horne, 1983)<sup>[18-19]</sup>.

The average seasonal values of nitrate-nitrogen varied between 0.0331 to 0.219 mg/L. The minimum value was observed during rainy season at both the water bodies but maximum value of nitrate nitrogen at New pond was during summer season while it was maximum in winter season at Old pond. Ganapati and Sreenivasan (1968)<sup>[20]</sup> also reported low concentration of nitrogen in tropical waters.

It is evident phosphate the data collected from both the water body for showed very narrow range seasonal variation during the study period. The maximum value was noted during rainy season while it was minimum in winter season. Finding in the case of present study are also similar to those of Wetzel (1975)<sup>[18]</sup>, Saha *et al.* (1971)<sup>[21]</sup>.

As far as the seasonal variations are concerned it was observed that sulphate concentration was lowest at both the water bodies during the rainy season. Nevertheless, summer season seems to be relatively favourable because the values were found to be highest at both the water bodies. During the winter season the concentration of sulphate was moderate. The analysis of correlation for sulphate showed  $r = 0.99$ . The present findings also derive support from the studies conducted by Hutchinson (1957)<sup>[22]</sup> and Goldman and Horne (1983)<sup>[23]</sup>.

Seasonal fluctuations in the concentration of reactive-silica were evident, since it was at its peak level (2.55 mg/L) in rainy season and lowest (2.16 mg/L) in summer season. From figures 6.17b it is clear that there were variations in the concentration of reactive-silica during different seasons. Though the seasonal correlation was insignificant  $r = 0.15$ . It was a coincidental factor and in harmony with the other hypothesis, which indicates silicate as a main part of diatoms Chaurasia and Adoni (1985)<sup>[15]</sup>.

## Conclusion

The seasonal variations of physico-chemical factors were pronounced and statically analysed using correlation. The analysis of variance for Physico-chemical and biological factors provided remarkable results between the two water bodies. Minimum and maximum air temperature was

recorded during winter and summer season respectively. The water temperature was minimum during winter season and maximum during rainy season. Water temperature had a positive correlation with Ca hardness, potassium phosphate and ammonical nitrogen, However it was negatively correlated with secchi-transparency, dissolved oxygen and Mg hardness. Chloride was ranged from 22.13 mg/L to 55 mg/L. Its maximum value was recorded during summer season. The analysis of variance showed significant value between both water bodies. Chloride content was positively correlated with conductivity, TDS, Total CO<sub>2</sub> Total alkalinity, hardness and sulphate. However it was negatively correlated with phosphate and ammonical nitrogen. Maximum concentrations of reactive silica was noted during rainy Season in both the water bodies.

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